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Affect and cognition in upper echelons' strategic decision making: Empirical and theoretical studies for advancing corporate governance.

Edited by
Matteo Cristofaro, Yongjian Bao, Sana Chiu, Ana Beatriz Hernández-Lara and Leticia Perez-Calero

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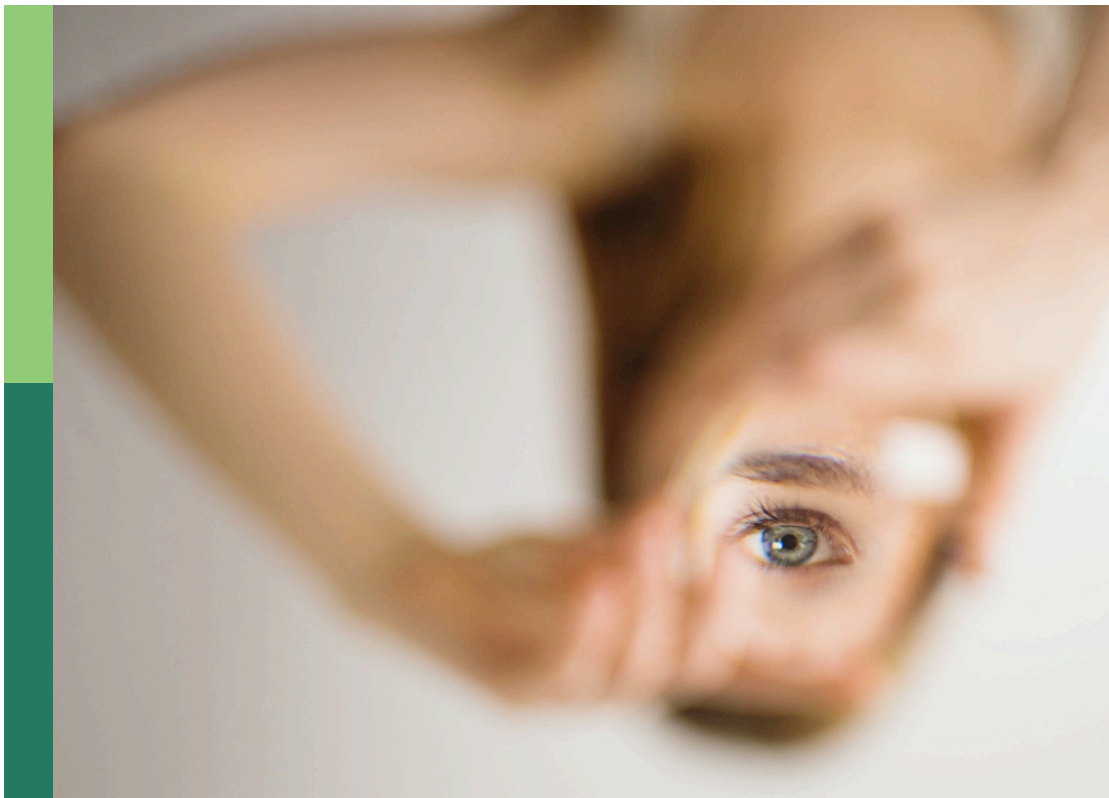

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Affect and cognition in upper echelons' strategic decision making: Empirical and theoretical studies for advancing corporate governance.

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Editorial: Affect and cognition in upper echelons' strategic decision making: Empirical and theoretical studies for advancing corporate governance

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Editorial on the Research Topic
Affect and cognition in upper echelons' strategic decision making: Empirical and theoretical studies for advancing corporate governance

1. Introduction to the Research Topic

Since the advent of the bounded rationality concept (Simon, 1947), scholars have been committed to understanding *how organizational agents really make choices*—mainly by adopting social and cognitive psychology lenses. Research over the last 40 years has advanced the investigation of upper echelons' strategic decision-making processes (e.g., Abatecola and Cristofaro, 2020), in which top managers and board directors are regarded as playing a pivotal role in shaping organizational outcomes (Hambrick and Mason, 1984). However, a long-standing limitation in research has been to access the socio-psychological underpinnings of leaders' decision-making, due to the fact that executives are "notoriously unwilling to submit themselves to scholarly poking and probing" (Hambrick, 2007, p. 337).

Recent advances in the space of behavioral strategy show that leaders are different than those postulated by Simon (1947): s/he is no longer affected only by bounded rationality, but s/he is increasingly also pervaded by non-rational forces (Cristofaro, 2017). For example, thanks to the cross-fertilizing advances in neuroscience studies (initiated by Antonio Damasio), the role of emotions—always considered as non-rational forces—has continuously and increasingly gained momentum within decision-making research. The "affect revolution" in research enables the investigation of other important

psychological variables considered to be antecedents or consequences of affective states—such as personality traits, mental disorders, beliefs, and spirituality—dismantling, de facto, the "human black box".

However, what remains largely unknown is the interplay of affective states and cognition (Cristofaro, 2020), considered by some scholars to be two parallel, competitive systems of the human mind (Hodgkinson and Sadler-Smith, 2018). In this regard, our Research Topic for Frontiers in Psychology (2022), entitled "*Affect and cognition in upper echelons' strategic decision making: Empirical and theoretical studies for advancing corporate governance*", aims to advance this line of inquiry: investigating the role of affective states, cognition, and their interplay in upper echelons' strategic decision making.

2. Contributions within the Research Topic

Starting on November 2020, the promotion of the Research Topic through personal contacts with authors, listservs, social media posts, and conference networks raised a total of 25 submissions. Manuscripts aligned with the Call for Papers passed at least two rounds of peer review, always followed by final comments of guest editors. In the end, 43 scholars produced 13 excellent works accepted for publication on this Research Topic. Among them, by considering the first author's institution, 60% of contributions are from China; others are from Italy and the U.S. As of October 17th, 2022, the Research Topic received 24,500 views approximatively, seeing an increasing trend in downloads.

The 13 papers in this issue highlight five crucial research directions for studies on the affect and cognition in upper echelons' strategic decision making: (i) upper echelons' features and personality, (ii) upper echelons' attitude, (iii) upper echelons' identity, (iv) upper echelons' leadership, and (v) domains' cross-fertilization.

We offer some insights emerging from these papers to accompany the readers throughout this editorial endeavor. See Figure 1.

FIGURE 1
A synthesis of the crucial directions taken for studying affect and cognition in upper echelons' strategic decision making.

2.1. Upper echelons' features and traits

Three studies investigate the innate features and personality of upper echelons and link with cognition, emotions, and decisions. Yang et al., use secondary data from a sample of 64 Chief Executive Officers (CEOs) of listed firms in China for the period 2010–2019, to investigate whether leaders' proactive personality affects Merger and Acquisition (M&A) decisions. They argue that leaders with a proactive personality are more prone to take the initiative to change the external environment. Their study shows that proactive and overconfident CEOs are indeed more inclined toward cross-industry mergers in traditional industries. By contrast, non-proactive CEOs are inclined toward intra-industry mergers. The study by Larsen and Stanley investigates why affect drives decisions in some situations and not others. By comparing New Zealand Prime Minister Jacinda Ardern's and US President Donald Trump's responses to COVID-19, these authors advance that leaders' neurobiological windows of tolerance to affect arousal and their self-regulatory capacity—their capacity to regulate stress and emotions so that these phenomena do not drive resulting decisions—may hold the key to explaining the variation in affect's influence on decision-making. Leaders who prioritize self-care and regulated themselves signal to their followers that self-regulation is a critical aspect of successful performance.

2.2. Upper echelons' attitude

Three articles investigates the cognitive influence of attitudes of upper echelons in organizational decisions. Liu et al. collect data on 188 vice CEOs in China regarding their entrepreneurial orientation (i.e., the inclination to emphasize innovation) and firm performance. Results show that vice CEOs' entrepreneurial orientation is positively related to corporate dynamic capabilities and firm performance and that corporate dynamic capabilities mediate the positive relationship between CEO entrepreneurial orientation and firm performance. Similarly, Zheng investigate how the temporal focus at the organizational level affects the investment decisions of venture capital (VC) firms. Using data

from 606 VCs with 1,473 VC-year observations of long-term orientation from 2012 to 2019, they show that VCs with a higher level of long-term orientation prefer to invest in less popular industries and ventures in the expansion period. Meanwhile, they are less likely to invest in very new start-ups. Moreover, long-term-oriented VC firms tend to re-invest in start-ups in their portfolios. Finally, by considering observations of 5,352 firms listed in the Shanghai and Shenzhen Stock Exchanges between 2010 and 2019, Jiang et al. investigate whether TMT media exposure can influence Corporate Social Responsibility (CSR) performance. Media exposure acts as an external control mechanism to monitor TMT behavior and that the authors find that a high level of TMT media exposure promotes social responsibility. In addition, the TMT power and political connections negatively moderate the relationship between TMT media exposure and CSR, because these allow TMTs to pursue profit instead.

2.3. Upper echelons' identity

Three papers investigate how the identity of the founders or CEOs influences their cognition and decisions. Xiaofei et al. collected 7,491 observations on founders of Chinese private listed companies between 2010 and 2018 to study the effect of the founder of private enterprises on CSR. Their results show that founder-led firms have better CSR performance because of founders have a long-term vision, care about the reputation of the company and take a broad perspective of value-creation activities. Similarly, Ma et al.—by analyzing 2019 IPO data of 635 private companies in the China A-share market through the fuzzy-set qualitative comparative analysis (fsQCA)—found that the presence of a highly educated founder, large firm size, and the absence of risk tolerance as core conditions leads to high innovation input. Yet, the combination of large firm size with having a male, highly educated, highly risk-tolerant founder, coupled with being CEO and having strong political connections, is more conducive to increasing the innovation investment of the firm. Finally, Zhang et al., by using 1,330 firm-year observations of Chinese-listed family firms from 2009 to 2015, investigated the factors that affect the pay dispersion between CEO and non-family managers. This study shows that the presence of non-family CEOs could decrease the pay dispersion between CEO and non-family managers. Empirical evidence also supports that the negative relationship between CEO identity and pay dispersion weakens when CEO tenure increases and the institutional environment matures.

2.4. Upper echelons leadership

Two published articles in the Research Topic deal with the role of upper echelons' leadership in their cognition and related decisions. In particular, Xu et al. collected data from 26 supervisors and 304 new-generation employees in a new energy vehicle company in East China to understand how the executives can effectively stimulate the proactive behavior of new-generation employees. Results indicated that (i) distributed leadership is positively related to the proactive behavior of new-generation employees; (ii) idiosyncratic deals and meaningfulness of work mediated the linkage between distributed leadership and new-generation employees' proactive behavior; (iii) idiosyncratic deals and meaningfulness of work play a multistep mediation role between distributed leadership and new generation employees' proactive behavior. Relatedly, Liang et al. investigated leaders' positive implicit followership (LPIF) influence on employees' innovative behavior (EIB) across 389 leaders and their direct employees at 45 large- and medium-sized enterprises in China. LPIF has a significant positive effect on EIB, and leader-member exchange (LMX) and psychological empowerment (PE) have multiple mediation effects on the relationship between LPIF and EIB. When the level of LPIF is high, LMX and PE are also enhanced, promoting the increase in EIB.

2.5. Domains' cross-fertilization

A series of studies in the RT pushed cross-fertilization among management and other domains, mainly neuroscience, psychology, and philosophy, to investigate upper echelons' decisions better. The work by Cristofaro et al. provides a systematization of 23 contributions produced on the role of affect and cognition in managerial decision-making by considering the recent cross-fertilization of management studies with the neuroscience domain. Results of the analyses support an emerging "unified" mind processing theory for which the two systems of our mind are not in conflict and for which affective states have a driving role toward cognition. They also strongly recommend using neuroscience methods to support behavioral studies. In line with this latter, Mastrogiorgio et al. investigate how to enhance organizational cognitive memory. They administered a task to 82 employees of a large banking group, comparing the results of a virtual memoryscape (VM; treatment) concerning the mnemonic tool based on the "method of loci" (MoL; control). The VM is not superior to the MoL in the short term, but it is equivalent to 1 week later. Compared to the method of loci, the virtual memoryscape presents the advantages—relevant for organizations—of being collective, controllable, dynamic, and non-manipulable. Finally, Adinolfi and Loia propose an integrated interdisciplinary framework suitable for a rich account of intuition, contemplating how affect and cognition intertwine in the intuitive process, and how intuition scales up from the individual to collective decision-making. In particular, by bridging the psychological, philosophical, and organizational domains, authors conceptualize "intuition

as emergence"—a new property that emerges in a decisional space. Intuition, according to that property, *emerges out of self-organizing holistic associations*. In this proposition, the properties of self-organization and emergence are the defining features of intuition.

3. Implications for future research

Studies published in the RT advance the research on affect and cognition in upper echelons' strategic decisions. Some studies advanced affect and cognition as two parallel cooperative systems of humans that interact with each other and together relate with the environment in which upper echelons are embedded and from which are influenced by its factors, such as technology. However, to advance this line of research, which finds its natural space within the new field of Behavioral Strategy (Powell et al., 2011), other open research questions still need to be answered, such as: *How do biases scale up from the individual to the collective level? Under what contexts and individual conditions are heuristics beneficial for executives? How do stakeholders' cognition and/or affective states impact those of executives? Do cognitive and affective states play out differently for executives in state or private-owned firms, small and medium-sized enterprises or big firms, family firms, and start-ups? What psychological or cognitive attributes are more likely to influence executives' decisions related to non-financial firm outcomes such as corporate social responsibility or sustainability? What situational factors are likely to moderate this relationship?*

As to help answer the above, we firmly believe that the way traced by some works (Adinolfi and Loia; Cristofaro et al.; Mastrogiorgio et al.) toward the cross-fertilization of (apparently) unrelated domains (e.g., management, psychology, philosophy, neuroscience, etc.) to inform upper echelons' strategic decisions research is the one to beat to open executives' black box and understand the behavior of organizations. This is the main value-added coming from this Research Topic.

Author contributions

MC contributed to the conception and design of the Editorial and wrote the first draft of the manuscript. All authors contributed to the manuscript revision, read, and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Chief Executive Officer Proactive Personality and Acquisitions: A Fuzzy Set Qualitative Comparative Analysis of China's Listed Firms

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The role of the CEO in an enterprise's management decisions renders their individual characteristics influential in decisions about mergers and acquisitions (M&As). Personal characteristics are based on many aspects, therefore, we provide a multi-angle insight into the personal characteristics of managers. Drawing on the upper echelons theory, we examine whether CEOs' proactive personality affects merger and acquisition decisions. The fuzzy-set qualitative comparative analysis (fsQCA) is performed using a sample of 64 listed firms in China for the period 2010–2019. There are three solutions for cross-industry mergers, and five for intra-industry mergers. The results suggest that: (a) proactive and overconfident CEOs are inclined toward cross-industry mergers; (b) non-proactive and low-educated CEOs are inclined toward intra-industry mergers; (c) emerging industry enterprises tend to choose intra-industry mergers; (d) overconfident CEOs are more likely to undertake cross-industry mergers in traditional industries.

Keywords: proactive personality, CEO characteristics, M&As, fsQCA, emerging industries, upper echelons theory

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INTRODUCTION

Mergers and acquisitions (M&As) are typically strategic decisions in business management; they have become an important way for enterprises to realize rapid scale expansion and development (Lee and Lieberman, 2010). In this vein, the Upper Echelons Theory (UET) advances that the decisions and behavior of its executives are largely dependent on their socio-demographic features and psychological variables.

Previous empirical studies have broadly examined the relationship between CEO characteristics and M&A decisions. For example, Ferris et al. (2013) focused on the overconfidence of CEOs. They found that overconfidence helped to explain the number of offers made by a CEO, the frequencies of non-diversifying and diversifying acquisitions, and the use of cash to finance a merger deal. In terms of managerial background, research suggested that CEOs with financial experience would choose aggressive business strategies (Custódio and Metzger, 2014). Thanks to the cross-fertilization between psychology and upper echelons theory, scholars have increasingly been considering the influence of personality traits of executives on decision-making, such as narcissism, hubris, or overconfidence (Ham et al., 2018; Malhotra et al., 2018; Abatecola and Cristofaro, 2020). In fact, the proactive personality of executives has also a significant influence on strategic decisions, especially on M&A decisions. Proactive personality is the tendency of individuals to take active actions to change their external environment (Bateman and Crant, 1993). Contrasting with

intra-industry mergers, cross-industry mergers will bring more changes and challenges from the external environment for executives. On this basis, it is logical to anticipate: the CEOs of enterprises that choose cross-industry mergers are more likely to have proactive personality. In doing that, our study analyzed the comprehensive influence of different characteristics of CEOs on M&A decisions and incorporated socio-demographic and psychological features of CEOs into a unified research framework.

Yet, over time the evolving context of upper echelons analyses has obtained widespread attention, especially for a number of research implications in terms of firm-environment relationships (Abatecola and Cristofaro, 2020). Looking at the industry level of the environment, the most investigated industries have been those of semiconductors, furniture, food, aerospace, and cement (Abatecola and Cristofaro, 2020). Hambrick and Quigley (2014) examined the industry's discretion and analyzed the industry's condition through the size-weighted mean return on assets. However, in a multitude of studies on mergers and acquisitions, the industry is usually used as a control variable (Lin et al., 2018). In fact, the impact of industry characteristics on M&As cannot be ignored. Hence, our study analyses the influence of industry on M&A decisions. Based on the industry division in China's 13th Five-Year Plan for the Development of National Strategic Emerging Industries, our study introduces emerging industries and traditional industries as conditions and explores the difference in the choice of M&As between them.

Based on the above, we explore the influence of different factors on M&A decisions, including socio-demographic features of CEOs, psychological variables of CEOs, and industry level of the environment. In our study, CEO proactive personality, overconfidence, educational background, financial experience, and industry are taken as conditions, and the fuzzy set qualitative comparative analysis (fsQCA) is used for the sufficiency and necessity of the conditions. The influences of multiple conditions on the results are comprehensively explained from the perspective of configuration (Fiss, 2011). Through the fuzzy-set qualitative comparative analysis (fsQCA) method, our study explores not only the core conditions that affect M&A decisions but also the marginal factors when many characteristics appear in the same manager. In addition, the rapid increase of M&As in China provides the context within this study. Different from global M&A waves, which started at the end of the 19th century and experienced more than a century, Chinese M&As started late but developed rapidly in the last 20 years. Currently, China's economy is in a transition stage, with the profitability of traditional industries in decline. Many enterprises seek new profit growth points through M&As to transform or expand traditional businesses. Therefore, our study selected China as a context and used 64 M&As of Chinese listed companies from 2010 to 2019 as examples for empirical analysis.

Our study contributes significantly to the existing literature. Firstly, it adds to the literature on proactive personality and presents novel evidence on how CEO proactive personality affects M&A decisions. The results show that proactive CEOs are more inclined toward cross-industry mergers. Secondly, through the fsQCA, M&A decisions are shown to be influenced by several conditions simultaneously. The results of the QCA of the fuzzy sets show that there are three configurations for cross-industry mergers and five paths for intra-industry mergers. Finally, this study introduces traditional and emerging industry conditions and finds that the type of the acquirer's industry has a significant influence on the choice of M&A target. The results show that intra-industry mergers occur more in emerging industries. Furthermore, in intra-industry mergers, CEOs are usually characterized by a focus on the industry, low innovation, and low education. However, in cross-industry mergers, CEOs are usually characterized by proactive personality and overconfidence.

The remainder of this study is organized as follows. Section Theoretical Framework and Literature Review reviews the related literature and theories. Section Context of the Research introduces the context of the research. Section Research Design describes our data and the fsQCA method. Section Research Results shows empirical analysis. Finally, we discuss the results and summarize the main conclusions of the paper.

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

Upper Echelons Theory

The upper echelons theory holds that the decisions and behavior of the enterprise are realized by the decisions and behavior of its senior executives, which in turn are largely dependent on their psychological and demographic characteristics (Hambrick and Mason, 1984). The characteristics, corporate governance, or investment decision-making research in the literature mainly focuses on three aspects: The first is the relationship between managers' experience and corporate governance performance (Wang and Yin, 2018; Burns et al., 2021). The second is the relationship between managers' personality and corporate governance or operating performance (Billett and Qian, 2008; Malmendier and Tate, 2008). The third is the relationship between executives and corporate governance or operating performance (Shi et al., 2019; Wang et al., 2020).

After that, many studies have continuously improved the theory, including proposing the job requirements for senior executives as a moderator variable (Hambrick, 2007). The personal ambition of a manager in the job requirements is presented as a desire for success and self-actualization. High job requirements drive managers to take shortcuts and to rely on their previous successful experiences; in turn, their previous experience will have a stronger influence on their decisions (Jeganathan et al., 2021).

Existing literature on the influence of managers' personality traits on M&As focuses on overconfidence, extraversion (Malhotra et al., 2018), and pre-existing narcissism (Ham et al., 2018). Recently, researchers investigated the impact CEOs' dispositional preventative focus had on firms' deal structuring choices in M&As (Gada et al., 2021). Additionally, Shi et al. (2019) verified that in the presence of high CEO-CFO language style matching, firms tended to undertake more mergers and acquisitions. Chen et al. (2021) found that the fit between

CEO human capital makeup and their type of acquisitions relates to stronger performance. Moreover, studies exist on the educational background (Wang and Yin, 2018), social status (Plaksina et al., 2019), executive migration (Wang, 2019), supply chain industry experience (Burns et al., 2021), and multiple merger experience (Jeganathan et al., 2021). Acquisitions by firms with high managerial ability generated better abnormal returns at the announcement as well as better post-announcement abnormal returns than firms with low managerial ability did (Chen and Lin, 2018). Bachmann and Spiropoulos (2021) proposed that bidders with female board members preferred to target firms that also have female board representation.

CEO Proactive Personality

Based on interactionism, proactive personality is defined as the tendency of individuals to take initiative to change their external environment (Bateman and Crant, 1993). Studies show that proactive personality has a positive effect on job performance (Wei et al., 2021) and work attitude (Harvey et al., 2006), leadership transitions (Lam et al., 2018), entrepreneurial intention (Baluku et al., 2020), sustainable investment (Vanwalleghem and Mirowska, 2020), employee creativity (Li et al., 2021), and employee resilience (Zhu and Li, 2021).

Through the influence of proactive personality, executives tend to change the existing environment when making decisions. M&As obviously pose new challenges to the existing business environment. However, proactive personality has not been introduced into M&A research.

Regarding the measurement of proactive personality, Bateman and Crant (1993) first developed a 47-item questionnaire. Through exploratory factor analysis, a 17-item proactive personality scale was obtained; subsequent research reduced the scale to 10 items (Seibert et al., 1999). In addition, some studies further reduced the proactive personality scale to 6 items (Parker, 1998), 5 items (Kickul and Gundry, 2002), and 4 items (Parker and Sprigg, 1999). **Table 1** summarizes the core information for proactive personality. To demonstrate the cross-cultural universality of the proactive personality scale, Claes et al. (2005) used samples from Belgium, Finland, and Spain. Based on the characteristics of China's economic system, corporate governance, and cultural environment, the scale used to measure a proactive personality may not be suitable for cross-cultural Chinese samples. Therefore, the use of the proactive personality scale measurement that has been carried out by previous researchers is doubtful in this study and cross-cultural consistency of the proactive personality scale remains to be tested.

The above literature focuses on the influence of individual proactive personality on individuals and organizations, rather than on decision-making; there has been no in-depth research on the relationship between proactive personality and M&As in the literature related to developments in the upper echelons theory. Our study complements the existing literature on proactive personality and corporate strategy.

TABLE 1 | Illustration of proactive personality and overconfidence.

Type	Proactive personality	Overconfidence
Theory	Interactionism	Behavior finance theory
Concept	Tendency to change the external environment	Cognitive bias
Measurement	17-item proactive personality scale; 10-item scale; 6-item scale; 5-item scale; 4-item scale	CEO shareholding; CEO relative compensation; Historical business performance; Frequency of CEO M&As; Weight of manager personal characteristics; Business climate index; CEO evaluation by mainstream media; Earnings forecast bias; CEO being a founder or heir
Outcome	Job performance; Work attitude; Leadership transitions; Entrepreneurial intention; Sustainable investment; employee creativity; Employee resilience	Ambidextrous innovation Diversification Bigbaths Overinvestment Firm risk

CEO Overconfidence and M&As

The overconfidence of managers is one of the factors that have been widely studied in M&A decision-making. Overconfident managers tend to have psychological and cognitive biases. They will ignore risks, overestimate their own abilities, and make irrational decisions (Brown and Sarma, 2007). It is precise because managers have more rights to make important decisions and choices than ordinary employees that they tend to show overconfidence (Hayward and Hambrick, 1997). Overconfidence in M&A decisions was first studied by Roll (1986). This was followed by the widely recognized study on M&As by Malmendier and Tate (2008). Their study found that overconfident managers are 65% more likely to carry out M&A activities than rational managers. When the internal capital of an enterprise is abundant and the executive has the mandate to undertake diversifying mergers, it is obvious that overconfident managers will undertake more M&As than rational managers. However, other studies suggest that, although overconfidence can promote M&As, it does not affect whether they are diversified (Ferris et al., 2013). CEO overconfidence is relatively mature in the study of M&As, although previous works have only done univariate studies.

CEO overconfidence is also widely used in other management research, including ambidextrous innovation (Wong et al., 2017), diversification (Andreou et al., 2019), big baths (Pierk, 2021), overinvestment (Kwon et al., 2021), and firm risk (Ali and Tauni, 2021). Many quantitative indicators have been used in the measurement of CEO overconfidence in the literature; for example, CEO shareholding (Malmendier and Tate, 2008), the relative compensation of CEOs (Huang et al., 2011), historical business performance, frequency of CEO M&As (Doukas and Petmezas, 2007), weight of manager personal characteristics (Barber and Odean, 2001), business climate index (Yu et al.,

2006), CEO evaluation by mainstream media (Malmendier and Tate, 2008), and earnings forecast bias (Lin et al., 2008). However, in many of the above examples, it is not obvious when specific indicators are appropriate for the measurement. According to the control illusion theory (Langer, 1975), psychological research has found that people tend to believe that they can influence some random events. When people expect certain outcomes, and those outcomes do occur, they tend to attribute them to their actions rather than luck, and further confirm their control over the situation. Hayward and Hambrick (1997) found that the higher the relative salary of a CEO, the more likely it was to cause the illusion of personal control, resulting in managerial overconfidence. Huang et al. (2011) used this method to test Chinese companies and found the moderating effect of managerial overconfidence on the sensitivity of cash flows. **Table 1** summarizes the core information for overconfidence.

Managerial Background and M&As

Executives' background is also an important factor in M&A decision-making, according to the upper echelons theory. The background of an executive determines the decision-making horizon. A person's career is influenced by their past life experience; their education and past working environment will affect their future career behavior (Xie, 2003). There is a close relationship between the choice of intra-industry mergers or cross-industry mergers in the M&A decision and educational background and working experience. Some studies suggest that highly educated managers have a greater tolerance for ambiguity and uncertainty. They are more likely to accept the impact of environmental changes and formulate strategies conducive to enterprise reform and development (Bantel, 1993). Compared with CEOs with a low education level, CEOs with a high education level have more advantages in information processing. Many innovative and developmental enterprises are mostly led by managers with high education levels (Wally and Baum, 1994). CEOs with financial business experience have both a financial knowledge foundation and rich practical experience. They know how to use financial leverage to formulate business decision strategies rationally and to improve the profitability of enterprises (Jiang et al., 2012). In addition, managers with financial experience are better able to use professional financial knowledge to conduct capital operations and deal with crises, which affords them more confidence and tolerance for risks (Graham et al., 2013). CEOs with financial experience will choose aggressive business strategies (Custódio and Metzger, 2014). In terms of M&As, it has been shown that CEOs who obtained an MBA degree after the 1970s focus more on non-diversified acquisitions (Jung and Shin, 2019). Other studies believe that relevant experience of the target industry will promote the evaluation of the target company in the diversified M&As (Wang et al., 2015). CEOs with a broader set of knowledge and skills are more likely to engage in unrelated acquisitions (Chen et al., 2021).

Briefly, the choice of M&A target is the result of many factors. However, it is unknown how factors such as CEO proactive personality, overconfidence, and background work together to influence that choice. Traditional regression analysis methods have been used to explore the influence of a single key variable on the selection of merger type; however, the methods cannot effectively reveal the interaction between different variables (Fiss, 2011). Therefore, this study introduces the QCA method to explore the joint effect of the above three characteristics of a CEO on the choice of merger type. There exists abundant research on CEO overconfidence and demographic characteristics; combined with the improvements in the upper echelons theory, this study adds the characteristics of CEO proactive personality to reflect the influence of CEO ambition on the choice of merger types. Based on the characteristics of China's economic system, corporate governance, and cultural environment, it is meaningful to study Chinese M&A cases.

CONTEXT OF THE RESEARCH

In the early stage of China's economic development since 2002, Chinese enterprises increased industrial concentration through mergers and acquisitions (M&As), to improve corporate competitiveness. At the same time, the Chinese government issued a series of laws and regulations on enterprise M&As and improved related market mechanisms. In 2005, China began non-tradable shares reform. The capital market continues to mature; the government has increased the structural adjustment of strategic corporations by proposing relevant financing policies. These actions promoted mergers and acquisitions and in the 2010s, they increased rapidly. M&As of Chinese enterprises increased from 2,947 in 2010 to 4,498 in 2019; in monetary terms, M&A transactions increased from USD143.9 billion to USD272.4 billion (PWC, 2014, 2019). M&A transactions in China's economic transformation usually have the following characteristics: (1) cross-industry M&As, wherein a layman manages an expert, (2) a traditional industry enterprise merging with an emerging enterprise, (3) a high P/E ratio enterprise merging with a low P/E ratio enterprise, (4) more attention on the M&A than on integration, and (5) the integration of only economies of scale. Shenwan Hongyuan's group chief of operations (CO) calls such M&As "Chinese-style merger and acquisitions." With the rapid development of digitalization in China, acquisitions target the information technology, biomedicine, and chemical industries. The acquirers are not only digital companies, but also traditional corporations undergoing digital transformation, including those in the automobile, consumer goods, medical, retail, media, telecommunications industries as well as public utilities.

RESEARCH DESIGN

Samples and Data

The M&A transactions of Chinese listed companies come from the RESSET database, which is the main event database for companies in the RESSET stock database. The data on innovation and social capital network of CEO proactive personality and CEO overconfidence is also from the RESSET database, whereas the background information on CEOs, which includes educational background and financial experience, comes from the CSMAR database. We require that (i) only the completed M&As are

TABLE 2 | Sample selection and distribution.

			Total
Panel A: Sample selection			
Mergers and acquisitions from Chinese mainland during 2010–2019			17,126
Less			
Observations not complete M&As			1,908
Observations in the financial industry			2,198
Leveraged buyouts, spin-offs, capital structure changes, privatization			8,513
Observations equity proportion < 50%			2,106
Observations with missing CEO data			2,337
Final sample			64
Types	**Industry**	***n***	**(%)**
Panel B: Observations by merger type			
Cross-industry merger	Emerging industry	20	31.25%
	Traditional industry	6	9.38%
Intra-industry merger	Emerging industry	30	46.88%
	Traditional industry	8	12.50%
Total		64	100.00%
Types	**Industry**	***n***	**(%)**
Panel C: Observations by industry			
Emerging industry	New-generation information technology	3	4.69%
	High-end equipment manufacturing	14	21.88%
	New materials	14	21.88%
	Biological	6	9.38%
	New energy automobile	2	3.13%
	New energy	1	1.56%
	Energy conservation and environmental protection	1	1.56%
	Digital creative	1	1.56%
	Related services	8	12.50%
Traditional industry		14	21.88%
Total		64	100.00%

included, (ii) the merging firms are not in the financial industry, given differences in financial reporting systems, and related regulations, (iii) according to the purpose of M&As, leveraged buyouts, spin-offs, capital structure changes, privatization, and similar types of transactions be excluded, and (iv) the equity proportion in M&A transactions should not be <50%, to avoid portfolio investment situations. Following these criteria and eliminating observations with missing data, we collected 64 major Chinese domestic M&As during 2010–2019. **Table 2** Panel A provides the sample selection process.

Table 2, Panel B shows the breakdown of observations by M&A type. The results show that the most heavily represented M&A type is intra-industry mergers in emerging industries (46.88%), followed by cross-industry mergers in emerging industries (31.25%). The fewest observations are cross-industry mergers in traditional industries (9.38%).

Panel C presents the breakdown of observations by industry. The enterprises in the sample are divided according to the concept of strategic emerging industries proposed in China's 13th Five-Year Plan for the Development of National Strategic Emerging Industries. There are 50 enterprises in emerging industries, accounting for 78.12%. The remaining 14 are traditional industries. There are nine types of emerging industries: new-generation information technology industry, high-end equipment manufacturing industry, new materials industry, biological industry, new energy automobile industry, new energy industry, energy conservation and environmental protection industry, digital creative industry, and related services industry. The buyers of emerging industries in the sample are mainly in the high-end equipment manufacturing industry (14) and the new materials industry (14).

Measurement

Table 3 shows the description, codification, and data source of the outcome and conditions. The choice of M&A target, *MEG*, is an outcome. Referring to the guidance on industry classification of listed companies issued by the China Securities Regulatory Commission (2013), different category codes are represented as A, B, C, etc. The large class code is represented by two numbers, coded sequentially, starting at 01. If all three codes of the acquiring enterprise and the target enterprise are identical, *MEG* equals 0. If they are not identical, *MEG* equals 1, which is regarded as a cross-industry merger.

CEO proactive personality is an antecedent condition. The board of directors is the highest authority in listed companies in China. In the power structure and configuration of companies, the chairperson is the core of power and has the final say in decisions. Therefore, "CEO" in this study refers to the chairperson of the board. Some studies in psychology have found that proactive personality is significantly positively related to innovation (Kim, 2019) and social capital network in careers (Yang et al., 2011). Therefore, the chairperson's innovation and social capital network are used as proxy variables for proactive personality. The social capital network is measured by whether the CEO has a concurrent post in other companies (*PRO_CP*), which is regarded as a binary variable: Where they have a concurrent post, it equals 1, and 0 otherwise (Yang et al., 2011). The ratio of R&D investment divided by operating income measures innovation (Howella et al., 2020).

CEO overconfidence is an antecedent condition. As mentioned above, in the study of the illusion of control it is believed that the higher the compensation ratio of managers, the stronger their control. Therefore, the higher the managers' salary relative to that of the other managers in the company, the higher the managers' status, and the more likely they are to be overconfident. Considering the availability and feasibility of the data, the proportion of the top three directors' salary divided by the total board of directors' salary is used to measure CEO overconfidence (Jiang et al., 2011).

CEO background is an antecedent condition. Highly educated CEOs with MBA degrees are more likely to adopt aggressive

TABLE 3 | Outcome and conditions: description, codification, and data source.

	Symbol	Description	Codification	Data source
Outcome				
Merge type	*MEG*	A binary variable that assumes a value of 1 if the industry code of the buyer and the target enterprise are not the same, and zero otherwise	Crisp value	RESSET
Condition				
Proactive personality	*PRO_CP*	A binary variable that assumes a value of one if a CEO has a concurrent post in other companies, and zero otherwise	Crisp value	RESSET
	PRO_R&D	R&D investment divided by operating revenue	Fuzzy value	RESSET
Overconfidence	*OC*	Top three directors' salary divided by the total board of directors' salary	Fuzzy value	RESSET
Managerial background	*MB_EDU*	A binary variable that assumes a value of 1 if the highest degree of CEO is master's degree or above, and zero otherwise	Crisp value	CSMAR
	MB_FIN	A binary variable that assumes a value of 1 if CEO has ever worked in the financial department and financial analysis, and zero otherwise	Crisp value	CSMAR
Industry	*industry*	A binary variable that assumes a value of 1 if the industry of the enterprise is one of the nine emerging industries, and zero otherwise	Crisp value	RESSET

and high-risk investment strategies (Bertrand and Schoar, 2003). Here, *MB_EDU* equals 1 if the CEO has a master's degree or above, and 0 otherwise. A CEO's financial experience is defined as having worked in a financial department or financial analysis; such a CEO has worked in an accounting or auditing position, has been in a finance or major finance position, has a license for a middle or senior accountant, or is a certified public accountant. CEO financial experience (*MB_FIN*) is regarded as a binary variable. If CEO has financial experience, it equals 1, otherwise, it is 0 (Jiang et al., 2012).

Emerging industries is also a binary variable, based, as mentioned above, on China's 13th Five-Year Plan for the Development of National Strategic Emerging Industries. There are nine types of emerging industries. The variable, *industry* equals 1 if a company is from an emerging industry, and 0 otherwise.

Qualitative Comparative Analysis and Calibration

The fuzzy-set qualitative comparative analysis (fsQCA) is performed in our study. This method is moving beyond qualitative and quantitative strategies (Ragin, 1987). The primary function of the statistical method assumes that the relationship exhibits constancy, consistency, additivity, and symmetry. The collinearity between variables should also be strictly controlled. This assumption and the request in social science research are too idealistic. The QCA verifies the necessity and sufficiency of a single condition or conditional configuration by means of the relation between sets. In the relation of necessary conditions, the conditions constitute the superset of the result, without which the result cannot exist. In the relation of sufficient conditions, the conditions constitute a subset of the results, and the existence of the conditions can fully produce the results (Ragin and Fiss, 2008). The QCA method can be applied to cross-case comparisons of the large, medium, and small samples, especially in studies of small and medium samples ($<$100) (Fiss, 2011). In QCA, because of the logic of causal asymmetry, the conditional configuration (CC) affects the results from positive research; we can also further compare the configuration with the conditional one that leads to the disappearance of results, and the configuration obtained by the two kinds of analyses may be different.

The QCA includes three basic categories: clear set QCA (csQCA), A fuzzy set qualitative comparative analysis (fsQCA), and multi-value set QCA (mvQCA). Compared on the basis of characteristics, csQCA and mvQCA are only suitable for dealing with categorical problems, fsQCA can further deal with problems related to degree variation or partial membership. The fuzziness of granules, their attributes, and their values are characteristic of the ways in which humans granulate and manipulate information. Moreover, no methodology other than fuzzy logic provides machinery for fuzzy information granulation.

In fsQCA, each condition (i.e., the six factors in this study) and outcome (the choice of M&A target) are treated as a set. Each case has a membership score in these sets. The process of assigning membership grades is calibration (Schneider and Wagemann, 2012). Calibrated scores ranged from 0 to 1, representing cases without and with full membership, respectively. According to the data types of the various conditions and results, we use the direct calibration method (Ragin and Fiss, 2008) to convert the data into fuzzy set membership scores. The calibration process was based on the thresholds for full membership ($\geq$0.75), no membership ($\leq$0.25), and the crossover point (0.5). **Table 4** summarizes the calibration information for each condition and outcome in this study.

RESEARCH RESULTS

Necessary Condition Analysis

First, we examine whether a single condition (including its non-set) constitutes a necessary condition for a cross-industry merger or an intra-industry merger. Considering a set, the necessary analysis of a single condition is to check whether an outcome set is a subset of a set of conditions. In fsQCA, when an outcome occurs, a certain condition always exists; this condition is a necessary condition for the outcome (Ragin and Fiss, 2008).

TABLE 4 | Calibration for outcome and conditions.

Outcome and conditions	Calibration		
	Full membership	Cross-over point	Full non-membership
MEG	1		0
PRO_CP	1		0
PRO_R&D	3.5175	2.595	1.11
OC	33.5725	28.225	25.2225
MB_EDU	1		0
MB_FIN	1		0
industry	1		0

TABLE 5 | Analysis of necessary conditions.

Condition	Cross-industry merger		Intra-industry merger	
	Consistency	Coverage	Consistency	Coverage
PRO_CP	0.5769	0.4286	0.5263	0.5714
~PRO_CP	0.4231	0.379	0.4737	0.6207
PRO_R&D_fz	0.6954	0.5696	0.3595	0.4304
~ PRO_R&D_fz	0.3046	0.2455	0.6405	0.7545
OC_fz	0.7154	0.5730	0.3647	0.4270
~ OC_fz	0.2846	0.2346	0.6353	0.7654
MB_EDU	0.8462	0.4783	0.6316	0.5217
~ MB_EDU	0.1538	0.2222	0.3684	0.7778
MB_FIN	0.2308	0.3158	0.3421	0.6842
~ MB_FIN	0.7692	0.4444	0.6579	0.5556
industry	0.7692	0.4000	0.7895	0.6000
~industry	0.2308	0.4286	0.2105	0.5714

Consistency is an important criterion to measure the necessary condition. When the consistency level is higher than 0.9, the condition can be considered as a necessary condition for the outcome (Schneider and Wagemann, 2012).

Table 5 shows the test results for the necessary conditions for cross-industry mergers and intra-industry mergers, analyzed by fsQCA3.0 software. In **Table 5**, the outcome and all the conditions have been calibrated (suffix "fz" denotes a calibrated variable). The consistency level for all the conditions is not higher than 0.9; therefore, of the five conditions, none is a necessary condition for cross-industry mergers or intra-industry mergers.

Conditional Configuration Analysis of Cross-Industry Mergers

Conditional configuration analysis solves the problem of the sufficiency of an outcome caused by different configurations formed by multiple conditions. From the perspective of set theory, conditional configuration analysis checks whether a set constituted by multiple conditions is a subset of an outcome set. Consistency is still used in conditional configuration analysis to measure configuration sufficiency. The acceptable minimum criteria and calculation methods are different from those in conditional configuration analysis. Generally, the consistency of sufficiency is determined to be no lower than 0.75 (Schneider and Wagemann, 2012). In different research contexts, different consistency thresholds apply, such as 0.75 (Ragin and Fiss, 2008) and 0.8 (Fiss, 2011). The frequency threshold needs to be determined based on sample size (Schneider and Wagemann, 2012). For medium and small samples, the frequency threshold is usually 1; for large samples, the frequency threshold should be >1. Coverage is an important indicator that measures relevance in QCA and reflects the relevance or importance of a configuration. Coverage is similar to R^2 in regression analysis (Fiss, 2011).

Having studied the truth table and the case, we set the consistency threshold to 0.75 and the frequency threshold to 1. Thus, the threshold setting includes at least 75% of the observations and reduces the potential conflict configuration, PRI (proportional reduction in inconsistency). However, there is no consensus or theoretical expectation on the relationship between the six conditions and cross-industry mergers or intra-industry mergers. Therefore, we choose "presence or absence" for the question of which state of the six conditions will lead to cross-industry mergers or intra-industry mergers (Schneider and Wagemann, 2012).

The software fsQCA3.0 outputs three solutions: a complex solution, a parsimonious solution, and an intermediate solution. We report intermediate solutions (Fiss, 2011), supplemented by parsimonious solutions (Fiss, 2011). Following Fiss (2011), solid circles (●) indicate the existence of a condition, crossed-out circles (⊗) indicate the absence of a condition, and blank spaces indicate an ambiguous state. An ambiguous state means that a condition either exists or does not. A large circle signifies a core condition that exists in both the parsimonious solution and the intermediate solution. A small circle signifies an auxiliary condition (one that exists only in the intermediate solution). Core elements are those causal conditions for which the evidence indicates a strong causal relationship with the outcome of interest; and peripheral elements are those for which the evidence for a causal relationship with the outcome is weaker (Fiss, 2011).

There are five configurations with three solutions in **Table 6**. The consistency level for both the single configuration and the overall solution is higher than the acceptable minimum standard of 0.75. The consistency for the overall solution is 0.91, and the coverage is 0.40. These are consistent with the QCA research in the field of organization and management. The analysis shows that 91% of the cases satisfying these three solutions can lead to cross-industry mergers, while the three solutions can explain 40% of cross-industry merger transactions. The consistency level was adjusted from 0.75 to 0.8 for robustness tests, and the case frequency was changed from 1 to 2. The conclusion remained robust.

"Proactive–Overconfidence" in Cross-Industry Mergers

Specifically, concurrent post, innovation, overconfidence, advanced education, and non-financial experience are the core conditions in Conditional Configuration 1a

TABLE 6 | Configurations leading to cross-industry mergers.

Antecedent conditions	Cross-industry merger (presence of the outcome)				
	1a	1b	1c	2	3
PRO_CP	●	●	●	⊗	⊗
PRO_R&D_fz	●	●	•	⊗	●
OC_fz	●	●	●	●	⊗
MB_EDU	●	●		●	⊗
MB_FIN	⊗		⊗	⊗	●
industry		•	•	⊗	⊗
Consistency	0.8966	0.8552	0.8693	0.9135	1
Raw coverage	0.22	0.2135	0.1688	0.0365	0.0196
Unique coverage	0.0896	0.0831	0.0385	0.0365	0.0196
Solution consistency	0.9094				
Solution coverage	0.3977				
Cases coverage	7	7	6	1	1

Solid circles (●) indicate the existence of a condition, crossed-out circles (⊗) indicate the absence of a condition, and blank spaces indicate an ambiguous state. An ambiguous state means that a condition either exists or does not. A large circle signifies a core condition that exists in both the parsimonious solution and the intermediate solution. A small circle signifies an auxiliary condition (one that exists only in the intermediate solution).

(*PRO_CP*PRO_R&D_fz*OC_fz*MB_EDU*∼MB_FIN*). This indicates that proactive, overconfident and highly educated CEOs who are ambitious to change the current business environment will overestimate their own ability. This renders them more likely to choose cross-industry mergers when making decisions. This path has the highest explanatory power of the three configurations. Concurrent post and overconfidence are the core conditions in Conditional Configuration 1b (*PRO_CP*PRO_R&D_fz*OC_fz*MB_EDU*industry*) and Conditional Configuration 1c (*PRO_CP*PRO_R&D_fz*OC_fz*∼MB_FIN*industry*). Hence, we named this solution "Proactive–overconfidence."

"Overconfidence-Industry Experts" in Cross-Industry Mergers

In Conditional Configuration 2 (∼*PRO_CP*∼PRO_R&D_fz*OC_fz*MB_EDU*∼MB_FIN*∼industry*), overconfidence, advanced education, and traditional industry are the core conditions, while no concurrent post, low innovation, and non-financial experience are the auxiliary conditions. This suggests that CEOs in traditional industries with overconfidence and advanced education tend to choose cross-industry mergers. The path is called "Overconfidence-industry experts." The chairperson of Guangzhou Development Group is a senior engineer. The company is mainly engaged in the construction and operation of electric power and other infrastructure, which is a traditional industry. In 2019, it acquired Shenzhen Guangfa Electric Power Investment Co., Ltd. for investment management. The total compensation of the top three directors of the company accounted for 33.56% of the total compensation of directors, which was typical for overconfident managers and senior engineers in the industry. The chairperson fits the stereotype of an overconfident manager in a traditional industry.

"Innovation–Business Mind" in Cross-Industry Mergers

Conditional Configuration 3 (∼*PRO_CP*PRO_R&D_fz*∼*OC_fz*∼ MB_EDU*MB_FIN*∼industry*) is named "Innovation–business mind." This suggests that in traditional industries, managers who are innovative and focus on their own work can make up for their lack of educational background by using their own management knowledge. CEOs are familiar with the capital operation, capital markets, and making decisions prudently. Such managers are more inclined toward cross-industry mergers.

Conditional Configuration 1 and Conditional Configuration 3, "Proactive–overconfidence" and "Innovation–business mind," can be integrated into proactive CEO. For example, the chairperson of Chongqing Laimei Pharmaceuticals holds a master's degree and has been engaged in biomedical research since university. He has no financial background, although he has served as a director of Jinxing Pharmaceuticals and an executive director of Tibet Laimei Pharmaceuticals. The R&D investment of the company accounts for 11.97% of the operating income, which makes it a highly innovative enterprise. The total compensation of the top three directors accounts for 37.11% of the total compensation of directors. The directors possess enormous power and financial resources, suggesting that they are overconfident managers. In 2014, Chongqing Laimei Pharmaceuticals acquired Heyuan Investment; Chongqing Laimei Pharmaceuticals is a pharmaceutical manufacturing enterprise (C27), while Heyuan Investment Co., Ltd. is a capital market service company (J67). The acquisition of the company incorporated venture capital, industrial investment, equity investment, and investment management of Heyuan Investment Co., Ltd. into the business scope of the company. These departments formed the investment department of the company. In 2008, the chairperson of Furi Group was a senior economist with a junior college degree; he did not have a concurrent post. He belonged to the "Innovation–business mind" manager. The company's R&D investment accounted for 11.97% of the operating income, which made it a highly innovative enterprise. Furi Group was engaged in the textile industry, through an entity called "Towel King." It entered the photovoltaic industry, and almost considered the photovoltaic industry as the company's first main business. He tried to "save" the home textile industry by creating new growth through cross-industry mergers.

Conditional Configuration Analysis of Intra-industry Mergers

There are nine configurations with five solutions in **Table 7**. The consistency of each solution (configuration) and that of the overall solution is higher than the acceptable minimum of 0.75. The consistency of the overall solution is 0.93, and the coverage is 0.52. The analysis shows that 93% of the cases satisfying the nine configurations can lead to intra-industry M&As. Furthermore, the nine configurations can explain 52% of the cases. In this study, the consistency level was adjusted from 0.75 to 0.8 for the robustness test: the research conclusion remained robust.

TABLE 7 | Configurations leading to intra-industry mergers.

Antecedent conditions	Intra-industry merger (absence of the outcome)								
	1a	1b	2	3	4a	4b	4c	5a	5b
PRO_CP	⊗	⊗	•	●		•	•	⊗	⊗
PRO_R&D_fz		⊗	⊗		⊗	⊗		•	⊗
OC_fz	⊗	⊗		⊗	⊗	⊗	●		●
MB_EDU	●	●	•	⊗	⊗	⊗	⊗	⊗	⊗
MB_FIN	⊗	⊗	●	⊗	●	●	●	⊗	⊗
industry	•		⊗	•	•		•	•	
Consistency	0.8255	0.8527	1	0.947	0.9953	0.9955	0.9771	0.9239	1
Raw coverage	0.1518	0.1082	0.1021	0.0658	0.0558	0.0582	0.045	0.0447	0.0532
Unique coverage	0.0676	0.0239	0.1021	0.0432	0.0237	0.0261	0.0253	0.0221	0.0439
Solution consistency	0.9312								
Solution coverage	0.5168								
Cases coverage	6	5	4	3	2	2	2	2	2

Solid circles (●) indicate the existence of a condition, crossed-out circles (⊗) indicate the absence of a condition, and blank spaces indicate an ambiguous state. An ambiguous state means that a condition either exists or does not. A large circle signifies a core condition that exists in both the parsimonious solution and the intermediate solution. A small circle signifies an auxiliary condition (one that exists only in the intermediate solution).

"Concentration–Industry Experts" in Intra-industry Mergers

Specifically, in Conditional Configuration 1a (∼*PRO_CP* * ∼ *OC_fz* * *MB_EDU* * ∼ *MB_FIN* * *industry*), no concurrent post, non-overconfidence, and advanced education are the core conditions. It shares core conditions with Conditional Configuration 1b (∼*PRO_CP* *∼ *PRO_R&D_fz** ∼*OC_fz* * *MB_EDU* *∼ *MB_FIN*). This path has the highest coverage of the nine paths, which can explain about 15% of intra-industry M&A cases. This suggests that CEOs who focus on their own work and industry can make prudent decisions. They are likely to be in favor of intra-industry mergers. Moreover, they are usually not overconfident, nor do they overestimate themselves. We name it "Concentration–industry experts." Sheng Ji Tang Pharmaceuticals is engaged in the manufacturing of chemical raw materials and chemical products, as well as pharmaceutical manufacturing. The board of Sheng Ji Tang Pharmaceuticals was optimistic about the development prospects of the chemical and pharmaceutical businesses of the Chi Tian Hua Group, especially in the fields of urea, methanol, and pharmaceutical logistics. In 2015, the Chi Tian Hua Group was absorbed in a merger. The president of Sheng Ji Tang Pharmaceuticals, with a bachelor's degree, had no concurrent post or financial experience during his tenure. He was a type of CEO who focuses on his own position and industry. The purpose of the M&A was to strengthen the company's main business and achieve rapid development in the industry.

"Low Innovation–Financial Experience" in Intra-industry Mergers

Conditional Configuration 2 (*PRO_CP**∼*PRO_R&D_fz* **MB_EDU**MB_FIN**∼*industry*) can explain 10% of the cases. The analysis indicates that in traditional industries, CEOs lacking innovation but with basic business knowledge will not pursue transformation because the integration risk in a cross-industry merger is higher than that in an intra-industry merger. CEOs with business knowledge are aware of the management problems in the process of M&As; they will thus not blindly implement cross-industry mergers but will prefer intra-industry mergers. The path is named "Low Innovation–financial experience." In 2015, Shaoxing Wine acquired Zui Zhi Yuan Wine. The chairperson holds a master's degree. In 2014, the R&D investment of the company accounted for 0.32% of the operating income, in line with the low innovation intra-industry M&A profile. The purpose of the M&A was mainly to integrate the land resources of the two enterprises and reserve the necessary land resources for the company's subsequent development of the factory.

"Low Education–Deliberation" in Intra-industry Mergers

Regarding Conditional Configuration 3 (*PRO_R&D_fz**∼*OC_fz* **∼*MB_EDU**∼*MB_FIN**industry*), concurrent post, non-overconfidence, low education and non-financial experience are the core conditions. We named it "Low education–deliberation." Ji Shi Media acquired Jilin Cable Radio and Television Transmission in 2013. The chairperson of the company has a college degree, with no further education. He does not have financial experience, and therefore fits the intra-industry M&A profile of a CEO with low educational background.

"Low Education–Financial Experience" in Intra-industry Mergers

Conditional Configuration 4a (∼*PRO_R&D_fz**∼*OC_fz* **∼*MB_EDU**MB_FIN**industry*) shares core conditions with Conditional Configuration 4b (*PRO_CP* *∼ *PRO_R&D_fz* *∼ *OC_fz* *∼ *MB_EDU* * *MB_FIN*) and Conditional Configuration 4c *(PRO_CP* * *OC_fz* *∼ *MB_EDU* * *MB_FIN* * *industry*). Low education and financial experience are the core conditions, thus

named "Low education–financial experience." The companies that belong to configuration 4 are Chongqing Pharmaceuticals (0.99, 1), the Shanxi Antai Group (0.9, 1), Jiangsu Huaxin Materials (0.79, 1), the Wanhua Chemical Group (0.66, 1), and the Hangzhou Oxygen Generator Group (0.53, 1).

"Low Education–Concentration" in Intra-industry Mergers

No concurrent post and low educational background are the common core conditions of Conditional Configuration 5a (*∼PRO_CP * PRO_R&D_fz *∼ MB_EDU *∼ MB_FIN * industry*) and Conditional Configuration 5b (*∼PRO_CP *∼ PRO_R&D_fz * OC_fz *∼ MB_EDU *∼ MB_FIN*), thus it is named "Low education–concentration." The companies that belong to Configuration 5 are Kunming Yunnei Power (0.9, 1), Nanjing Medicine (0.79, 1), the Hunan Aihua Group (0.77, 1), and Henan Zhongyuan Expressway (0.56, 1).

Connection Between Conditions

Innovation and overconfidence are two important factors in cross-industry M&As. Innovation is the core condition or auxiliary condition for Solution 1(1a, 1b, and 1c) and Solution 2. Overconfidence is the core condition or auxiliary condition for Solution 1 1(1a, 1b, and 1c) and Solution 3. The key factors in intra-industry M&As are low educational background and non-proactiveness. Low educational background is the core condition for Solution 3, Solution 4 (4a, 4b, and 4c), and Solution 5 (5a and 5b). Non-proactiveness is the core condition for Solutions 4 and 5. That is, proactive and overconfident CEOs are inclined toward cross-industry M&As, whereas non-proactive, low-educated CEOs prefer intra-industry M&As. This is different from the traditional quantitative analysis of the symmetry of linear correlation. Moreover, the factors that lead to cross-industry and intra-industry M&As are not single, but multiple concurrent causal relationships.

In cross-industry mergers, "Proactive–overconfidence" occurs in emerging industries, and "Proactive–business mind" occurs in traditional industries. Proactive CEOs prefer cross-industry M&As in both paths. "Overconfidence-industry experts" occurs in traditional industries. It suggests that overconfident CEOs in traditional industries also tend to undertake cross-industry mergers. In the solution of intra-industry mergers, emerging industries appear in the five paths as auxiliary conditions. It is obvious that intra-industry mergers are dominated by emerging industries.

DISCUSSION

This study examines the influence of CEO proactive personality, overconfidence, background, and industry on M&A decision making. The results of fsQCA show that CEO characteristics and M&A decision-making is multiple concurrent causal relationships, rather than a one-way linear relationship of independent variables and causal symmetry. The results show that there are three configurations for cross-industry mergers and five paths for intra-industry mergers, which is inconsistent with regression analysis symmetry results.

We find that proactive managers who overestimate their capabilities tend to undertake cross-industry M&As. According to the upper echelons theory, previous research has shown that overconfident managers often engage in diversified M&As (Malmendier and Tate, 2008). Malhotra et al. (2018) showed that extraverted CEOs are more likely to engage in acquisitions, and to conduct larger ones, than other CEOs. They are also more likely than other CEOs to succeed in M&As. Moreover, narcissistic CEOs have been examined to invest more in M&A expenditures (Ham et al., 2018). This study adds a new psychological variable for the research on the influence of specific personality traits of executives on M&A cases. From the perspective of proactive personality, our study has extended the research on the influence of proactive personality on strategic decisions. Prior research has suggested that proactive employees had a positive effect on job performance and creativity (Li et al., 2021; Wei et al., 2021). Furthermore, research has also proved that CEO overconfidence is a core condition in cross-industry M&As (Malmendier and Tate, 2008). This study expands on prior research and finds that CEO overconfidence is not the only factor leading to cross-industry M&As. Through the fsQCA method, we find that a proactive personality and overconfidence both influence managers' decisions in emerging industries; they tend to choose cross-industry M&A. In addition, CEOs in traditional industries possessing advanced education and overconfidence tend to choose cross-industry mergers. Consistent with Zhang et al. (2019), we suggested that CEO overconfidence alone does not explain M&A decision-making.

Proactive, overly confident CEOs tend to choose cross-industry M&As. The same is true for proactive CEOs in traditional industries who possess financial experience. Managers with financial experience are better able to use professional financial knowledge to conduct capital operations and deal with crises to some extent (Graham et al., 2013). Custódio and Metzger (2014) have also indicated that CEOs with financial experience will choose aggressive business strategies. In addition, the results have shown that if one proactive manager shows overconfidence, another may tend to be cautious, changing the circumstances. They all choose to pursue cross-industry M&As. Sometimes, managers with different backgrounds, personalities, even working in different industries, may tend to make similar decisions since they evaluate their own management competence and judge industry competition (Chen and Lin, 2018).

Non-innovative CEOs with low education tend to choose intra-industry mergers. Emerging industries dominate such intra-industry mergers. Intra-industry mergers are not exactly the opposite of cross-industry mergers (Fiss, 2011). This is consistent with QCA method characteristics. In practice, intra-industry mergers and cross-industry mergers are not two sides of a coin. CEOs with low education who pay no attention to innovation, but have rich industry experience, tend to choose intra-industry mergers. Wally and Baum (1994) have examined the influence of CEOs' education on management competencies. They found that compared with CEOs with a low education level, CEOs with a high education level had more advantages in information processing. Many innovative and developmental enterprises are mostly

led by managers with high education levels. Therefore, CEOs' decisions are consistent with their judgment and competencies. Industry experts can excel at the integration of industries (Chen et al., 2021).

This study also adds perspective on traditional vs. emerging industry conditions, exploring the difference in M&A decision-making between traditional and emerging industries. The most investigated industries have been those of semiconductors, furniture, food, aerospace, and cement in the research on the upper echelons theory (Abatecola and Cristofaro, 2020). In other studies, the industry is usually used as a control variable in M&A studies (Lin et al., 2018). Hambrick and Quigley (2014) considered the industry's condition through the size-weighted mean return on assets. They creatively analyzed CEOs' effect in industries with different grades of discretion. However, our study uses a new type of industry division, which is based on Chinese policy. Our results show that emerging industries dominate intra-industry mergers. Overconfident proactive managers tend to choose cross-industry M&As in the emerging industry sector. At the same time, "Proactive–business mind" and "Overconfidence-industry experts" are two personality types in cross-industry M&As in traditional industries. Emerging industry managers desire integration. As traditional industries are mature, if managers want to make a breakthrough, they tend to enter a new industry to increase operational profits (Lee and Lieberman, 2010).

CONCLUSION

This study introduces new conditions for the psychological characteristics of CEOs and deviates from the widely discussed topic of overconfidence and M&As. We follow the upper echelons theory development and use innovation and social capital network to measure CEO proactive personality. On this basis, the study also adds an industry perspective: traditional and emerging industry conditions. The study explores the difference in the choice of M&As between the traditional and the emerging industries.

This research has several theoretical implications for organizations. Firstly, our study has extended the research on the influence of proactive personality on strategic decisions. In previous research, scholars studied the relationship between proactive employees and leadership. For example, Wei et al. (2021) found that proactive personality would energize employees and benefit job performance through decreasing psychological strain under high leader-member exchange. Li et al. (2021) examined the relationship between proactive employees and the organization. They suggested that proactive employees were more likely to engage in multisource information exchange activities with internal and external in the context of social exchange-based employee-organization relationships. Vanwalleghem and Mirowska (2020) studied proactive personality on investor preferences for sustainable investment. The results of their experiment indicated that highly proactive individuals exposed to positive environmental images will remain with the green fund longer than low proactive individuals. Nevertheless, our findings are just the beginning of exploring the influence of proactive personality on the type of M&A. Future study efforts need to expand more on the relationship between proactive personality and other strategic decisions.

Secondly, our study examined the influence of CEO characteristics on intra-industry M&As and cross-industry M&As. Based on the upper echelons theory, strategic decisions will further affect corporate performance (Hambrick, 2007). Scholars have widely studied the influence of CEO characteristics on firms' performance. Wang and Yin (2018) indicated that acquirers paid a lower target premium for education-state deals and the cumulative abnormal announcement returns were positive. Burns et al. (2021) found that acquirer board with supply chain experience was positively related to post-merger operating performance. Therefore, future studies may continue to explore the effect of proactive personality on merger performance. It would also be interesting to study the asymmetric effects of different configurations on post-merger performance (Fiss, 2011).

Thirdly, this study presents a novel perspective on M&A choices between different industries. Previous research regarded industry as a control variable in M&A studies (Lin et al., 2018). According to the division from the Chinese government, our study explores the difference in the choice of M&As between the traditional and the emerging industries. Future studies may explore the black box of the way that personality traits affect decision-making at the industry level (Abatecola and Cristofaro, 2020).

Finally, this study introduces the QCA method to reveal the interaction between different variables and explore the joint effect of characteristics of a CEO on the choice of merger type (Fiss, 2011). Although the framework of the upper echelons theory used here has covered many aspects of socio-demographic features and psychological variables of CEOs including proactive personality, overconfidence, and managerial background. There remain variables that are not discussed. The study does not examine the impact of socio-demographic characteristics (such as CEO age, gender, tenure, and political affiliation) or psychological factors (such as narcissism and extroversion) on M&A decisions. The results show that CEO characteristics and M&A decision-making is multiple concurrent causal relationships, and each characteristic alone does not explain M&A decision-making (Zhang et al., 2019). Therefore, future research directions include exploring the interaction of multiple socio-demographic features and psychological variables on management decision-making. An additional research topic is exploring M&As and business strategies through interviews and qualitative studies. Then, we may research that how these findings affect CEO type in different M&A situations.

The practical implications of the present study are two-fold. Firstly, due to the uniqueness of Chinese mergers and acquisitions, our samples mainly came from Chinese listed companies. China has an active economic environment, featuring rapid transformation, competitive markets. To perform well in a dynamic and uncertain work environment, employees need to be

proactive in their job (Crant, 2000). Increasing pressure on CEOs due to fierce competition stimulates greater proactivity. The more proactive the CEO, the more radical the M&A decisions. When making M&A decisions, managers should pay attention to the national environment and economic background, Moreover, they should strive to overcome bounded rationality and cognitive limitations under high pressure (Cristofaro, 2017). Due to the uniqueness of Chinese M&As and economic background, whether our research also applies to companies outside China remains for future research. For instance, when comparing contrasting cultural environments (i.e., American and Chinese), Li and Tang (2013) discovered that CEO hubris was also widely impacted by the beliefs and values at the country-system level.

Secondly, CEO personality and socio-demographic characteristics have been proved to affect the type of M&A decisions. The study's findings could help shareholders understand the role of managers' personality traits in decision-making. To improve the quality of decision-making, the company should pay attention to the characteristics and changes of managers' personality traits in strategy formulation. When making M&A decisions, CEOs must also consider their own competencies, background, and knowledge, judging whether they comprehend the target industry's characteristics and operations (Wally and Baum, 1994; Chen et al., 2021). Managers must attempt successful acquisitions that will positively affect the corporation and reduce the possibility of acquisition failure. Whether M&A achieves industry integration or internal innovation, successful acquisitions provide a steady stream of power for Chinese economic development (Lee and Lieberman, 2010).

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

GY conceived the study and was responsible for the revision of the article. XB was responsible for the research design and the writing of the article. SY was responsible for data collection and analysis. All authors contributed to the article and approved the submitted version.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.703678/full#supplementary-material

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Enhancing Organizational Memory Through Virtual Memoryscapes: Does It Work?

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Enhancing cognitive memory through virtual reality represents an issue, that has never been investigated in organizational settings. Here, we compared a virtual memoryscape (treatment) – an immersive virtual environment used by subjects as a shared memory tool based on spatial navigation – with respect to the traditional individual-specific mnemonic tool based on the "method of loci" (control). A memory task characterized by high ecological validity was administered to 82 subjects employed by large banking group. Memory recall was measured, for both groups, immediately after the task (Phase 1) and one week later (Phase 2). Results show that (i) in Phase 1, the method of loci was more efficient in terms of recalling information than the to the virtual memoryscape; (ii) in Phase 2, there was no difference. Compared to the method of loci, the virtual memoryscape presents the advantages – relevant for organizations – of being collective, controllable, dynamic, and non-manipulable.

Keywords: virtual reality, memory offloading, digital amnesia, organizational memory, virtual memoryscapes

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INTRODUCTION

With the rise of information technology and digitalization, memory offloading is becoming paramount in organizations. Information systems represent devices in which knowledge can be externalized to be stored, shared, and easily accessed to support decision-making (Stein, 1995; Alavi and Leidner, 2001; Barros et al., 2015). However, this massive memory offloading onto artificial devices comes at a price. The more we are used to offloading information, the less we rely on our memory (we quickly realize that the more pictures we take with our phone, the less we need to remember the things we see). There is evidence – also known as "*digital amnesia*" or "Google effect" – of a generalized decrease of memory performance: rates of recall of specific information depends on how much subjects expect to rely on external sources, such as the information on the Internet (Sparrow et al., 2011; Wegner and Ward, 2013). As discussed by Sparrow et al. (2011, p. 776): "The Internet has become a primary form of external or transactive memory, where information is stored collectively outside ourselves." Digital amnesia is critical in organizations in which not just the Internet but also dedicated intranets are heavily used to support decision-making. The more the information technology allows offloading a significant amount of fine-grained information on external devices, the less organizational actors rely on their memory (for a discussion, see Heersmink, 2016). Despite the advantage of freeing cognitive resources, offloading is often maladaptive and impairs memory performance (Carr, 2011; Greenfield, 2014).

How to enhance the cognitive memory of organizational actors is a relevant topic that is gaining in importance in the age of digital amnesia, acknowledging that not everything can be offloaded. In many organizational contexts, information must be strictly memorized to be cognitively handled and effectively used. While the well-known "transactive memory theory" (Wegner et al., 1985; Wegner, 1987; Bachrach et al., 2019) assumes that different subjects of a social group possess different information – memory is distributed – how to align information among individuals – *memory is shared* – is a relevant matter, unaddressed in current research. The problem significantly characterizes teamwork. We easily realize that some information is externalized onto dedicated systems, while other is distributed among team members.

Nevertheless, there is another type of information that cannot be offloaded on external artifacts, neither distributed among team members. Indeed, there are types of information that are simply shared: all the team members must be aligned; that is to say, *they all need to retain and recall the same information*. In addition, often, such information creates a significant cognitive burden, is continuously updated, and must be retained without errors (for the sake of simplicity, think about a team working on the design of a novel complex product so as all team members need to retain and quickly recall the general layout of the product in order to accomplish their tasks).

In this contribution, we argue that the current emphasis on information systems, as offloading devices, is diverting the attention of scholars from a number of alternative, cutting-edge applications of digital technologies. Such applications could be relevant to enhance organizational memory. *De facto*, digital technologies allow creating digital memoryscapes, that can be used by organizational actors as collective memory tools. While the non-technical notion of memoryscape refers to spatial representations of socially shared memory (Butler, 2007; Kappler, 2017), a *virtual memoryscape* is an immersive virtual environment used by subjects as a shared memory tool based on spatial navigation (cfr., Krokos et al., 2019). A virtual memoryscape, being – by definition – non-individual, can be used to create, in a controllable manner, a memory shared among the members (for a discussion on collective memory, see Hirst and Manier, 2008).

The use of virtual reality to enhance memory is also an emerging method in neuroscience research (Mishra et al., 2016; Wais et al., 2021). Evidence shows that memory processes involve spatial navigation, that is to say, superior memorizers tend to associate specific information to specific places, requiring a visual-motor experience (Maguire et al., 2003; Buzsáki and Moser, 2013; Hartley et al., 2014). The well-known mnemonic strategy called "Method of Loci," hereafter MoL (Yates, 1966; Legge et al., 2012, where "locus/loci" is the Latin of "place/places") requires associating the items to be remembered to specific experienced places. The involvement of active visual-motor interaction with the environment by leveraging vestibular and proprioceptive senses is functional to memorization (Brooks, 1999). Virtual reality allows creating "memorable" experiences to enhance productivity through a better recall of information (Krokos et al., 2019). The use of virtual reality as a collective memory tool represents a cutting-edge application in organizational settings and represents a tool to counterbalance the maladaptive consequences of massive offloading to "fix" digital amnesia in organizations.

In our study, we investigate the efficacy of a virtual memoryscape (where the locus is identical for all the subjects and is implemented through virtual reality) compared to traditional MoL (where the locus is individual-specific and mentally represented). We administered a memory task characterized by high ecological validity to 82 subjects with responsibilities in a business unit of a large banking group. Memory performance measured as memory recall was compared between a treatment group that used the virtual memoryscape and a control group that used the traditional MoL. The results highlight that, in the long-term, the virtual memoryscape and the traditional MoL are equivalent. The results are relevant as the virtual memoryscape presents a number of advantages with respect to the traditional MoL. Indeed, the virtual memoryscapes is (a) collective (the memoryscape is shared among organizational actors); (b) controllable (the memoryscape can be managed by a central authority); (c) dynamic (the memoryscape can be easily updated); and (d) non-manipulable (the memoryscape cannot be easily adulterated), as compared to individual usage of MoL.

Mnemonics

The "method of loci" (MoL) is the oldest known mnemonic strategy used to recall a sequence of items. It consists of imaging to place the items in specific locations ("loci" is the Latin for "places") of a familiar environment so that a person will be able to recall the items simply by visualizing the environment (Yates, 1966). MoL has been used since ancient Roman and Greek times and is also called the "memory journey" or "memory palace" because familiar places, such a house or a palace, were used as "loci": items to be remembered were ideally placed and recalled by mentally walking through the familiar environment. MoL is surprisingly effective as it allows memorizing a relevant number of items in a relatively easy manner. It is used in memory competitions, in which skilled individuals have to memorize the largest number of items (Raz et al., 2009). While memory champions can memorize a hundred items in a matter of minutes, unskilled individuals are able to memorize dozens of items even if they are applying the method for the first time. This makes MoL surprisingly powerful as it is relatively effortless considering its immediate results. Learning to link items to a place is a relatively easy task that can radically improve declarative memory with a relatively limited training time (Legge et al., 2012). The neural substrates involved in the MoL are "self-explaining": superior memorizers do not possess exceptional intellectual abilities or abnormal brain structures, but they are simply proficient in applying spatial navigation, based on the hippocampus, as a memory tool (Maguire et al., 2003; see also Mallow et al., 2015). Brain areas involved in spatial navigation and memory are connected: how we move in and perceive the environment influences the way we create our memory, that is to say, how we retain and recall contents (Buzsáki and Moser, 2013; Hartley et al., 2014).

However, the cognitive pillar of MoL also constitutes its main limitation: the familiar environment, in which items are ideally placed to be recalled, cannot be controlled across individuals. MoL relies on idiosyncratic resources, as different individuals use different places (i.e., everyone uses their own house) as a memory tool. This limitation is probably why MoL has been mainly used and investigated with reference to single individuals, while applications to larger social groups, such as the whole organization, are quite marginal. In other words, because loci are individual-specific, they could involve variables that cannot be controlled. In order to overcome these difficulties in experimental research, an experimenter-supplied environment, identical for all the participants, has been used (Jamieson and Schimpf, 1980; Moè and De Beni, 2005).

Virtual Reality and Memory

Virtual environments represent a substantial innovation for the application of MoL, as they allow creating "virtual palaces" that present the significant advantage of being immersive: such palaces do not need to be mentally represented, but they are implemented through a computer interface. The use of virtual environments presents some evidence, though limited (for an overview, see Krokos et al., 2019). Traditional MoL was compared with virtual environments, administered through a computer monitor (desktop condition). While some studies show that virtual environments are superior to traditional MoL (Legge et al., 2012), others show no difference between conditions (Fassbender and Heiden, 2006). What makes the difference is not the use of virtual environments *per se*, but that the virtual environments are *immersive* and can be experienced as 3D realistic spaces. Evidence of better memory recall is related to added dimensionality, such as using more displays to create a visual angle (Bowman and McMahan, 2007; Ragan et al., 2010). Indeed, there is solid evidence that visual- and motor-related processes influence memory (Maguire et al., 2003; Madan and Singhal, 2012a,b). Considering that the hippocampus plays a central role in both long-term memory and spatial navigation (e.g., Rolls and Xiang, 2006), it is possible to enhance memory (also for therapeutic interventions) through the experience of enriched environments administered through videogames and virtual reality (Clemenson and Stark, 2015; Mishra et al., 2016; Wais et al., 2021).

A fundamental and relatively recent innovation relies on the possibility of implementing MoL in virtual reality, in particular using a head-mounted display (hereafter HMD) which provides a stereoscopic field of regard, through distinct images for each eye, to allow a 3D realistic immersion into the environment (Shibata, 2002; Bowman and McMahan, 2007). As discussed by Krokos et al. (2019, p. 1): "HMD condition provide a superior memory recall ability compared to the desktop condition (2D). We believe this is a first step in using virtual environments for creating more memorable experiences that enhance productivity through a better recall of large amounts of information organized using the idea of virtual memory palaces." Virtual reality represents a fresh and novel application for memory recall: it allows creating virtual "memory palaces," that, involving a significant visual-motor experience, provide a strong association between the content to be retained and its spatial placement. Virtual reality is connoted by the fact that the individual perceives to be included in and interacting within an environment (Steuer, 1992; Slater et al., 2010). In particular, when place illusion (the sensation of "being there" in a real place) and plausibility illusion (the illusion that the scenario being depicted is actually occurring) occur, participants respond realistically to the virtual reality (Slater, 2009).

The possibility of an active visual-motor interaction with the environment, by leveraging vestibular and proprioceptive senses instead of a passive visualization, enhances memory and increases recall rates (Brooks, 1999). The use of virtual reality, implemented through an HMD, has been analyzed with reference to navigation time (Ruddle et al., 1999) and cognitive awareness of objects (Mania et al., 2003) and compared with a control group represented by desktop condition (where the spatial navigation was implemented through a computer screen). Vindenes et al. (2018) implemented MoL in a virtual environment, demonstrating that subjects with higher spatial reasoning abilities benefit more from the use of the MOL. Virtual reality was used to promote transfer: memory training to older adults with memory impairment increased performance on virtual reality memory tasks (Boller et al., 2021), in contrast with previous evidence showing that playing brain-training games in virtual environments did not improve the transfer of cognitive training (Parong and Mayer, 2020). A fundamental aspect of learning in a virtual environment pertains to the role of haptics (which is crucial in specific settings such as medical simulators, see Coles et al., 2010). Morimoto (2020) shows that haptic working memory and visual working memory share a common storage system. Memorization and recall are processed by different brain areas as there is a significant difference in the integration of multisensory information between the exploration of an object for encoding or the exploration for recalling purposes (Sciutti et al., 2019). Furthermore, social interaction also plays a role as immersion mediates person-virtual environment interaction effects on satisfaction and loyalty of VR applications (Hudson et al., 2019), contrary to previous findings showing that social interactions decrease the impact.

Very importantly, the widespread implementation of VR applications through HMD induces a number of symptoms and effects, so-called VRISE (Kourtesis et al., 2020) such as nausea, dizziness, disorientation, fatigue, and instability. Researchers' technological competency on HMD hardware, software, and procedures is paramount to ensure the health and safety standards to minimize cybersickness symptomatology (Kourtesis et al., 2019), particularly when HMD is use for long periods.

Research Gaps

Virtual reality, involving perception and action mechanisms, represents a relatively novel tool to enhance memory through spatial navigation in known architectures and places. The use of virtual reality as a tool for memory enhancement has never been investigated in organizational settings. Indeed, while previous studies (discussed in previous sections) have been conducted in non-ecological settings on non-representative populations (in particular, students, or patients), our study represents a novelty.

Virtual reality represents a new-generation tool for memory that creates virtual "memory palaces," which can be easily exploited by larger social groups (i.e., teams) to enhance memory. In other words, virtual reality allows extending the benefit of the MoL to larger social groups, as it provides a shared memoryscape, where *the same conditions for spatial navigation apply to all the users*. The non-technical notion of memoryscape refers to such places and landscapes used to recall information of cultural importance (Butler, 2007; Kappler, 2017) and is related to the general consideration that memory, in its cultural meaning, is not just "a property of time" but it normally refers to the spatial presence in specific places. In our contribution, we extend the general notion of memoryscape to virtual memoryscape, and we define, for instrumental purposes, *virtual memoryscapes* (hereafter VM) as virtual environments used by organizational actors as a shared memory tool based on spatial navigation. The traditional distinction between individual memory and organizational memory (assumed to be an individual-like construct, Walsh and Ungson, 1991) takes on particular importance. While transactive memory theory (Wegner et al., 1985; Wegner, 1987; Bachrach et al., 2019) assumes that different subjects of a social group possess different information (information is distributed: specific actors possess specific information), how to align information among subjects (information is shared: all actors must retain and recall the same information) is a relevant problem in organizational settings, for which virtual reality comes in help.

As we explain in the next sections, our study was implemented in a real organization and is connoted by stringent ecological conditions: (i) participants were part of a large banking group in which they have responsibilities in a business unit; (ii) experimental task was like real tasks they accomplish in their standard working activities; (iii) spatial navigation occurred in virtual places consistent with real workplaces, experienced by the participants.

Hypotheses

In our study, we investigate the efficacy of a virtual memoryscape (where the locus is identical for all the subjects and is implemented through virtual reality) in comparison with traditional MoL (where the locus is individual-specific and mentally represented).

We expect – *Hypothesis 1* – that *the traditional MoL is more effective than a VM in the short term. De facto* individual-specific familiar places (loci) are, from the cognitive point of view, more vivid and accessible, with respect to a novel virtual environment, so they constitute a more reliable short-term-memory tool (cfr., Jamieson and Schimpf, 1980; Moè and De Beni, 2005).

Short-term effects are trivial in organizational settings in which memory processes become critical when they involve long-term constructs. Then, we expect – *Hypothesis 2* – that *in the long term, a VM constitutes an equally, if not more, reliable memory tool as compared to traditional MoL, as it presents lower memory decay*. The potential reasons for hypothesizing a lower decay of memory after experiencing a VM is strictly related to the peculiarities of virtual reality (discussed in previous sections): virtual reality (used in the experimental group), allowing 3D immersive experience, exerts powerful cognitive imprinting, more effective than just "thinking about" familiar places (control group).

MATERIALS AND METHODS

Participants

Eighty-two participants were recruited from a large banking group. They had responsibilities in the business unit of customer support and sales. Participants had a normal or a corrected-to-normal vision, no history of auditory or psychiatric disorders. The study was compliant with the ethical principles of the Declaration of Helsinki (World Medical Association, 2013) and was conducted under a protocol approved by the Area Vasta Nord Ovest Ethics Committee (protocol n. 24579/2018). Participants were provided with an exhaustive description of all the procedures and were required to sign a written informed consent. The average age of participants was 44.52 (St. Dev. = 7.67), 34% were females, and 66% were males.

Task

Subjects involved in the experiment normally handle complex insurance contracts. Hence, we used the information of a (new but not publicly launched) insurance contract unknown to the subjects who participated in the experiment. We used as task an insurance contract to be remembered. Importantly, an insurance contract represents typical information that must be cognitively processed to be effectively handled. Such information can be undoubtedly offloaded onto external devices, but this offloading is somehow trivial, as this type of information must be cognitively retrieved by the decision-makers to be effectively used.

The use of a real insurance contract allows reproducing the ecological conditions normally faced by participants in their standard working activities. The memory task consisted of remembering specific contents of the new insurance contract. Such contents were represented by a list of words and descriptions, characterized by both numerical and textual information.

Phase 1

We created two randomized groups. We administered the memory task to the control group ($N = 41$) to be accomplished through the traditional MoL. First, MoL was explained to participants through the reading of descriptive information, then the contents of the insurance contract were listed in a textual manner on a screen. Participants applied MoL using individual-specific places (such as their own house) as memory tools. The memorization phase took 10 min, and then we measured the memory performance of participants through a 17-item questionnaire in which we asked them to recall specific information – words and descriptions – about the contract. We codified answers through a 5-point scale: from 0 ("totally incorrect"), through 0.5, 1, 1.5, to 2 ("totally correct"), so as to calculate a memory score for each participant (as the sum of items scores), where the maximum potential score was 34, resulting

from 2 (maximum score for a "totally correct" response) × 17 (number of items).

We administered the memory task to the experimental group ($N = 41$) to be accomplished through the VM. The experimental group ($N = 41$) experienced the virtual memoryscape through an HMD (Oculus Go^{TM}), allowing a 3D realistic immersion into the environment. The virtual environment had been specifically recorded by a 360-camera to resemble the real working setting experienced during everyday activities (same type of furniture and artifacts, similar layouts, etc.). This specific design of the virtual environment improves the ecological validity and is functional to the purpose of our study, implemented in strict organizational settings. The virtual memoryscape, see **Figure 1A**, was composed of five rooms: (1) Entrance, (2) Computer Room, (3) Meeting Room, (4) Book Crossing, (5) Break Room.

After a preliminary exploration session (10 min), the method of loci was explained through a text superimposed on the digital setting, and then participants entered again (for 10 min) into the virtual environment in which different objects were presented in each room. As shown in **Figure 1B**, by clicking each object, a pop-up window containing the word and the description was shown. Such words and definitions were the contents to be remembered, associated with different objects present in the virtual environment.

Immediately after the memory session, we measured the memory performance of participants through the 17-items questionnaire (described previously), in which we asked them to recall the specific information. The items were codified using a 5-point scale (from "totally incorrect" to "totally correct"). We calculated a memory score for each participant as the sum of the item scores.

Phase 2

In Phase 1, we assessed memory immediately after the memorization session. There are reasons to think that such memory performance was significantly based on the recency effect, which is the tendency to better recall the items at the beginning and the end of the administered list (Mack et al., 2017). Therefore, we cannot exclude that memory performance was significantly based on the information present in working memory, as the questionnaire was administered immediately after the use of MoL. Considering that our interest is not in working memory but in demonstrating the long-term efficacy of virtual memoryscapes in organizational settings, we replicated the 17-items questionnaire after a week, during which the participants had no opportunity to refresh the information to be memorized, in order to (re)assess the memory performance. Using the same questionnaire and same scoring system of Phase 1, we calculated the memory score for each participant after a week (Phase 2).

Statistical Analysis

The memory scores in Phase 1 and Phase 2 can be considered as a proxy of a memory decay to be intended as a delta of memory performances. This memory decay is related to the opportunity of assessing long-term effects ruling out short-term effects, relying on the evidence that memory decay is due to time passage or interference of other memoranda (Berman et al., 2009). Notice that memory decay, in our experiment, is related to a time-window of a week, but the results related to a week can be likely, generalized to longer terms as we can reasonably assume that the decay is monotonic according to the well-known Ebbinghaus' forgetting curve (Ebbinghaus, 1880), recently replicated (Murre and Dros, 2015).

We compared memory decay (between Phase 1 and Phase 2) related to treatment and control (VM and MoL, respectively). We first calculated descriptive statistics, then in order to test Hypothesis 1 and Hypothesis 2, we run a *two-factor ANOVA with repeated measures on one factor* after checking for the assumptions. Through the ANOVA, we compared treatment and control, calculating memory score in two different Phases for each subject (in which age and gender were covariates), along with effect size (using Hedges' g and ω^2, see Lakens, 2013). After that, we run a *post hoc analysis* for pairwise comparisons between control and treatment, in Phase 1 and Phases 2, using a *t-test* (evaluated through the Bonferroni adjustment). Statistical analyses were conducted with JASP (Version 0.14.1; JASP Team, 2020).

RESULTS

Descriptive Statistics

Table 1 shows the descriptive statistics of memory recall scores for control (MoL) and Treatment (VM) measured in Phase 1 (immediately after the task) and in Phase 2 (one week later). While control group memory is characterized by a decrease in memory recall from 12.207 in Phase 1 to 8.256 in Phase 2, the experimental group memory performance seems to be stable, ranging from 9.561 in Phase 1 to 9.585 in Phase 2. The control group presents less variability (i.e., lower standard deviation) in both Phases than the experimental group. Pearson's correlation between memory scores of the same individual in both Phases is negative: in particular, the moderate negative correlation in the control group (MoL) is significant and highlights that subjects with higher performance in Phase 1 present lower performance in Phases 2, suggesting a worsening in memory recall. The weak negative correlation in the experimental group (VM) is not significant.

Figure 2 shows memory scores in the previous table (37 is the maximum potential score, as described in section "Phase 1"). While for traditional MoL (control), memory recall drastically decreases between Phase 1 and Phase 2, for VM (treatment), there is no relevant difference between the two Phases.

Evidence

The assumptions of ANOVA were met as Shapiro–Wilk test for normality was not rejected, and Levene's test for the equality of variances was not rejected [$F_{(1,80)} = 1.416$, $p = 0.238$ for Phase 1 and $F_{(1,80)} = 0.942$ $p = 0.335$ for Phase 2]. Sphericity was not performed as there are only two levels of the repeated measures factors.

Table 2 reports results for the ANOVA. There is a significant difference between Phase 1 and Phase 2 as $F = 4.280$, $p = 0.042$.

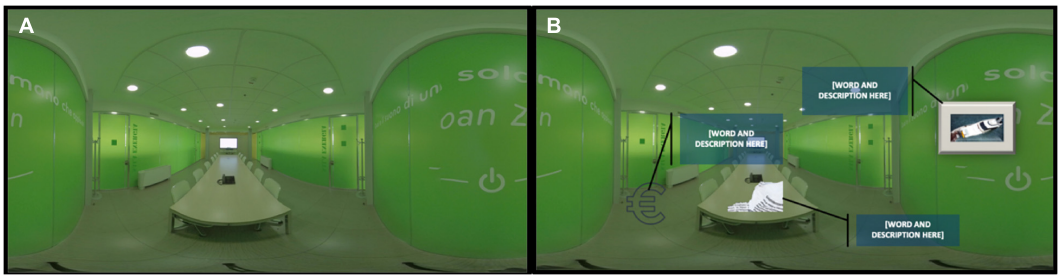

FIGURE 1 | 2D representation of the Meeting Room of the virtual memoryscape **(A)** with the objects and their pop-up windows in which words and descriptions were placed **(B)**.

TABLE 1 | Descriptive statistics of memory recall.

Groups	Repeated measures	*Mean*	*St. Dev.*	*Pearson's r*
MoL (control)	Phase 1	12.207	3.860	−0.342*
	Phase 2	8.256	3.659	
VM (treatment)	Phase 1	9.561	4.673	−0.038
	Phase 2	9.585	4.005	

*Score range: from 0 to 34. *P minor equal 0.05.*

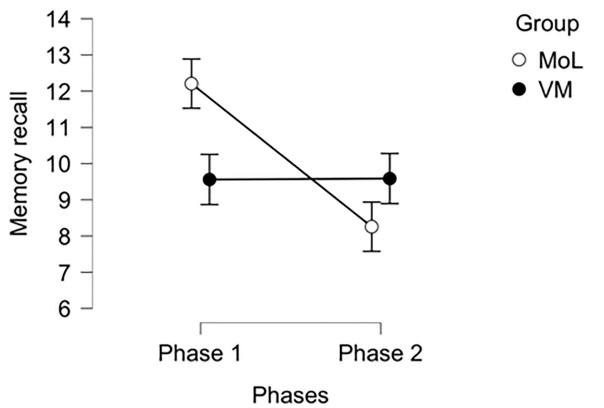

FIGURE 2 | Memory recall for control (MoL) and treatment (VM) in Phase 1 and Phase 2.

There is no significant difference between MoL group and VM group as $F = 1.347$, $p = 0.249$. Very importantly, the interaction effect Phases × Groups is significant, $F = 8.322$, $p = 0.005$, indicating that memory decay – the significant difference between Phases 1 and Phase 2 – differs between MoL group and VM group. The covariate "age" is significant in its main effect $F = 4.165$, $p = 0.045$ between groups. No significant difference in terms of main effect and interaction was found for gender. With reference to Within Subjects, the effect size is small for Phases ($\omega^2 = 0.024$), Phases × Group ($\omega^2 = 0.052$), Phases × Age ($\omega^2 = 0.014$), with reference to Between Subjects, effect size is very small for Group ($\omega^2 = 0.002$) and small for Age ($\omega^2 = 0.020$). Hedges'g is 0.154.

In order to articulate the results of the ANOVA, we conducted a *post hoc analysis* (with Bonferroni adjusted level) for pairwise comparisons among groups (MoL and VM) and repeated-measures (Phase 1 and Phase 2). Results are in **Table 3**.

In the MoL condition, memory decay between Phase 1 and Phase 2 is significant ($t = 3.734$, $p = 0.002$). In VM condition, memory decay between Phases 1 and Phases 2 is not significant. There is a significant difference between MoL and VM in Phase 1 ($t = 2.956$, $p = 0.022$), but there is no significant difference between MoL and VM in Phase 2. Furthermore, there is a significant difference between MoL in Phase 1 and VM in Phase 2 ($t = 2.671$, $p = 0.050$), but there is no significant difference between MoL in Phase 2 and VM in Phase 1.

Hypothesis 1

With reference to Hypothesis 1, in the short term, the traditional MoL was more effective than the VM, that is to say, subjects that used their individual-specific places (e.g., their house) as mnemonic tools exhibited a better recall, immediately after the task, with respect to the subjects that used the VM. Hence Hypothesis 1 is not rejected.

Individual-specific familiar places are probably more vivid and accessible with respect to a novel virtual environment, so they constitute a more reliable short-term-memory tool (cfr. Jamieson and Schimpf, 1980; Moè and De Beni, 2005). In the short-term the superior sense of immersion induced by virtual reality (which should help for better retention of information) is unable to compensate for the efficacy of the MoL, which results as a better, short-term mnemonic tool.

Hypothesis 2

With reference to Hypothesis 2, in the long term, there is no difference between the traditional MoL and the VM, that is to say, after only a week, the advantage of MoL disappears as subjects using the VM exhibit a performance similar to the subjects using the traditional MoL. Hence Hypothesis 2 is rejected.

Very importantly, the interaction effect indicates that memory decay (from Phase 1 to Phase 2) is significant in the MoL condition but not in the VM condition.

The potential reasons for hypothesizing a lower decay of memory in correspondence of the VM with respect to the MoL are plausibly related to the "cognitive availability" of familiar places, which work as a double-edged sword. Indeed, familiar places are probably as much vivid as much noisier because they are associated with many experiences in the subject's everyday

TABLE 2 | Results of two-factor ANOVA with repeated measures and covariates.

	Sum of squares	df	Mean square	*F*	*p*	ω^2
Within subjects effects						
Phases	81.577	1	81.577	4.280	0.042	0.024
Phases × Groups	158.627	1	158.627	8.322	0.005	0.052
Phases × age	56.655	1	56.655	2.972	0.089	0.014
Phases × gender	9.376	1	9.376	0.492	0.485	0.000
Residuals	1486.733	78	19.061			
Between subjects effects						
Groups	18.058	1	18.058	1.347	0.249	0.002
Age	55.847	1	55.847	4.165	0.045	0.020
Gender	3.633	1	3.633	0.271	0.604	0.000
Residuals	1045.807	78	13.408			

TABLE 3 | Results of *post hoc* analysis.

		Mean difference	SE	*t*	p_{bonf}
***Post hoc* comparisons – groups × phases**					
MoL, Phase 1	VM, Phase 1	2.645	0.895	2.956	0.022
	MoL, Phase 2	3.775	1.011	3.734	0.002
	VM, Phase 2	2.465	0.923	2.671	0.050
VM, Phase 1	MoL, Phase 2	1.130	0.923	1.225	1.000
	VM, Phase 2	−0.180	0.979	−0.184	1.000
MoL, Phase 2	VM, Phase 2	−1.310	0.895	−1.465	0.871

life. Precisely because familiar environments are cognitively available in the short term (they are part of a subject's life, so as to be easily employed in the traditional MoL), they cannot be exclusively dedicated to memory processes in the long term. In the long term, the VM, allowing 3D immersive experience, exerts a powerful cognitive imprinting, more effective than just "thinking about" familiar places.

DISCUSSION

Our study shows that immediately after the task, the MoL is a mnemonic tool superior to the VM (Hypothesis 1); after 1 week, there is no difference between the VM and MoL (Hypothesis 2). Our study also shows that while the MoL presents a significant memory decay (after only 1 week), the same cannot be maintained for the VM, as there is no difference in recall between Phase 1 and Phase 2.

The comparison between MoL and VM should be understood not in absolute terms (which mnemonic tool is better) but in relative terms, i.e., whether the advantages of the VM are able to "challenge" the well-known MoL. Hence the fact that Hypothesis 2 is rejected (VM and MoL are equivalent) is, nevertheless, a relevant result for organizational applications: *precisely because VM and MoL present an equivalent performance in long-term recall task, VM should be preferable as it possesses a number of advantages, that are missing in the MoL:*

(1) Virtual memoryscapes are collective. While the traditional mnemonic strategies (i.e., MoL) are individual-specific, virtual memoryscapes represent a substantial innovation as they extend the peculiarities of individual navigation (typical of the MoL) to social groups (i.e., teams) so as to constitute a collective tool able to align long-term memory among the members of a social group. The possibility of creating cognitively shared contents probably represents the most relevant advantage of using virtual reality to enhance organizational memory.

(2) Virtual memoryscapes are controllable. An intrinsic limit of the traditional mnemonic strategies (such as MoL) is that they are not experimentally controllable: subjects exploit idiosyncratic resources (each subject uses her/his own house) as a memory tool. Hence a comparative assessment of memory performance is problematic because it is strongly dependent on individual-specific factors. VM is controllable as the same virtual environment applies to all the subjects. This guarantees that such a tool, when implemented in organizational settings, admits tailormade design and implementation able to meet the specific needs of a team.

(3) Virtual memoryscapes are dynamic. Being experimentally controllable, it is possible to constantly update the VM (but this is not possible for the traditional MoL). For example, it is possible to place new content or to update an existing one. In this way, it is possible to "update the collective memory" simply by instructing subjects to re-navigate the virtual environment in order to retain the new information. VM, being implemented through an HMD, can be navigated often and easily. Of note is that the efficacy of VM for retaining continuously updated information (requiring novel spatial navigation) has not been tested so far. The

lack of evidence suggests exploiting this dynamic property parsimoniously and investigating it in future research.

(4) Virtual memoryscapes are non-manipulable. Information offloaded into external devices can be manipulated for deliberate purposes or erroneously (Risko et al., 2019). Virtual memoryscapes by enhancing cognitive memory are less subject to manipulation. If manipulated (i.e., some data are adulterated), the novel information generates a dissonance: adulterated data, present in the memoryscape, do not correspond to the ones retained in the cognitive memory of memoryscape users, so they are easily detected. Such dissonance could represent an effective control to erroneous adulteration and a deterrent to deliberate information manipulation.

Notice that a real memoryscape (not a virtual one), such as a real house or palace known by all the participants, could be used as a collective memory tool. *De facto*, it is possible to instruct subjects to navigate a common physical place to retain the specific contents located along the walking path. This strategy, though possible, is not easily implemented: it requires choosing an adequate physical place and asking participants to explore the place in controllable conditions. Virtual reality allows substituting physical places with tailormade virtual environments designed in order to fit specific organizational needs.

Implications for Organizations

Memory is often a collective phenomenon, not bounded to individuals (Hirst and Manier, 2008; Hirst et al., 2018). For centuries, we are used to offloading memory by distributing information among the members of our social group. Each member of the social group not only remembers her/his own information but somehow knows what kind of information other members are storing. The distribution of information among the members of a social group is a central argument of transactive memory theory, which, after almost 40 years since its seminal contributions, represents a traditional topic of organizational literature (see Wegner et al., 1985; Wegner, 1987). In organizations, teams constitutively rely on distributed information: each member delegates others to remember specific information and is entrusted with remembering its own. Information offloaded onto team members is broader and richer if compared to the one that a single member handles. Such distributed information tends to bind the members and free their cognitive resources (Brandon and Hollingshead, 2004; Zhang et al., 2007; Peltokorpi, 2008). While in its original formulation, transactive memory theory placed emphasis on the fact the knowledge was distributed among the members of a social group (Wegner, 1987), in its recent reformulation, such members are somehow substituted by digital technologies that constitute a handy and dynamic transactive memory (Wegner and Ward, 2013). Generally speaking, information systems can be helpful to extend transactive memory to larger groups to create a transactive memory that is no longer defined in the context of small groups, but that is valid for the entire organization (Nevo and Wand, 2005).

The possibility of extending memory outside individual brain-bounded boundaries, is related to the notion of extended cognition: it relies on the hypothesis that a number of cognitive processes are made possible either through the use of internal resources (i.e., brain) or external artifacts (Clark and Chalmers, 1998). Part of our memory can be transferred to external resources with an evident advantage of reducing cognitive load. In this perspective, cognitive offloading is an adaptive strategy used to free cognitive resources (Sparrow and Chatman, 2013; Heersmink, 2016). For example, whenever we use a calendar to keep a record of future meetings, we are offloading information that otherwise should be retained in our cognitive memory. But offloading is also maladaptive, as there is evidence of a general decrease of memory performance properly because the internal memory is substituted by external devices (Carr, 2011; Greenfield, 2014), contributing to generalized digital amnesia (Sparrow et al., 2011; Wegner and Ward, 2013). Furthermore, offloading facilitates information manipulation (Risko et al., 2019).

Hence, the pillar of information systems ("everything should be offloaded") could become the main cause of organizational digital amnesia: organizational actors are used to forgetting information precisely because they expect to rely on external memory devices, such as information systems. But such digital amnesia, which is, by definition, an individual phenomenon, presents systematic risks if its consequences spread in the whole organization. The maladaptive consequences of memory offloading (for an updated overview, see Heersmink and Sutton, 2020) are relevant in organizational settings, in which such maladaptive consequences could become systematic when they are not anymore idiosyncratic (limited to single subjects) but are "shared" among organizational members. The more organizational actors offload information, the less they possess at hand information to interact with other organizational members and to accomplish tasks. The less they possess at hand information, the more maladaptive consequences spread in the social group producing endemic consequences. For instance, the fine-grained content of a complex insurance contract (like the one we used in our experiment) can be surely managed through a dedicated information system, but this does not substitute that its content must be memorized (also in a coarse-grained manner) by decision-makers to be effectively used. If the decision-makers are not aligned – i.e., do not possess the same level of knowledge of the contract – they will be unable to use, on the fly, its content and effectively interact. Furthermore, they could make errors in modifying the contract. Due to their unaligned memory, they could create inconsistencies in the content of the contract, caused by their inability to handling its content as a "whole."

From the normative point of view, we argue that virtual memoryscape can be used (i) to fix the maladaptive consequences of massive offloading so as to counterbalance organizational digital amnesia; (ii) to align memory of the members of social groups (i.e., teams), overcoming the limits of traditional mnemonic methods (such as MoL) that are individual-specific.

Limitations and Future Research

Our study presents a number of limitations:

(1) In our study, we did not consider cybersickness symptomatology, such as nausea, dizziness, disorientation, fatigue, and instability, which stems from the implementation of VR systems (Kourtesis et al., 2019). Such symptomatology negatively affects cognitive and behavioral performance, and user experience. Despite the maturity of VR technology, how to evaluate this symptomatology is debated (see Somrak et al., 2021, for a comparison of cybersickness questionnaires).
(2) Researchers' technological competency on HMD hardware and software are paramount to reduce adverse symptoms and effects of virtual reality application, so as to ensure the health and safety standards. Inappropriate headsets produce cybersickness symptomatology and negatively affect performance and experience. In our experiment, we used an Oculus Go but other devices (such as Oculus Quest), able to better mitigate such negative effects (Kourtesis et al., 2019), are available. Consider, also that, in our experiment, the limited exposure to the virtual environment (10 min) limits the inductions of adverse symptomatology.
(3) Our experiment is characterized by the absence of ergonomic interactions and haptic sensations, and this reduces immersion. Haptic and visual working memory are strictly related (Morimoto, 2020), and the integration of multisensory information is crucial for exploratory or recalling purposes (Sciutti et al., 2019). Our study does not consider such aspects.
(4) We cannot exclude that one factor that might affect performance in the VM condition is the novelty, and in particular the excitement to use a novel technology (HMD). Indeed, we cannot exclude that this factors made the participants in the VM more motivated and enthusiast, that is to say, excitement for novelty, and not just immersive experience, played a role.
(5) A fundamental feature of our design is the predefined association between place/object and memory in the virtual environment. This aspect normally constitutes a limitation in standard applications in which personalization is desirable. Actually, this feature is a specific methodological choice in our study. The possibility of creating a virtual environment that *applies to all the subjects* (without a personalization) is precisely the organizational application that we are testing in order to align collective memory in a controllable manner. The notion of memoryscape is, by definition, collective (as we discuss in section "Introduction"). In our study, we were not interested in memory performance in absolute terms but in relative terms: we compared the VM (which applies to a social group) with respect to the MoL (which is individual-specific).

Results of our study show that the virtual memoryscape is not superior to the MoL in the short term, but it is equivalent one week later. But there are two caveats:

1. In our experiment, memory decay (the difference of memory performances between Phase 1 and Phase 2) is related to a time window of a week. If we project the decay on a longer-term, consistently with Ebbinghaus' forgetting curve (Ebbinghaus, 1880; Murre and Dros, 2015), we can reasonably assume that VM will surpass the traditional MoL. Put differently, there are reasons to hypothesize that memory performance based on MoL is probably less reliable in the long-term with respect to the one based on a VM.
2. In our virtual environment (treatment) we did not consider the role of ergonomic interactions and haptic sensations, and this represents a fundamental limitation (as discussed a few lines above). We cannot exclude that the introduction of ergonomic interactions and haptic sensations will increase the effect size in favor of the VM.

We postpone to future research the comparison between MoL and VM on longer-terms, taking into account of the limitations discussed above.

CONCLUSION

Despite the maturity of virtual reality technology and the increasing application for memory purposes, implementations in organizational settings are lacking. Our study represents a first attempt as it was implemented in strict ecological conditions: (i) participants were recruited from large banking group in which they had responsibilities in their business unit, (ii) experimental task was very similar to real tasks they accomplish in standard working activities, (iii) spatial navigation occurred in virtual places consistent with experienced workplaces.

Our experiment was not addressed to assess memory performance in absolute terms but to evaluate the virtual memoryscape (which is a novel, collective tool and could be salient in organizational settings) with respect to the traditional individual-specific MoL, representing a benchmark. In many organizational activities (such as the cases of team members working on complex projects), there are types of information that are simply shared (and not distributed as it happens in transactive memory) as all the team members must be aligned to remember the same contents. And often, such contents create a significant cognitive load, are continuously updated and must be retained without errors. In such situations, virtual memoryscapes came in help as they represent mnemonic tools that are intrinsically collective, provide a solution to the relevant problem of *memory alignment of team members,* and are able to support the creation of shared cognitive memory.

Our emphasis on memory enhancement through virtual memoryscapes is not simply motivated by the necessity of "fixing" digital amnesia and "counterbalancing" massive offloading in organizations. There is more. In the last two decades, the explosion of ICT has led to an increase of complexity, as technological advancements had an impact on connectivity among people and devices, computational power and storage of information (Merali, 2004; Hanseth and Lyytinen, 2016). The

advanced use of information systems became a mantra, not just for strictly functional and operational reasons but also because information systems represent critical resources with a strategic potential (Pearlson et al., 2019). Such an explosion of information often translates to increasing complexity with a great impact on existing business models. Far from producing only digital amnesia, information systems often generate complexification, which must be managed to require, to a greater extent, the use of dedicated cognitive resources.

Concluding, the use of virtual memoryscapes should be conceptualized as a novel digital tool that meets the challenges faced by many organizations in the age of complexity. Decision-makers are, more and more, involved in collective complex projects that require effortful cognitive processes characterized by significant cognitive burden. Digital technologies could come in help by augmenting cognitive faculties.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available. Requests to access the datasets should be directed to corresponding author (a.mastrogiorgio@imtlucca.it).

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Area Vasta Nord Ovest Ethics Committee (protocol n. 24579/2018). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

AM: validation, formal analysis, writing – original draft, writing – review & editing, and visualization. FZ: methodology and investigation. FM: project administration and funding acquisition. ER and NL: writing – review & editing, and funding acquisition. APM: conceptualization, methodology, writing – review & editing, and supervision. All authors contributed to the article and approved the submitted version.

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The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Are Founders More Socially Responsible? —An Empirical Research on Private Listed Companies in China

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Personal factors such as the founder's values and psychological characteristics will influence founder's vision, his perception and interpretation of the decision-making environment, and his strategic choice and decision-making. Based on the theory of entrepreneurial characteristics, combined with the founder's unique psychological characteristics, this paper takes Chinese private listed companies between 2010 and 2018 as a research sample to study the effect of the founder of private enterprises on corporate social responsibility. Furthermore, this study analyzes the impact of different management roles of the founder on corporate social responsibility. We demonstrate that the private enterprises have better social responsibility performance when there are founders; the founders have different management roles, and their corporate social responsibility performance has certain differences, and the higher the management level of the founders, the better the corporate social responsibility performance. This paper studies the issue of corporate social responsibility from the perspective of the characteristics of founders, which expands the current framework of corporate social responsibility research and provides an empirical basis for founders to effectively participate in corporate management in practice.

Keywords: founder, founder management, founder's management level, corporate social responsibility, empirical research

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INTRODUCTION

The issue of corporate social responsibility has long been a research topic which has received much attention from researchers. Corporate social responsibility affects the performance and development of the enterprise itself, also affects the economic growth and long-term stability of the whole society (Van Beurden and Gössling, 2008; Lenssen et al., 2011; Wang and Sarkis, 2017; Kong et al., 2020; Li et al., 2020). Due to the typical external characteristics of corporate social responsibility activities, in the short term, it may be more the increase of cost than the improvement of performance (Luo and Bhattacharya, 2006). Therefore, the current research on the influencing factors of corporate social responsibility focuses more on how to promote corporate social responsibility through the system, such as legal system (Gaint, 2010), media attention (Dyck et al., 2008; Saxton et al., 2019), moral culture (Ujan et al., 2020), and corporate internal governance mechanism (Li and Zhang, 2010),

through various formal and informal systems to promote corporate social responsibility. However, even under the same system background, there are still great differences in the level of social responsibility and the focus of social responsibility among different enterprises, which indicates that the system is not the only way for enterprises to fulfill their social responsibility. According to the theory of entrepreneurial characteristics, entrepreneurs will have an important impact on the behavior and performance of enterprises. These characteristics dominate the thinking mode, decision-making habits, and action logic of entrepreneurs (Li, 2013), and have different impacts on the corporate strategy and operating performance (Wu and Wu, 2008), as well as the corporate social responsibility activities (Duan, 2011). Therefore, on the one hand, we should pay attention to external institutional factors, on the other hand, we should also take note of internal factors such as enterprise managers.

With the concern of the public on corporate social responsibility, Chinese enterprises are increasingly aware that corporate social responsibility behavior is conducive to the positive response of the public, which may have a positive effect on corporate performance and even form a competitive advantage (Biswas, 2019; Biswas and Tortajada, 2020). Therefore, enterprises will actively carry out corporate social responsibility strategic behavior to pursue greater profits (Flammer, 2015; Kaul and Luo, 2018). Its special personality and psychological characteristics enable the founder to have a broader vision and more accurate perception and deep interpretation of the decision-making environment than other managers, so as to promote the rapid development of the enterprise more effectively. The founder has made arduous efforts in the survival and development of the enterprise, and has a strong sense of responsibility and belonging to the enterprise. Therefore, when the founder participates in the management of the enterprise, compared with other senior management team members, the founder will use various ways to promote the development of the enterprise (Hu and Su, 2020). Mace (1985) and Pound (1995) have pointed out that founders and other senior managers have the power and responsibility to make decisions at the top of the organization. The founder has made outstanding contributions to the development of the company, has great influence and decision-making ability on the company, and has greater value. However, there is little literature on the relationship between founders, founder management, and corporate social responsibility.

Thus, this paper takes the founder of private enterprises as the starting point and analyzes the impact of the founders of private enterprises on corporate social responsibility according to the theory of entrepreneurial characteristics. Based on the previous analysis, we further analyzes whether the different management roles of founders affect corporate social responsibility (The research model of this paper is shown in **Figure 1**). These researches have the following important theoretical and practical significance: first, the research on the impact of founders on corporate social responsibility will help enrich the content of corporate social responsibility motivation research. At present, the research on the motivation of corporate social responsibility mainly focuses on the institutional motivation and economic motivation of corporate social responsibility, that is, it is generally believed that corporate social responsibility is for the system legally or to bring economic benefits to the enterprise. As a special manager in an enterprise, it will help to further understand the founders to clarify their motivation to fulfill their social responsibilities. Second, it will help to have a deeper understanding of the role of founder. As a special manager of an enterprise, the social responsibility consciousness of the founder of an enterprise is closely related to the development of the enterprise. From the perspective of the special management role of the founder of the enterprise, this paper studies the impact of the founder on corporate social responsibility and further explains the role of the founder in the corporate governance of private enterprises. Third, it provides the empirical basis for the founder to participate in the management of enterprises in practice. Based on the private enterprises with founders, this paper examines the influence of different management roles of founders on corporate social responsibility, which is of great significance to the management practice of private enterprises and provides inspiration for the formulation of relevant policies of private enterprises.

LITERATURE REVIEW AND RESEARCH HYPOTHESIS

Founders of Private Enterprises and Corporate Social Responsibility

The important reason for an enterprise to fulfill its social responsibility is to realize its profit and enterprise value (Flammer, 2015). The research found that corporate social responsibility can improve corporate reputation (Zhang et al., 2016), corporate financial performance (Wang et al., 2018), staff efficiency and emotional recognition (Tourigny et al., 2019). According to the theory of entrepreneurial characteristics, entrepreneurial behavior has a direct impact on the strategic decisions and operational activities of an enterprise. Therefore, entrepreneurial behavior is closely related to the fulfillment of the social responsibility of enterprises. The research of Wasserman (2003) and He (2008) pointed out that the special identity of the founder makes it easier to establish an emotional connection with the enterprise. Compared with other managers, the founder will strive to play his talents to promote the development of the enterprise. The close relationship between the founder and the enterprise enables the founder to put their various relationships and capital into the growth of the enterprise (Xu and Liu, 2012). Therefore, compared with other managers, the founder has a long-term and unique vision for the development of the enterprise, which makes them more inclined to pursue long-term interests rather than focusing on short-term actions or simply ensuring the stable profitability of the enterprise, thus providing a guarantee for improving the scientific decision-making and operating performance of the enterprise (Duchesneau and Gartner, 1990), and ensuring the growth and profitability of the enterprise. The founder's characteristics make the founder pay more efforts for the enterprise, carry out strategic corporate social

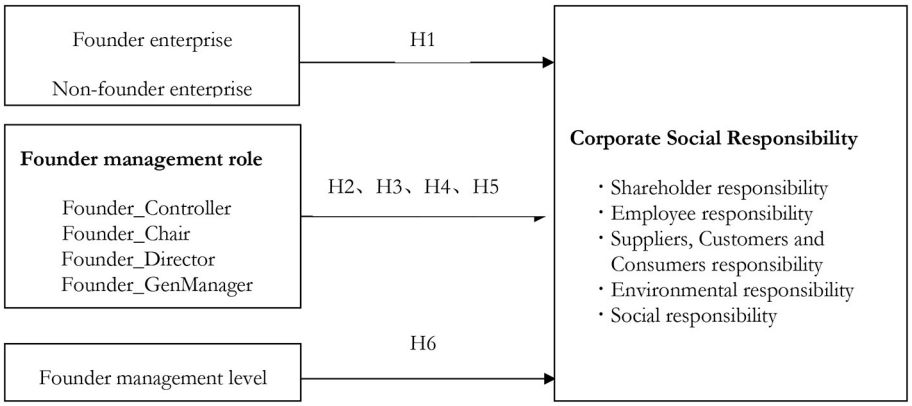

FIGURE 1 | Conceptual Model of founder and corporate social responsibility.

responsibility behavior to pursue greater profits (Flammer, 2015; Kaul and Luo, 2018), and make the enterprise develop more long-term and healthy. These research results show that when there are founders in private enterprises, founders will pay more attention to corporate social responsibility to maintain their own property, long-term development, and reputation. Consequently, the following research assumptions are proposed:

Hypothesis 1. The founders of private enterprises have a positive effect on the overall performance of corporate social responsibility and have a positive effect on all dimensions of corporate social responsibility.

Founder Management and Corporate Social Responsibility

As the initial framer of the organizational structure and development strategy, the special ability of the founder is very crucial to the sustainable growth of the enterprise (Nelson, 2003). Compared with the general managers, the founder has a stronger entrepreneurial spirit, can identify opportunities more effectively and be more willing to take risks (Johnson and Yi, 2013); in the decision-making process, the founder tends to respond more quickly to the market environment and have a long-term vision (Burgstaller and Wagner, 2015); moreover, the founder's hard work in the process of enterprise establishment and development will also endow him with a strong sense of mission and responsibility, and make him take less negative self-interest behaviors such as laziness and slowness (Wu and Hsu, 2018). Therefore, when the founder participates in the operation and decision-making of the enterprise, their special knowledge, experience, and organizational position will contribute to the long-term development of the enterprise (Johnson and Yi, 2013).

Founders are born with psychological ownership of the enterprises they founded (Wang et al., 2016). Therefore, founders often hold important management positions in the enterprises at the beginning of the establishment of the enterprises, such as the chairman, the CEO, or the chairman concurrently serving as the CEO. These positions are crucial to the enterprises, Pound (1995) pointed out that the CEO and other senior management has the power and responsibility for the senior decision-making of the organization within the organization. As the founder has made outstanding contributions to the development of the company, have great influence and decision-making ability on the company, and have greater value, therefore, when the founders are the senior management of the company, they have "natural advantages" (Fahlenbrach, 2009). Previous studies have shown that founders and other managers are not the same in terms of both internal characteristics and external incentives, which may have different impacts on the company's performance. When the founder participates in the company management, the connection between capital and non-capital gives the founder more enthusiasm and motivation to make better decisions and supervision. Therefore, the founder as a manager who actively participates in business management can significantly enhance the corporate value of the enterprise (Certo et al., 2001; Anderson and Reeb, 2003; Wu and Hsu, 2018). Xia et al. (2012) believes that in the long-term entrepreneurial process, the founder has accumulated a lot of management experience, authority and government relationship, so the impact of the founder management on the overall development of the enterprise will be more direct, and will certainly reflect the positive impact on the development of the enterprise. Li and Srinivasan studies have shown that when founders act as directors, there are more capital and non-capital connections that require founders to exercise supervision functions with better ability and motivation, and have a better governance environment than companies in which non-founders participate (Li and Srinivasan, 2011). Nelson (2003) pointed out that the founder as the general manager of the company has a positive effect on corporate governance and corporate development. This positive effect may come from the long-term incentive of the founders, in other word, the founders pay more attention to the long-term development of the enterprise rather than short-term performance, and may also come from the special assets of the operation and management of the enterprise owned by the founders themselves, such as reputation, experience, ability and relationship with the outside world. Therefore, when the founder participates in the enterprise management, for the development of the enterprise and the

creation of a broader living space, the enterprise will take the initiative to undertake social responsibility, which is not only conducive to the establishment of the corporate image but also enables the sustainable development of the enterprise's society, economy and ecology (Hu, 2004). Consequently, we propose the following research assumptions:

Hypothesis 2. The founder of private enterprises as the actual controller has a positive effect on the overall performance of corporate social responsibility and has a positive effect on all dimensions of corporate social responsibility.

Hypothesis 3. The founder of private enterprises as the chairman of the board has a positive effect on the overall performance of corporate social responsibility and has a positive effect on all dimensions of corporate social responsibility.

Hypothesis 4. The founders of private enterprises as general managers have a positive effect on the overall performance of corporate social responsibility and have a positive effect on all dimensions of corporate social responsibility.

Hypothesis 5. The founder of private enterprises as a director has a positive effect on the overall performance of corporate social responsibility and has a positive effect on all dimensions of corporate social responsibility.

Founder's Management Level and Corporate Social Responsibility

Based on the logical relationship of the impact of founder management on corporate social responsibility, it can be concluded that the level of founder management will also have an impact on corporate social responsibility. Since undertaking social responsibility can bring strategic benefits and reputation to the enterprise, the founder, as a special manager of the enterprise, can make its decision-making influence bigger by holding multiple management positions. The founder has accumulated rich professional knowledge and management experience in the development process of the company. The residual claim and residual control rights owned by the founder endow the founder with greater rights that guarantee a smooth advancement of their decision-making and increase their enterprise value. Donaldson believes that the ability of management can only be fully exerted if the power of management is not limited (Donaldson and Davis, 1991). If the general manager concurrently serves as the chairman of the board of directors, he will have stronger independence than other management, be more able to realize his own will, and have more power. Therefore, if the founder concurrently holds multiple management roles, the founder will have more stable power, which is conducive to the improvement of corporate value. Founder roles with different numbers of positions affect firms differently. Therefore, we select the number of important management roles held by founders to measure the management level of founders and propose the following research assumptions:

Hypothesis 6. The higher the management level of the founders of private enterprises, the positive effect on the overall performance of corporate social responsibility and the positive effect on all dimensions of corporate social responsibility.

TABLE 1 | Sample distribution.

Year	Total sample	Founder sample
2010	758	514
2011	896	629
2012	956	676
2013	987	698
2014	1,050	756
2015	1,161	850
2016	1,303	984
2017	1,492	1,182
2018	1,516	1,202
Total	10,119	7,491

MATERIALS AND METHODS

Sample Selection

In 2009, in response to the requirements of "notice on strengthening the social responsibility undertaking of listed companies" issued by the Shanghai Stock Exchange, some listed companies in China successively disclosed independent social responsibility reports, which made it possible to obtain more systematic and comprehensive social responsibility information. Based on the social responsibility report of listed companies, Hexun.com began to evaluate the social responsibility performance of Listed Companies in 2010, and released data publicly, which provides the basis for this paper to measure the performance of corporate social responsibility. We were able to obtain data about CSR from 2010 and onwards. Hence, our sample consists of firms during 2010–2018. Due to the structural diversification of China's market economy and its unique institutional background, China's private economy has a broad and narrow sense. This paper draws on Wang Jinsong's narrow definition of the private economy (Wang et al., 2005). Thus, this study will selects enterprises other than state-owned and state-controlled enterprises and foreign-funded enterprises as the research sample. We also exclude financial and insurance listed companies because of the particularity of the business and accounting of financial and insurance companies in China. Finally, after excluding observations with incomplete data, a final sample with 10,119 firm-year observations is obtained. In the study of founder management, the enterprises without founders were excluded, and a total of 7,491 samples were obtained. The sample distribution is shown in **Table 1**.

In this paper, the founder data is used to obtain the stock code of private listed companies according to the CSMAR database, and the company that is the founder is pointed out through the "information of the issuer" in the prospectus of the listed company, and through CSMAR database family business basic information database and Chinese listed company equity nature document database and Baidu.com search for auxiliary confirmation. Corporate social responsibility score related data from Hexun.com (http://stockdata.stock.hexun.com/) Social responsibility report of listed companies. Other data in this study are from the CSMAR database.

Research Methodology

In order to test our hypotheses, we estimate the following models using OLS regression.

Model 1.

$$CSR^* = \beta_0 + \beta_1 Founder + \gamma\ Control\ Variables_{jt} + Industry\ dummies_j + Year\ dummies_t + \epsilon$$

Model 2.

$$CSR^* = \beta_0 + \beta_1 Fou\_Controller + \gamma Control\ Variables_{jt} + Industry\ dummies_j + Year\ dummies_t + \epsilon$$

$$CSR^* = \beta_0 + \beta_1 Fou\_Chair + \gamma Control\ Variables_{jt} + Industry\ dummies_j + Year\ dummies_t + \epsilon$$

$$CSR^* = \beta_0 + \beta_1 Fou\_Director + \gamma Control\ Variables_{jt} + Industry\ dummies_j + Year\ dummies_t + \epsilon$$

$$CSR^* = \beta_0 + \beta_1 Fou\_GenManager + \gamma Control\ Variables_{jt} + Industry\ dummies_j + Year\ dummies_t + \epsilon$$

Model 3.

$$CSR^* = \beta_0 + \beta_1 Fou\_Manager + \gamma Control\ Variables_{jt} + Industry\ dummies_j + Year\ dummies_t + \epsilon$$

Among them, CSR* is the score of corporate social responsibility, which are the total score of CSR_Total, shareholder responsibility score CSR_Shareholders, employee responsibility score CSR_Employees, supplier, customer and consumer responsibility score CSR_Suppliers, Customers, Consumers, environmental responsibility score CSR_Environmental and score CSR_Social.

Dependent Variable

In these two models, the dependent variable is corporate social responsibility (CSR). In recent years, foreign kinds of literature mostly use the KLD index to measure, but there is no consistent method in China. In addition to using the well-known professional institution evaluation index KLD for reference, the domestic evaluation indicators of corporate social responsibility also use the scoring data of the third-party rating agencies for corporate social responsibility in China, such as Hexun.com social responsibility report professional evaluation system and Runling global organization for rating corporate social responsibility performance. Based on the research of Wang and Xu (2016) and Feng et al. (2016) this paper uses the social responsibility score of hexun.com professional evaluation system to measure the level of social responsibility of private enterprises. This score is based on the social responsibility report and financial report information of China's listed companies, which sets up 13 second-level indicators and 37 third level indicators, respectively from five aspects of shareholder responsibility, employee responsibility, supplier, customer and consumer responsibility, environmental responsibility, and social responsibility. The evaluation system systematically evaluates corporate social responsibility, which can reflect corporate social responsibility comprehensively and objectively. In recent years, it has been applied in more and more related researches.

Explanatory Variables

The explanatory variables are founder, founder management and founder's management level. In this paper, referring to the relevant research of Xiaogang et al. (2011) and Xiaofei (2014), we define the founder as following the establishment and growth of the enterprise, relying on certain market opportunities and resources, relying on their organizational management ability, innovation consciousness, ability to identify and bear risks, and playing a role of actual control, interest coordinator, and risk-taking in the enterprise The final decision-maker and other important management roles. In this study, as long as the founder exists in the existing organizational structure of the company, we are identified as the founder company. In the process of founder confirmation, if the same enterprise has more than one founder, this article takes the founder with the highest position as the statistical object. It is defined as a binary variable and takes on two values: 1, indicating the existence of a founder in a private enterprise; otherwise 0.

We define founder management as the founder holding different management positions in the enterprise. After identifying the founder, we obtained the names of the actual controller, chairman, director, and general manager of the company from the CSMAR corporate governance database, and checked with the founder's name to determine whether the founder was the actual controller, chairman, director or general manager of the company. It is defined as a binary variable and takes on two values: 1, indicating the founder as actual controller of the company, otherwise 0; If the founder is the chairman of the company, the value is 1, otherwise 0; If the founder serves as general manager of the company, the value is 1, otherwise 0; If the serves as director of the company, the value is 1, otherwise 0.

We define founder's management level as the number of management positions held by the founder. It is defined as a categorical variable and takes on one of four values: 1, indicating the founder holds one management position; 2, indicating the founder holds two management positions; 3, indicating the founder holds three management positions; 4, indicating the founder holds four management positions; otherwise 0.

Control Variables

In order to control the influence of other factors on the research conclusion, the following variables are selected as the control variables for the other main factors affecting the corporate social responsibility performance.

Firm Size. The research of Jia and Liu (2014) controlled the enterprise-scale and found that the enterprise-scale will affect the corporate social responsibility behavior.

Return on Assets (ROA). ROA equals operating profits divided by total assets. The higher the enterprise performance, the more likely the enterprise is to report its corporate social responsibility activities (Liao et al., 2018).

Asset-liability Ratio. Asset-liability Ratio equals total liabilities divided by total assets. which is used to control the impact of the capital structure of listed companies (Jia and Zhang, 2010).

Largest Shareholder Ratio. Based on Xia Lijun's literature, this paper selects the shareholding ratio of the first largest shareholder as the control variable, which represents the equity concentration (Flammer, 2018).

Total Assets Growth Rate. Total Assets Growth Rate refers to the growth of the enterprise's asset scale in the current period, reflecting the growth of the enterprise. Tian (2009) pointed out that corporate growth performance promotes corporate social responsibility.

Independent Director Ratio. Chen et al. (2015) believes that the board of directors with a higher proportion of independent directors improves the accounting information environment and improves the quality of financial reports, so independent directors can promote the implementation of corporate social responsibility and protect the interests of stakeholders (Fernández-Gago et al., 2016).

Board Size. Liao et al. (2018) believes that a large-scale board of directors can obtain different views from different stakeholders, and will invest more energy and resources to fulfill their roles in social activities and performance. Therefore, the larger size of the board of directors, the greater the possibility of enterprises voluntarily undertake social responsibility.

Separation of Ownership and Management. Separation of Ownership and Management refers to the difference between the control right and the ownership of the listed company owned by the actual controller. Yi et al. (2018) pointed out that the lower the separation of the two rights, the more conducive to the fulfillment of corporate social responsibility.

Firm Age. Referring to the research of Jia and Liu (2014), corporate age will affect corporate social responsibility behavior. This study controls the age of enterprises from the establishment of enterprises to 2018.

Year and Industry. In order to control the impact of uncertain factors at the macro-economic environment level and industry level on the corporate social responsibility performance, we use dummy variables to control the year and industry.

All variable definitions are shown in **Table 2**.

RESULTS

Tables 3, **4** display the descriptive statistics of our sample. According to the descriptive statistics in **Table 3**, the average value of CSR_Total is 23.472, and the standard deviation is 14.988. According to the scoring method of Hexun, the total score of social responsibility should be 100, while the average score of social responsibility of private listed companies is 23.472, which indicates that the overall level of social responsibility of private listed companies in China is low, and there are differences in the level of social responsibility among different private enterprises. Regarding the variable of the founder, which accounts for 74% of the total sample. It shows that there are founders in most private enterprises. In **Table 4**, it can be seen that the actual controller of the founders accounts for 90% of the founder sample, and the founder chairman accounts for 74% of the founder sample. It shows that most of the founders participate in the management of the enterprise with the positions of actual controller and chairman. The founder's participation in enterprise management as the actual controller or chairman of the board has an impact on the enterprise's management and decision-making. The founder's characteristics make him make decisions conducive to the development of the enterprise when participating in enterprise management. Therefore, the founder's participation in enterprise management as the actual controller or chairman of the board is more conducive to the implementation of corporate social responsibility.

In this study, Pearson test was used to analyze the correlation of founder, founder management degree, corporate social responsibility and other related variables. The detailed results are shown in **Table 5**. The research shows that there is the correlation among various variables, which preliminarily indicates that there is an internal relationship between variables, which can be further studied. In order to prevent the multicollinearity problem between variables, the VIF test is performed on variables. The multicollinearity test shows that the variance expansion factor VIF of all independent variables is less than the empirical critical value of 10, indicating that the variables are reasonable.

In this paper, the sample is divided into six groups according to whether there is a founder, whether the founder is the actual controller, chairman, general manager and director of the enterprise, and the management level of the founder. The one-way ANOVA is used to test the level of corporate social responsibility among the groups. The statistical results are shown in **Table 6**.

It can be seen from **Table 6** that the average value of corporate social responsibility of private enterprises with founders is higher, and it passes the test at the 1% level, indicating that private enterprises with founders have more sense of social responsibility, which is consistent with our previous analysis. When the founder plays the role of enterprise management, the study finds that when the founder acts as the actual controller, chairman, general manager and director of the enterprise, the average value of corporate social responsibility is higher than that when the founder does not play the role of management, and it passes the inspection at the level of 1% and 10%, indicating that the private enterprise has better social responsibility performance when the founder plays the role of enterprise management, When the founder acts as the actual controller and chairman of the company, the sense of corporate social responsibility is stronger. From the perspective of Founder management, the higher the level of Founder management, the higher the average social responsibility, and passed the test at 1%, indicating that the higher the level of Founder management, the better the performance of corporate social responsibility.

First of all, based on whether there are founders in private enterprises, private enterprises are divided into founder enterprises and non-founder enterprises. In this part, this paper tests whether the founder of enterprise existence has a sense of social responsibility to verify Hypothesis 1.

Table 7 reports the regression results of corporate social responsibility of founders. It can be seen from **Table 7** that

TABLE 2 | Variable definitions.

	Definition
CSR_Total	Hexun's social responsibility for listed companies is mainly investigated from five aspects: shareholder responsibility, employee responsibility, supplier, customer and consumer rights and interests responsibility, environmental responsibility, and social responsibility
CSR_Shareholders	Hexun's responsibility to shareholders mainly measures profit, debt repayment, return, credit approval and innovation
CSR_Employees	Hexun's responsibility to employees mainly measures performance, safety and caring for employees
CSR_Suppliers, Customers, Consumers	Hexun's responsibility for the rights and interests of suppliers, customers, and consumers mainly measures product quality, after-sales service, and mutual trust
CSR_Environmental	Hexun's environmental responsibility mainly measures environmental governance
CSR_Social	Hexun's main measure of social responsibility is contribution value
Founder	The existence of a founder in a private enterprise, Fou equals 1, and 0 otherwise
Founder_Controller	If the founder is the actual controller of the company, Fou_con equals is 1, and 0 otherwise
Founder_Chair	If the founder is the chairman of the company, Fou_chi equals is 1, and 0 otherwise
Founder_Director	If the serves as director of the company, Fou_dir equals is 1, and 0 otherwise
Founder_GenManager	If the founder serves as general manager of the company, Fou_gen equals is 1, and 0 otherwise
Founder_Manager	The founder holds one management position, Fou_man equals is 1; The founder holds two management positions, Fou_man equals is 2; The founder holds three management positions, Fou_man equals is 3; The founder holds four management positions, Fou_man equals is 4; otherwise 0
Firm Size	The logarithm of a firm's total assets
Return On Assets	Operating profits divided by total assets
Asset-liability Ratio	Total liabilities divided by total assets
Largest Shareholder Ratio	The shareholding ratio of the largest shareholder
Total Assets Growth Rate	The growth of the enterprise's asset scale in the current period.
Board Size	The total number of directors in the board
Independent Director Ratio	The percentage of independent directors in the board
Separation of Ownership and Management	The difference between the control right and the ownership of the listed company owned by the actual controller
Firm Age	It is represented by the natural logarithm value of the number of years since a firm's inception
Industry	Dummy variable
Year	Dummy variable

the regression coefficient of the CSR_Total variable is 2.035, and it has passed the 1% significance level ($\beta = 2.035$, $p < 0.01$), indicating that the private enterprises with founders have better social responsibility performance, and Hypothesis 1 has been verified. The main reason is that the founders are more entrepreneurial than the other managers, more responsive to the market environment, and have a long-term vision. Therefore, the founders are more willing to encourage enterprises to engage in social responsibility activities than the other managers. Therefore, private enterprises with founders have a better realization of social responsibility. Column (2) to Column (6) of **Table 7** examines the impact of founders on shareholder responsibility, employee responsibility, supplier, customer and consumer responsibility, environmental responsibility, and social responsibility. The results show that the regression coefficient of CSR_Shareholders, CSR_Suppliers, Customers, Consumers, and CSR_Environmental are 1.444, 0.253 and 0.196, and are significant at the level of 1%, 5%, and 10%, which indicates that the founders can better fulfill the shareholder responsibility, supplier, customer, and consumer responsibility and environmental responsibility. The relationship between founders' responsibility to employees and social responsibility is not significant, indicating that the founder pays insufficient attention to these two indicators. Through the test of grading indicators, the results show that founders prefer to perform external corporate social responsibility, which may be because the performance of external social responsibility will increase the goodwill of external stakeholders to the enterprise and have a positive impact on the company value. The results also reflect that the founders' understanding of corporate social responsibility may be more external.

Secondly, for the development and control of the enterprise, founders often have absolute residual claim rights and residual control right over the enterprise. For the development and control of the enterprise, founders often have absolute residual claim rights and residual control right over the enterprise. They have a stronger desire for profit and the greatest degree of operational autonomy. Therefore, it is inevitable for the founder

TABLE 3 | Descriptive statistics (Founder).

	Mean	Median	Std. dev.	Min	Max
CSR_Total	23.472	21.7	14.988	−17.19	89.01
CSR_Shareholders	13.981	14.72	6.477	−13.12	27.92
CSR_Employees	2.301	1.35	2.712	−0.02	15
CSR_Suppliers, Customers, Consumers	1.328	0	4.229	0	20
CSR_Environmental	1.243	0	4.184	0	30
CSR_Social	4.619	4.11	4.452	−15	30
Founder	0.74	1	0.438	0	1
Independent Director Ratio	0.375	0.333	0.052	0.333	0.667
Largest Shareholder Ratio	32.886	30.73	14.609	2.38	95.95
Asset-liability Ratio	0.404	0.392	0.204	0.007	0.996
Total Assets Growth Rate	0.291	0.128	1.084	−0.957	47.927
Firm Size	21.803	21.728	1.185	10.897	26.739
Board Size	8.352	9	1.525	4	18
Return On Assets	0.044	0.042	0.26	−2.834	22.005
Firm Age	15.795	16	5.93	1	60
Separation of Ownership and Management	5.501	0.488	7.87	0	59.45

TABLE 4 | Descriptive statistics(Founder management).

	Mean	Median	Std. dev.	Min	Max
CSR_Total	23.76	21.99	14.315	−15.23	89.01
CSR_Shareholders	14.802	15.52	6.155	−11.69	27.92
CSR_Employees	2.197	1.31	2.63	−0.02	15
CSR_Suppliers, Customers, Consumers	1.242	0	4.137	0	20
CSR_Environmental	1.186	0	4.167	0	30
CSR_Social	4.334	3.74	3.917	−15	30
Founder_Controller	0.901	1	0.299	0	1
Founder_Chair	0.747	1	0.435	0	1
Founder_Director	0.122	0	0.328	0	1
Founder_GenManager	0.324	0	0.468	0	1
Founder_Manager	2.094	2	0.87	0	4
Independent Director Ratio	0.375	0.333	0.053	0.333	0.667
Largest Shareholder Ratio	34.231	32.73	14.427	4.53	95.95
Asset-liability Ratio	0.376	0.362	0.191	0.008	0.989
Total Assets Growth Rate	0.295	0.144	0.681	−0.896	23.817
Firm Size	21.781	21.68	1.04	10.897	26.298
Board Size	8.342	9	1.484	4	18
Return On Assets	0.048	0.046	0.267	−2.834	22.005
Firm Age	14.444	14	5.753	1	43
Separation of Ownership and Management	4.676	0	7.447	0	59.45

to play a core management role in the enterprise. In order to further explore the impact of different positions of founders on corporate social responsibility, Hypothesis 2, Hypothesis 3, Hypothesis 4, and Hypothesis 5 were tested. We divide the sample into: the founder serves as the actual controller, chairman, director or general manager of the listed company, that is, the value is 1, otherwise it is 0.

Table 8 reports the regression results of corporate social responsibility when the founder is the actual controller. According to **Table 8**, the regression coefficient of the CSR_Total is 2.564 and passed 1%Significance level ($\beta = 2.564$, $p < 0.01$), indicating that the private enterprises have better social responsibility performance when the founder is the actual controller, and Hypothesis 2 is verified. The reason lies in: firstly, when the founder is the actual controller of the enterprise, his interests tend to be consistent with the overall interests of the company. In order to enhance his interests and corporate value, the founder will be more active in fulfilling social responsibilities;

TABLE 5 | Correlation matrix.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1.CSR_Total	1											
2.CSR_Shareholders	0.620***	1										
3.CSR_Employees	0.752***	0.150***	1									
4.CSR_Suppliers, Customers, Consumers	0.799***	0.150***	0.813***	1								
5.CSR_Environmental	0.760***	0.125***	0.821***	0.878***	1							
6.CSR_Social	0.533***	0.279***	0.160***	0.203***	0.104***	1						
7.Founder	0.032***	0.214***	−0.064***	−0.034***	−0.023**	−0.108***	1					
8.Founder_Controller	0.068***	0.260***	−0.056***	−0.019*	−0.004	−0.092***	0.838***	1				
9.Founder_Chair	0.064***	0.257***	−0.065***	−0.029***	−0.010	−0.080***	0.658***	0.725***	1			
10.Founder_Director	0.010	0.032***	−0.008	−0.004	−0.013	0.008	0.187***	0.134***	−0.125***	1		
11.Founder_GenManager	0.010	0.140***	−0.050***	−0.040***	−0.037***	−0.067***	0.332***	0.367***	0.447***	−0.034***	1	
12.Founder_Manager	0.060***	0.270***	−0.070***	−0.035***	−0.022**	−0.093***	0.775***	0.867***	0.839***	0.231***	0.686***	1
13.Independent Director Ratio	−0.026***	−0.048***	0.002	−0.002	−0.018*	−0.001	−0.001	−0.008	0.008	−0.010	0.078***	0.026**
14.Largest Shareholder Ratio	0.143***	0.262***	−0.007	0.013	−0.009	0.101***	0.155***	0.188***	0.176***	0.039***	0.113***	0.199***
15.Asset-liability Ratio	−0.046***	−0.311***	0.123***	0.068***	0.078***	0.084***	−0.236***	−0.243***	−0.224***	−0.041***	−0.167***	−0.261***
16.Total Assets Growth Rate	0.036***	0.064***	0.025**	0	0.005	0.009	0.007	0.001	0.016	−0.001	0.026***	0.016
17.Firm Size	0.264***	0.170***	0.223***	0.165***	0.159***	0.200***	−0.030***	−0.029***	−0.056***	0.006	−0.090***	−0.066***
18.Board Size	0.112***	0.075***	0.082***	0.086***	0.078***	0.063***	−0.011	0.005	0.007	0.001	−0.072***	−0.021**
19.Return On Assets	0.114***	0.206***	0.016*	0.017*	0.012	0.047***	0.025**	0.023**	0.030***	−0.003	0.020**	0.028***
20.Firm Age	−0.056***	−0.131***	−0.006	−0.037***	−0.051***	0.088***	−0.385***	−0.394***	−0.351***	−0.039***	−0.197***	−0.385***
21.Separation of Ownership and Management	0.113***	0.044***	0.101***	0.097***	0.089***	0.078***	−0.177***	−0.164***	−0.165***	0.005	−0.157***	−0.190***

	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
Correlation matrix									
13.Independent Director Ratio	1								
14.Largest Shareholder Ratio	0.029***	1							
15.Asset-liability Ratio	−0.009	−0.023**	1						
16.Total Assets Growth Rate	−0.012	0.008	−0.026***	1					
17.Firm Size	−0.045***	0.099***	0.389***	0.060***	1				
17.Board Size	−0.575***	−0.043***	0.079***	0	0.166***	1			
19.Return On Assets	−0.002	0.046***	−0.052***	0.022**	−0.030***	0.004	1		
20.Firm Age	0.022**	−0.150***	0.190***	−0.030***	0.120***	−0.017*	−0.027***	1	
21.Separation of Ownership and Management	−0.086***	0.222***	0.107***	−0.023**	0.154***	0.105***	0.003	0.054***	1

	1	2	3	4	5	6	7
Phi Coefficients							
1.Founder	1						
2.Founder_Controller	0.838***	1					
3.Founder_Chair	0.658***	0.421***	1				
4.Founder_Director	0.187***	−0.043***	−0.335***	1			
5.Founder_GenManager	0.172***	0.172***	0.322***	−0.104***	1		
6.Industry	0.355***	0.146***	0.102***	0.061**	0.105***	1	
7.Year	0.089***	0.138***	0.119***	0.057***	0.051**	1.005***	1

****, **, * represent the significance level of 1%, 5%, 10%, respectively.*

TABLE 6 | ANOVA analysis results.

	CSR_Total		CSR_Shareholders		CSR_Employees		CSR_Suppliers, customers, consumers		CSR_Environmental		CSR_Social	
	Mean	**P**	**Mean**	**P**	**Mean**	**P**	**Mean**	**P**	**Mean**	**P**	**Mean**	**P**
Non-Founder	22.65	0.001	11.64	0.000	2.60	0.000	1.24	0.001	1.19	0.019	4.33	0.000
Founder	23.76		14.80		2.20		1.57		1.41		5.43	
Total	23.47		13.98		2.30		1.33		1.24		4.62	
Non-Founder_Controller	19.79	0.000	11.45	0.000	2.23	0.696	1.27	0.055	0.77	0.004	4.33	0.754
Founder_Controller	24.20		15.17		2.19		0.96		1.23		4.38	
Total	23.76		14.80		2.20		1.24		1.19		4.33	
Non-Founder_Chair	22.05	0.000	12.80	0.000	2.36	0.002	1.32	0.356	1.20	0.492	4.30	0.156
Founder_Chair	24.34		15.48		2.14		1.22		1.13		4.44	
Total	23.76		14.80		2.20		1.24		1.19		4.33	
Non-Founder_Director	23.74	0.706	14.83	0.381	2.19	0.700	1.24	0.824	1.20	0.351	4.28	0.001
Founder_Director	23.93		14.63		2.23		1.27		1.07		4.73	
Total	23.76		14.80		2.20		1.24		1.19		4.33	
Non-Founder_GenManager	23.74	0.940	14.42	0.000	2.26	0.002	1.34	0.002	1.29	0.002	4.45	0.000
Founder_GenManager	23.77		15.60		2.06		1.03		0.97		4.09	
Total	23.76		14.80		2.20		1.24		1.19		4.33	
Non-Founder_Manager	17.69	0.000	10.63	0.000	1.95	0.000	0.66	0.000	0.52	0.000	3.93	0.000
One-Founder_Manager	22.99		12.86		2.59		1.53		1.51		3.60	
Two-Founder_Manager	23.59		15.30		2.27		1.45		1.38		4.45	
Three-Founder_Manager	24.19		15.51		1.98		1.32		1.43		4.16	
Four-Founder_Manager	24.90		15.65		2.25		0.93		0.87		4.64	
Total	23.76		14.80		2.20		1.24		1.19		4.33	

TABLE 7 | Regression results (founder and CSR).

	CSR*					
	CSR_Total	**CSR_Shareholders**	**CSR_Employees**	**CSR_Suppliers, customers, consumers**	**CSR_Environmental**	**CSR_Social**
Founder	2.035***	1.444***	−0.018	0.253**	0.196*	0.160
	(5.46)	(9.62)	(−0.26)	(2.27)	(1.77)	(1.48)
Independent Director Ratio	8.914***	−1.441	2.757***	3.976***	2.048**	1.574*
	(2.85)	(−1.14)	(4.70)	(4.27)	(2.20)	(1.73)
Largest Shareholder Ratio	0.069***	0.084***	−0.007***	−0.009***	−0.015***	0.016***
	(6.92)	(21.16)	(−3.67)	(−3.20)	(−5.19)	(5.43)
Asset-liability Ratio	−14.20***	−12.49***	−0.062	−0.343	0.002	−1.312***
	(−18.22)	(−39.76)	(−0.42)	(−1.47)	(0.01)	(−5.78)
Total Assets Growth Rate	0.032	0.202***	−0.018	−0.090**	−0.061	−0.001
	(0.26)	(4.00)	(−0.75)	(−2.42)	(−1.63)	(−0.02)
Firm Size	4.425***	1.713***	0.572***	0.764***	0.761***	0.614***
	(32.79)	(31.51)	(22.59)	(18.98)	(18.95)	(15.62)
Board Size	0.510***	0.168***	0.068***	0.123***	0.071**	0.080**
	(4.61)	(3.76)	(3.29)	(3.73)	(2.15)	(2.48)
Return On Assets	5.581***	4.357***	0.226**	0.172	0.115	0.710***
	(10.92)	(21.17)	(2.35)	(1.13)	(0.76)	(4.77)
Firm Age	0.082***	−0.019*	0.013**	0.030***	0.019**	0.039***
	(2.90)	(−1.66)	(2.48)	(3.53)	(2.24)	(4.75)
Separation of Ownership and Management	0.090***	0.004	0.022***	0.029***	0.025***	0.010*
	(4.90)	(0.52)	(6.41)	(5.32)	(4.53)	(1.91)
Industry	Control	Control	Control	Control	Control	Control
Year	Control	Control	Control	Control	Control	Control
Constant	−66.84***	−20.10***	−9.176***	−11.87***	−13.13***	−12.56***
	(−16.64)	(−12.42)	(−12.17)	(−9.91)	(−10.98)	(−10.74)
N	10119	10119	10119	10119	10119	10119
R^2	0.230	0.331	0.171	0.139	0.124	0.260

****, **, * represent the significance level of 1%, 5%, 10%, respectively.*

In addition, the founder fulfills their social responsibilities, which is conducive to maintaining the stability of their control. If founders reduce their social responsibility, they will lose the support of stakeholders and related resources, which will affect the allocation of corporate control, and thus affecting the stability of the control of founders. Therefore, the founder will actively perform social responsibility to maintain its control. Column (2) to Column (6) of **Table 8** examines the impact of indicators of social responsibility grading, and the results showed that the regression coefficient of CSR_ Shareholders is 2.513, which was significantly correlated at the level of 1%, while Founder_Controller has no significant effect on other social responsibility indicators. It indicates that the actual controller of the founder is more inclined to perform the shareholder's responsibility and pays less attention to other indicators of social responsibility, which may be the founder has inherent new ownership of the enterprise he founded. As the highest shareholder of the enterprise, the actual controller of the founder will pay more attention to the shareholder's responsibility and safeguard his interests when performing the social responsibility. In addition, for corporate shareholders, the performance of other social responsibilities is an additional part of the enterprise, which will cause losses to the interests of shareholders. Therefore, the actual controllers of founders prefer to perform their shareholder responsibilities.

Table 9 reports the founder chairman's return to corporate social responsibility. According to **Table 9**, the regression coefficient of the CSR_Total is 1.873, and passed the 1% significance level ($\beta = 1.873$, $p < 0.01$), indicating that the founder would better perform social responsibilities when he served as the chairman, and Hypothesis 3 was verified. The reason lies in that, as the owner of the enterprise, the personal

TABLE 8 | Regression results (founder actual controller and CSR).

	CSR*					
	CSR_Total	**CSR_Shareholders**	**CSR_Employees**	**CSR_Suppliers, customers, consumers**	**CSR_Environmental**	**CSR_Social**
Founder_Controller	2.564***	2.513***	−0.154	−0.033	0.056	0.181
	(4.89)	(11.84)	(−1.54)	(−0.20)	(0.35)	(1.33)
Independent Director Ratio	8.778**	0.787	2.029***	2.945***	1.416	1.601*
	(2.46)	(0.54)	(2.99)	(2.72)	(1.29)	(1.73)
Largest Shareholder Ratio	0.055***	0.070***	−0.004*	−0.008**	−0.011***	0.007**
	(4.89)	(15.31)	(−1.79)	(−2.24)	(−3.07)	(2.57)
Asset-liability Ratio	−16.05***	−13.65***	−0.468**	−0.326	−0.025	−1.583***
	(−16.58)	(−34.86)	(−2.54)	(−1.11)	(−0.08)	(−6.29)
Total Assets Growth Rate	0.405*	0.760***	−0.066	−0.185***	−0.198***	0.093
	(1.81)	(8.38)	(−1.55)	(−2.71)	(−2.86)	(1.60)
Firm Size	4.048***	1.460***	0.656***	0.762***	0.775***	0.394***
	(22.42)	(20.01)	(19.13)	(13.94)	(13.93)	(8.40)
Board Size	0.422***	0.231***	0.014	0.064	0.028	0.084**
	(3.23)	(4.38)	(0.58)	(1.62)	(0.69)	(2.49)
Return On Assets	4.709***	3.656***	0.221**	0.174	0.176	0.482***
	(8.43)	(16.19)	(2.09)	(1.03)	(1.02)	(3.32)
Firm Age	0.092***	0.003	0.013**	0.034***	0.024***	0.019**
	(3.07)	(0.21)	(2.25)	(3.69)	(2.59)	(2.45)
Separation of Ownership and Management	0.117***	0.013	0.020***	0.037***	0.032***	0.015***
	(5.42)	(1.48)	(4.88)	(5.73)	(4.77)	(2.67)
Industry	Control	Control	Control	Control	Control	Control
Year	Control	Control	Control	Control	Control	Control
Constant	−66.89***	−20.33***	−11.60***	−12.90***	−13.95***	−8.126***
	(−12.19)	(−9.16)	(−11.12)	(−7.75)	(−8.25)	(−5.70)
N	7491	7491	7491	7491	7491	7491
R^2	0.213	0.304	0.159	0.135	0.119	0.291

****, **, * represent the significance level of 1%, 5%, 10%, respectively.*

interests of the founder and the chairman are highly consistent with the interests of the enterprise. In order to make the enterprise established by himself develop for a long time, the founder and the chairman of the board attach importance to the long-term development strategy of the enterprise, so the founder and the board of directors better perform their social responsibilities. Column (2) to Column (6) of **Table 9** examines the impact of social responsibility grading indicators test shows that the regression coefficient of CSR_Shareholders is 2.513 and was significantly correlated at the 1% level, whereas the regression coefficient of CSR_Employees is −0.173 and was significantly correlated at the 5% level, Founder_Chair and other indicators are not significant, indicating that the founder and chairman of the board are more inclined to perform the responsibilities of shareholders and less inclined to perform the responsibilities of employees for corporate social responsibility. This may be because the founder and chairman of the board will make business decisions based on the principle of maximizing their interests, and such business results will better meet the interests of shareholders. The reason for the negative correlation between the founder and the chairman of the board and employee responsibility, as well as other social responsibilities, is that: firstly, the performance of employee responsibility and other social responsibilities is a cost expense for the enterprise and will reduce the interests of shareholders; In addition, when the founder and the chairman of the board have a high degree of confidence, they will underestimate the importance of employees and other stakeholders for the development of the enterprise and do not pay attention to the performance of employee responsibilities and other social responsibilities.

Table 10 reports the regression results of the founder's general manager on corporate social responsibility. As can be seen from

TABLE 9 | Regression results (Founder and Chairman with CSR).

	CSR*					
	CSR_Total	**CSR_Shareholders**	**CSR_Employees**	**CSR_Suppliers, customers, consumers**	**CSR_Environmental**	**CSR_Social**
Founder_Chair	1.873***	2.054***	−0.173**	−0.152	−0.008	0.151
	(5.20)	(14.14)	(−2.52)	(−1.39)	(−0.07)	(1.62)
Independent Director Ratio	8.189**	0.147	2.082***	2.989***	1.417	1.553*
	(2.29)	(0.10)	(3.07)	(2.76)	(1.29)	(1.67)
Largest Shareholder Ratio	0.054***	0.068***	−0.004*	−0.007**	−0.010***	0.007**
	(4.81)	(14.99)	(−1.65)	(−2.10)	(−3.02)	(2.52)
Asset-liability Ratio	−16.08***	−13.63***	−0.480***	−0.356	−0.037	−1.580***
	(−16.63)	(−34.99)	(−2.61)	(−1.21)	(−0.12)	(−6.29)
Total Assets Growth Rate	0.355	0.711***	−0.063	−0.184***	−0.199***	0.090
	(1.58)	(7.88)	(−1.49)	(−2.71)	(−2.88)	(1.54)
Firm Size	4.106***	1.515***	0.653***	0.763***	0.777***	0.398***
	(22.84)	(20.92)	(19.13)	(14.01)	(14.02)	(8.52)
Board Size	0.395***	0.201***	0.017	0.067*	0.028	0.082**
	(3.03)	(3.82)	(0.69)	(1.69)	(0.70)	(2.42)
Return On Assets	4.682***	3.628***	0.223**	0.175	0.176	0.480***
	(8.39)	(16.13)	(2.11)	(1.04)	(1.02)	(3.31)
Firm Age	0.094***	0.006	0.012**	0.033***	0.024**	0.020**
	(3.13)	(0.49)	(2.16)	(3.60)	(2.56)	(2.49)
Separation of Ownership and Management	0.121***	0.018**	0.019***	0.036***	0.031***	0.015***
	(5.59)	(2.08)	(4.72)	(5.58)	(4.72)	(2.74)
Industry	Control	Control	Control	Control	Control	Control
Year	Control	Control	Control	Control	Control	Control
Constant	−66.07***	−19.54***	−11.64***	−12.90***	−13.93***	−8.069***
	(−12.05)	(−8.84)	(−11.18)	(−7.76)	(−8.24)	(−5.66)
N	7491	7491	7491	7491	7491	7491
R^2	0.214	0.310	0.159	0.136	0.119	0.291

****, **, * represent the significance level of 1%, 5%, 10%, respectively.*

Table 10, the regression coefficient of the CSR_Total variable is 0.575, and passed the 10% significance level ($\beta = 0.575$, $p < 0.1$), indicating that the founder would better perform social responsibilities when he served as the general manager, and Hypothesis 4 was verified. The reason is that when the founder is the general manager of the enterprise, his behavior affects the strategic decision-making and implementation of the company to a large extent. As the manager of the enterprise, the interests of the founder general manager tend to converge with the interests of the shareholders of the company, so that the founder general manager makes strategic decisions conducive to the long-term development of the enterprise. Therefore, the founder general manager will better perform the corporate social responsibility. Column (2) to Column (6) of **Table 10** examines the impact of social responsibility classification shows that the regression coefficient for CSR_Shareholders is 1.026 and is significantly correlated at the 1% level, whereas the regression coefficients of CSR_Suppliers, Customers, Consumers and CSR_Environmental are −0.171 and −0.170, and are significantly correlated at the 10% level, Founder_GenManager and other grading indicators are not significant, indicating that the founder general manager is more inclined to perform shareholder responsibilities and pays less attention to other social responsibilities, especially the rights and interests of suppliers, customers and consumers, and environmental responsibilities. The reason may be: first of all, as the doer of the principle of "self-interest," the founder general manager will give priority to the maximization of his value in the implementation of strategic decisions, so the attention to other social responsibilities is not high. In addition, the founder general manager may pursue short-term interests in the operation of the enterprise, therefore, his awareness of the rights and responsibilities

TABLE 10 | Regression results (founder general manager and CSR).

	CSR*					
	CSR_Total	**CSR_Shareholders**	**CSR_Employees**	**CSR_Suppliers, customers, consumers**	**CSR_Environmental**	**CSR_Social**
Founder_GenManager	0.575*	1.026***	−0.079	−0.171*	−0.170*	−0.030
	(1.73)	(7.59)	(−1.26)	(−1.70)	(−1.66)	(−0.35)
Independent Director Ratio	8.405**	0.159	2.077***	3.043***	1.512	1.614*
	(2.35)	(0.11)	(3.06)	(2.81)	(1.37)	(1.74)
Largest Shareholder Ratio	0.059***	0.072***	−0.004*	−0.007**	−0.001***	0.008***
	(5.25)	(15.73)	(−1.82)	(−2.09)	(−2.86)	(2.76)
Asset-liability Ratio	−16.43***	−13.95***	−0.452**	−0.347	−0.063	−1.621***
	(−17.01)	(−35.57)	(−2.46)	(−1.19)	(−0.21)	(−6.47)
Total Assets Growth Rate	0.339	0.685***	−0.061	−0.180***	−0.195***	0.090
	(1.51)	(7.51)	(−1.44)	(−2.65)	(−2.83)	(1.55)
Firm Size	4.139***	1.559***	0.650***	0.758***	0.774***	0.399***
	(22.98)	(21.31)	(19.01)	(13.91)	(13.96)	(8.54)
Board Size	0.432***	0.241***	0.014	0.064	0.028	0.085**
	(3.31)	(4.55)	(0.56)	(1.62)	(0.69)	(2.51)
Return On Assets	4.690***	3.632***	0.223**	0.176	0.178	0.481***
	(8.39)	(16.00)	(2.10)	(1.04)	(1.03)	(3.32)
Firm Age	0.084***	−0.004	0.013**	0.033***	0.023**	0.018**
	(2.80)	(−0.32)	(2.31)	(3.66)	(2.52)	(2.36)
Separation of Ownership and Management	0.113***	0.012	0.020***	0.036***	0.030***	0.014**
	(5.21)	(1.41)	(4.84)	(5.53)	(4.53)	(2.52)
Industry	Control	Control	Control	Control	Control	Control
Year	Control	Control	Control	Control	Control	Control
Constant	−66.10***	−19.63***	−11.64***	−12.87***	−13.89***	−8.056***
	(−12.03)	(−8.80)	(−11.16)	(−7.75)	(−8.22)	(−5.65)
N	7491	7491	7491	7491	7491	7491
R^2	0.211	0.297	0.159	0.136	0.119	0.291

****, **, * represent the significance level of 1%, 5%, 10%, respectively.*

of suppliers, customers and consumers, and environmental responsibility is poor.

Table 11 shows the return of founder directors to corporate social responsibility. According to **Table 11**, the overall performance of Founder_Director and social responsibility is not significant, and the social responsibility of each dimension is not significant, which indicates that when the founder serves as the corporate director, the corporate does not have better social responsibility performance, and Hypothesis 5 has not been verified. The reason may be that when the founder is a corporate director, the impact of the founder on the corporate strategic decision-making and implementation is not significant, therefore, the founder as a corporate director has no significant corporate social responsibility.

Through the above empirical research results, it is found that the founders' different management roles have a positive impact on corporate social responsibility, but different management positions have different impacts on corporate social responsibility. The regression results show that the founder as the actual controller, chairman, and general manager can better perform corporate social responsibility than as a director. The role of the founder as the actual controller, chairman, and general manager has a greater impact on the strategic decision-making and implementation of the strategy of the enterprise, thus, the enterprise has a better performance of social responsibility. While the role of the founder as a director has little influence on the enterprise, therefore, the impact of the founder director on corporate social responsibility is not significant. From the regression results, the founders as the actual controller, the chairman, and the general manager are more inclined to perform the responsibilities of shareholders, which is because the founder themselves, like corporate shareholders,

TABLE 11 | Regression results (founder director and CSR).

	CSR*					
	CSR_Total	**CSR_Shareholders**	**CSR_Employees**	**CSR_Suppliers, customers, consumers**	**CSR_Environmental**	**CSR_Social**
Founder_Director	0.134	−0.308	0.122	0.083	−0.010	0.246**
	(0.29)	(−1.64)	(1.40)	(0.59)	(−0.07)	(2.07)
Independent Director Ratio	8.741**	0.721	2.041***	2.951***	1.415	1.614*
	(2.44)	(0.49)	(3.01)	(2.73)	(1.29)	(1.74)
Largest Shareholder Ratio	0.061***	0.075***	−0.004**	−0.008**	−0.011***	0.008***
	(5.46)	(16.58)	(−1.97)	(−2.28)	(−3.05)	(2.73)
Asset–liability Ratio	−16.53***	−14.12***	−0.438**	−0.319	−0.035	−1.615***
	(−17.13)	(−35.92)	(−2.40)	(−1.09)	(−0.12)	(−6.46)
Total Assets Growth Rate	0.351	0.708***	−0.063	−0.184***	−0.199***	0.089
	(1.56)	(7.74)	(−1.48)	(−2.71)	(−2.88)	(1.53)
Firm Size	4.128***	1.538***	0.652***	0.761***	0.777***	0.400***
	(22.93)	(20.97)	(19.08)	(13.98)	(14.02)	(8.57)
Board Size	0.432***	0.241***	0.014	0.064	0.028	0.085**
	(3.30)	(4.52)	(0.56)	(1.62)	(0.70)	(2.52)
Return On Assets	4.697***	3.640***	0.223**	0.175	0.176	0.483***
	(8.40)	(15.97)	(2.10)	(1.03)	(1.02)	(3.33)
Firm Age	0.083***	−0.006	0.013**	0.034***	0.024**	0.018**
	(2.75)	(−0.53)	(2.33)	(3.70)	(2.58)	(2.35)
Separation of Ownership and Management	0.108***	0.005	0.020***	0.037***	0.031***	0.014**
	(5.03)	(0.62)	(4.95)	(5.73)	(4.75)	(2.47)
Industry	Control	Control	Control	Control	Control	Control
Year	Control	Control	Control	Control	Control	Control
Constant	−65.99***	−19.44***	−11.65***	−12.91***	−13.93***	−8.065***
	(−12.01)	(−8.68)	(−11.18)	(−7.77)	(−8.24)	(−5.66)
N	7491	7491	7491	7491	7491	7491
R^2	0.211	0.291	0.159	0.135	0.119	0.292

****, **, * represent the significance level of 1%, 5%, 10%, respectively.*

adhere to the principle of "egoism," and are more inclined to pursue long-term wealth creation for shareholders. This kind of interest orientation urges the founders to have more enthusiasm and motivation to make better decisions and supervision for the enterprise. However, for the founder, fulfilling other social responsibilities is a costly expense for the enterprise in the short term, which will damage their interests and the interests of corporate shareholders. Therefore, the founder does not pay much attention to other social responsibilities.

At the end of this paper, we examine the impact of the founder's management level on corporate social responsibility. Based on the positive impact of different management positions held by founders on corporate social responsibility, this section examines the impact of founder management on corporate society. Some researchers have pointed out that the more positive the attitude of senior managers toward corporate social responsibility, the better the economic performance of their enterprises (Sturdivant and Ginter, 1977). In the long-term entrepreneurial process, the founders have accumulated a lot of operation and management experience, authority and the relationship with government departments. Therefore, when the founder manages the enterprise, it is conducive to the development of the enterprise. The founder who holds multiple management roles at the same time will have more stable power, which is conducive to the improvement of corporate value.

Table 12 shows the regression results of the impact of the founder's management level on corporate social responsibility. In this table, the regression coefficient of the CSR_Total variable is 0.989, and passed the 1% significance level ($\beta = 0.989$, $p < 0.01$), indicating that the higher the founders'

TABLE 12 | Regression results (founder's management level and CSR).

	CSR*					
	CSR_Total	**CSR_Shareholders**	**CSR_Employees**	**CSR_Suppliers, customers, consumers**	**CSR_Environmental**	**CSR_Social**
Founder_Manager	0.989***	1.095***	−0.068*	−0.082	−0.048	0.091*
	(5.41)	(14.89)	(−1.95)	(−1.48)	(−0.85)	(1.92)
Independent Director Ratio	7.970**	−0.102	2.084***	3.008***	1.452	1.527*
	(2.23)	(−0.07)	(3.07)	(2.78)	(1.32)	(1.65)
Largest Shareholder Ratio	0.051***	0.065***	−0.004	−0.007**	−0.010***	0.007**
	(4.55)	(14.26)	(−1.64)	(−2.02)	(−2.88)	(2.40)
Asset-liability Ratio	−15.94***	−13.47***	−0.479***	−0.368	−0.064	−1.563***
	(−16.45)	(−34.55)	(−2.60)	(−1.25)	(−0.21)	(−6.21)
Total Assets Growth Rate	0.351	0.707***	−0.063	−0.184***	−0.199***	0.090
	(1.57)	(7.84)	(−1.48)	(−2.71)	(−2.88)	(1.54)
Firm Size	4.107***	1.515***	0.653***	0.763***	0.778***	0.398***
	(22.85)	(20.95)	(19.11)	(14.01)	(14.04)	(8.52)
Board Size	0.410***	0.217***	0.015	0.066*	0.029	0.083**
	(3.14)	(4.13)	(0.62)	(1.66)	(0.72)	(2.45)
Return On Assets	4.693***	3.640***	0.222**	0.174	0.176	0.481***
	(8.41)	(16.20)	(2.10)	(1.03)	(1.02)	(3.31)
Firm Age	0.094***	0.006	0.013**	0.033***	0.023**	0.020**
	(3.13)	(0.50)	(2.21)	(3.60)	(2.51)	(2.50)
Separation of Ownership and Management	0.123***	0.021**	0.019***	0.036***	0.031***	0.016***
	(5.70)	(2.42)	(4.74)	(5.53)	(4.61)	(2.80)
Industry	Control	Control	Control	Control	Control	Control
Year	Control	Control	Control	Control	Control	Control
Constant	−66.58***	−20.10***	−11.61***	−12.86***	−13.90***	−8.116***
	(−12.14)	(−9.11)	(−11.14)	(−7.74)	(−8.22)	(−5.70)
N	7491	7491	7491	7491	7491	7491
R^2	0.214	0.312	0.159	0.136	0.119	0.292

****, **, * represent the significance level of 1%, 5%, 10%, respectively.*

management level, the better the enterprise will perform its social responsibility and Hypothesis 6 is verified. Because when the founder holds multiple management positions, his decision-making influence becomes greater. The higher the power of the founder, the more he can ensure the smooth progress of decision-making and improve the enterprise value. When the power of the founder is not limited, the founder's ability can be fully exerted. Therefore, if the founder holds multiple management roles at the same time, the founder will have a more stable power and be more conducive to corporate social responsibility. Column (2) to Column (6) of **Table 12** examines the impact on social responsibility classification shows that the regression coefficients of CSR_Shareholders and CSR_Suppliers, Customers, Consumers are 1.095 and 0.091, and are significantly correlated at the 1% and 10% levels, while the regression coefficient of CSR_Employees is −0.068, which is significantly correlated at the level of 10%, Founder_Manager and other grading indicators are not significant, indicating that the higher the management level of founders, the more likely they are to perform their shareholder responsibilities and social responsibilities and pay insufficient attention to other social responsibilities, especially to employee responsibilities. The reasons may be as follows: firstly, the higher the management level of the founders, the greater their rights, and the stronger the founders' sense of belonging to the enterprise. The fulfillment of shareholders' and social responsibilities not only satisfies their interests but also brings a good reputation image to the enterprise, which is more conducive to the long-term development of the enterprise; secondly, the founder will make decisions according to their interests. The higher the

management level of the founders, the greater their rights, and the greater the ability of the founders to obtain private benefits for themselves. In order to obtain more benefits for themselves, they pay less attention to other social responsibilities; finally, when the management level of the founder is higher, the founder may have more confidence in his own business decisions. At this time, when the founder makes business decisions, he will not consider too much social responsibility to ease the relationship between the company and stakeholders, to stabilize the development of the company. Therefore, the founder will not pay too much attention to employee responsibility and other social responsibilities.

CONCLUSION

Based on the sample of private listed companies in China, this paper uses the data of sample firms 2010–2018 to analyze the impact of founders of private enterprises on corporate social responsibility and further discusses the impact of different management roles of founders on social responsibility. The results show that: firstly, compared with private enterprises without founders, private enterprises with founders have more sense of social responsibility. Moreover, the existence of founders can promote enterprises to better fulfill the responsibilities of shareholders, suppliers, customers and consumers, and environmental responsibilities, but pay less attention to employee responsibilities and social responsibilities, which also reflects that founders' understanding of corporate social responsibility may be more externality. Therefore, the founders of private enterprises can better perform their social responsibilities. Secondly, the impact of founders' different management roles on corporate social responsibility is positive, but there are certain differences in the performance of corporate social responsibility. The founders as the actual controller, chairman, and general manager can better perform the corporate social responsibility than the directors, because the founders as the actual controller, chairman, and general manager have a greater influence on the enterprise, so their social responsibility performance is better. In addition, when the founder serves as the actual controller, chairman, and general manager, he pays more attention to shareholders' responsibility and protects his interests. Because the performance of other social responsibilities is a costly expense for the enterprise in the short term, which will damage its interests and the interests of corporate shareholders, the founder does not pay much attention to other social responsibilities. Finally, the impact of founder's management level on corporate social responsibility found that the higher the level of founder management, the stronger the sense of corporate social responsibility. The founder has more power, which can promote the improvement of enterprise value, and the greater the management power, the greater the decision-making power, and is more conducive to the development of the enterprise.

This study analyzes the impact of private enterprise founders on corporate social responsibility from the perspective of founders, enriches the research content of corporate social responsibility, and further deepens the understanding of the special management role of founders. At the same time, this research conclusion has enlightenment significance for founders to manage enterprises in practice. Therefore, the following management suggestions are proposed:

First, the vigorous implementation of social responsibility activities by the founders of private enterprises is conducive to maintaining the personal reputation of the founders, obtaining more benefits, and long-term sustainable development of the enterprises. Therefore, the founder of an enterprise should first perform his due responsibilities, and then try to assume more responsibilities for all stakeholders. Second, under the condition of limited resources, the founders can make targeted investment in more external corporate social responsibility, but also cannot ignore the internal responsibility when making decisions on corporate development strategies. Although the external corporate social responsibility has more public relations effect and weakens the negative impact of the internal and external social responsibility inconsistency on the corporate value; however, from the perspective of long-term foundation, employees are the real assets and wealth of the enterprise. The enterprise can motivate employees and achieve the goal of common development of employees and the organization by obtaining their internal recognition and appreciation. Third, we should give full play to the role of the founder in the enterprise, allow the founder to participate in the enterprise management, give more rights to the founder, and make it play a greater role in the enterprise operation and decision-making, to achieve long-term healthy development of the enterprise.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

SX designed the paper, collected the data, summarized the literature review, developed the hypotheses, conducted the empirical analysis, and finalized the manuscript. ZX contributed to the hypothesis development and performed the empirical analysis. GL provided valuable suggestions and comments regarding the manuscript. All authors contributed to the article and approved the submitted version.

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Chief Executive Officers Entrepreneurial Orientation, Dynamic Capabilities, and Firm Performance: The Moderating Effect of the Manufacturing Industry

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This study explores the implications of CEO entrepreneurial orientation for firm performance through corporate dynamic capabilities. It explores the moderating effects of firm industry type on the above indirect effect. Based on 188 matched sample data collected from vice chief executive officers (CEOs) of Chinese firms, this study found that CEO entrepreneurial orientation was positively related to corporate dynamic capabilities and firm performance and that corporate dynamic capabilities mediated the positive relationship between CEO entrepreneurial orientation and firm performance. Firm industry type moderated the direct effect of CEO entrepreneurial orientation on corporate dynamic capability, and the indirect effect of CEO entrepreneurial orientation on firm performance through corporate dynamic capability. Both direct and indirect effects were stronger in manufacturing enterprises. The findings enrich the CEO entrepreneurial orientation literature by extending the existing knowledge on its underlying mechanism and its impact on firm performance, as well as its boundary conditions.

Keywords: chief executive officers entrepreneurial orientation, firm performance, dynamic capabilities, the manufacturing industry, China context

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INTRODUCTION

The relationship between firm-level entrepreneurial orientation and firm performance has been examined by many theoretical and empirical studies (Higgs and Rowland, 2005; Covin et al., 2006; Rauch et al., 2009; Keil et al., 2017; Shen et al., 2021). The findings over the last three decades have indicated that the positive relationship between both variables has been supported widely ($r = 0.242$, see, e.g., Rauch et al., 2009 for a review) and is robust to different cultural contexts (Rauch et al., 2009; Saeed et al., 2014). Some scholars have shifted to an emerging stream in the entrepreneurial orientation literature, namely, individual – for example, chief executive officer (CEO) – entrepreneurial orientation, and have explored its consequences (Bolton, 2012; Keil et al., 2017; Liu and Xi, 2021; Wang et al., 2021; Zhang et al., 2021). The value of studying individual entrepreneurial orientation lies in the fact that firm entrepreneurial orientation is implemented and strengthened by individuals including firm owners, top- and mid-level managers, and individual employees (Hughes et al., 2018) and manifests at all

organizational levels (Wales et al., 2011; Wiklund and Shepherd, 2011; Covin et al., 2020). Individual entrepreneurial orientation is a more proximal reflection of the operation of firm entrepreneurial orientation that can be linked to firm outcomes.

We make an inroad into the emerging stream of CEO entrepreneurial orientation literature. The CEO of a firm is the key decision maker and is ultimately responsible for its organizational outcomes (Hambrick and Mason, 1984; Hambrick and Finkelstein, 1987; Hambrick, 2007; Xi et al., 2017; Li et al., 2021). CEOs' attention, emphasis, and openness to entrepreneurial activities and behaviors may affect firm performance (Hambrick, 2007; Keil et al., 2017; Liu and Xi, 2021). To further contribute to the performance implication of CEO entrepreneurial orientation, the first aim of this study is to investigate how the CEO's attention, emphasis, and openness to entrepreneurial activities affect firm performance.

Then, we explored the mediating effect of dynamic capabilities in the relationship between CEO entrepreneurial orientation and firm performance. We focused on dynamic capabilities because of their entrepreneurial ability to adapt to a rapidly changing and uncertain organizational environment (Teece, 2007; Li and Liu, 2014). Therefore, CEO entrepreneurial orientation with innovativeness, proactiveness, and risk-taking characteristics may have a great impact on the development of dynamic capabilities in an uncertain environment (Lawson and Samson, 2001; Jiao et al., 2010; Haarhaus and Liening, 2020). Entrepreneurship can promote the circulation, dissemination, and transfer of knowledge within and between organizations and ultimately develop dynamic capabilities (Zahra et al., 1999). Helfat and Martin (2015) stated that enterprises need to quickly identify and understand environmental changes and have the dynamic capabilities to adapt to such changes in order to gain competitive advantage in market competition. The establishment of dynamic capabilities is both a key factor for an enterprise to cope with the uncertainties of the external environment and gain competitive advantage, and an important prerequisite for firms to improve their performance (Jiao et al., 2010; Zeng and Song, 2011).

Furthermore, this paper probes into the possible boundary condition that amplifies or narrows the influence of CEO entrepreneurial orientation. The manufacturing industry plays a crucial role in the adjustment of the economic structure in China (Pan and Zhao, 2019; Shen et al., 2020), which is our empirical context. In the course of industrial reforms, the transformation and upgrading of manufacturing enterprises face more severe challenges and uncertainties (Cheng and Song, 2016). It is an inevitable choice for manufacturing enterprises to enhance their connotation development, to strengthen their dynamic capacity, and to promote enterprise innovation. Mao and Wang (2015) pointed out that giving full play to entrepreneurship and enhancing organizational ability are important ways to improve innovation and firm performance of manufacturing enterprises. In the manufacturing industry, the CEO's attention to innovativeness and proactiveness intends to help the firm better deal with challenges and grasp opportunities emerging from industrial reforms, thus improving firm dynamic capabilities and performance. However, the existing literature has rarely treated the industry types of firms, such as manufacturing and non-manufacturing, as an important variable. Therefore, it is necessary to directly discuss the influence of the enterprise industry type on the variables of interest, in order to increase our differentiated understanding of the influence mechanism of CEO entrepreneurial orientation on firm performance in manufacturing and non-manufacturing enterprises. In this study, we will further examine whether firm industry type (manufacturing vs. non-manufacturing) shapes the positive relationship between CEO entrepreneurial orientation and dynamic capability, and the indirect effect of CEO entrepreneurial orientation and firm performance through dynamic capability.

Our work makes several important contributions to the entrepreneurial orientation literature. First, we seek to open up the "black box" of the implications of CEO entrepreneurial orientation for firm performance. Although CEO entrepreneurial orientation has been found to "matter" for firm value creation (Keil et al., 2017), we found that it can be a facilitator for firm performance, too. Second, this study is among the first to investigate how CEO entrepreneurial orientation improves firm performance by promoting the dynamic capabilities of the firm, which expands the underlying mechanism of entrepreneurial orientation on firm performance (Liu and Xi, 2021). Third, this study tests the moderating effect of industry type, instead of the constantly used firm size (Ha-Brookshire, 2009; Chelliah et al., 2010) and ownership (Campbell et al., 2010; Zahra, 2012), on the relationship between CEO entrepreneurial orientation and firm dynamic capabilities. Compared with non-manufacturing firms, CEO entrepreneurial orientation in manufacturing firms has a stronger impact on dynamic capabilities, which enhances our understanding of the boundary conditions for the impact of CEO entrepreneurial orientation on firm dynamic capabilities. This study provides a theoretical basis and empirical reference for future research on the manufacturing industry as a moderating variable, especially in the Chinese context.

The rest of this study is organized as follows. First, we present the theoretical development and hypotheses. Next, we present our research method and statistical results. Finally, we present a discussion that also details the theoretical and practical implications, limitations, and directions for future research.

THEORETICAL FRAMEWORK AND HYPOTHESES

In this section, we trace the development of our overall research model by first exploring the main effect of CEO entrepreneurial orientation and firm performance and then the mediating role of dynamic capabilities. We further incorporate industry type as a moderating variable to help explain the extent to which CEO entrepreneurial orientation influences firm performance through dynamic capabilities. **Figure 1** shows the hypothesized model of this study.

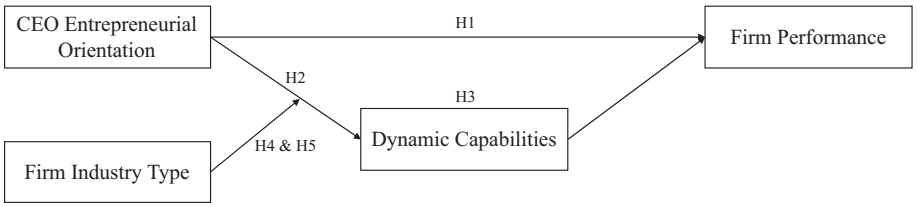

FIGURE 1 | The research framework of this study.

CEO Entrepreneurial Orientation and Firm Performance

Entrepreneurship orientation (EO), generally conceived as a firm-level construct, refers to "an organizational attribute reflecting how 'being entrepreneurial' is manifested in organizations or business units" (Covin and Wales, 2019: 4) and comprises innovativeness, proactiveness, and risk taking (Miller, 1983; Covin and Slevin, 1989; Rauch et al., 2009). However, CEOs, as key decision makers, are crucial to firms' strategic activities, decision making, and organizational outcomes (Hambrick and Mason, 1984; Hambrick, 2007; Busenbark et al., 2016; Yuan et al., 2017; Bao et al., 2020; Liu et al., 2021). A CEO can have power over strategic choices, investment decisions, entrepreneurial activities, and management practices (Jensen and Murphy, 1990; Bertrand and Schoar, 2003; Hambrick and Quigley, 2014) and influence over everyone in the company (Keil et al., 2017). This influence manifests in their behaviors, expectations, and in signaling the behaviors that are considered desired within the organization (Keil et al., 2017). Thus, firm-wide actions and behaviors instigated by entrepreneurial orientation and their performance consequences are critically influenced by CEOs (Cho and Hambrick, 2006; Simsek et al., 2015; Keil et al., 2017).

Liu and Xi (2021) defined CEO entrepreneurial orientation as "the extent to which the CEO is inclined to emphasize innovation and invest in innovative activities to achieve a competitive advantage, proactively cope with competition and identify business opportunities, and take business-related risks without fear of failure" (p. 3). According to this definition, CEO entrepreneurial orientation reflects the CEOs' attention toward, openness to, and emphasis on entrepreneurial behaviors and activities, demonstrating their commitment to entrepreneurial orientation (Ocasio, 1997, 2011; Keil et al., 2017; Wales et al., 2020; Liu and Xi, 2021). Given the key role of a CEO in an organization (Hambrick, 2007), and the positive relationship between entrepreneurial orientation and firm performance (Rauch et al., 2009; Saeed et al., 2014), we expect CEO entrepreneurial orientation to have a positive impact on firm performance.

First, by devoting considerable and consistent attention to entrepreneurship, the CEO emphasizes the production, adoption, and implementation of useful and novel ideas, products, and/or procedures (Farr and Ford, 1990) through various organizational channels (Ocasio, 1997). Research suggests that the effort and time spent on anticipating demand and promoting new products or services can often lead to higher performance (Ireland et al., 2003; Rauch et al., 2009).

Second, considering that pursing new value-creating entrepreneurial opportunities is important to lead rather than follow competitors in a certain business area (Covin and Slevin, 1989), CEOs with high entrepreneurial orientation are more likely to constantly seek out new and value-creating entrepreneurial opportunities (Lumpkin and Dess, 1996; Sullivan, 2010; Keil et al., 2017) by allocating their time and deploying firm resources (Keil et al., 2017).

Third, CEOs' attention, emphasis, and openness to entrepreneurial behaviors are a signal to invoke organizational members' innovative and pioneering behaviors. A CEO's entrepreneurial orientation can be distributed through structural channels within the organization, thus encouraging engagement in value-creating entrepreneurial activities (Ling et al., 2008; Keil et al., 2017; Yuan et al., 2017), which may be conducive to both establishing new sources of profit growth and achieving success in the future.

Finally, by focusing their attention on entrepreneurial behaviors and activities, CEOs can directly and indirectly shape organizational members' perceptions, attitudes, behaviors, and performance consequences (Salancik and Pfeffer, 1978; Ocasio, 1997, 2011; Keil et al., 2017).

In sum, by demonstrating attention, emphasis, and openness to entrepreneurial behaviors and activities, CEOs may evoke a firm-wide entrepreneurial orientation (Chatterjee and Hambrick, 2007; Simsek et al., 2010; Keil et al., 2017; Liu and Xi, 2021) that can enhance firm performance (Covin and Slevin, 1986; Wiklund and Shepherd, 2003; Dimitratos et al., 2004; Rauch et al., 2009). Keil et al. (2017) found that CEO entrepreneurial orientation positively results in firm value creation. Therefore, CEO entrepreneurial orientation can be seen as a factor fostering firm performance. We propose the following:

> *Hypothesis 1*: CEO entrepreneurial orientation is positively related to firm performance.

The Mediating Role of Dynamic Capabilities

With the rapid development of science and technology and the fiercely growing market competition in recent years, some authors have argued that the resource-based theory does not fully explain how companies gain competitive advantage in a rapidly changing business environment and have emphasized the role and importance of dynamic capabilities (Teece et al.,

1997; Eisenhart and Martin, 2000; Teece and Pisano, 1994; Winter, 2003). To gain competitive advantage in a rapidly changing environment, a firm's capabilities must be dynamic (Teece et al., 1997; Teece, 2007; Ren et al., 2021). It must have the ability to constantly update its capabilities in order to ensure coordination between the external environment and firm strategy (Li and Liu, 2014; Teece and Leih, 2016).

Studies have identified dynamic capabilities as a source of sustainable competitive advantage (Teece et al., 1997; Eisenhart and Martin, 2000). Teece et al. (1997) defined dynamic capabilities as the capabilities of a firm to integrate, develop, and reconfigure internal and external competences in order to respond quickly to a changing business environment. Teece (2007) proposed a sensing-seizing-reconfiguring framework of dynamic capabilities, which center on sensing and seizing opportunities, managing threats, and reconfiguration. We argue that CEO entrepreneurial orientation can effectively enhance these three capabilities.

First, environmental scanning is an important part of identifying opportunities and predicting competitive threats (Peteraf and Bergen, 2003). High environmental scanning capability means that a firm can quickly and effectively identify entrepreneurial opportunities and threats in a changing environment. Highly entrepreneurially oriented CEOs pursue new value-creating entrepreneurial opportunities by engaging in meaning-creating activities in uncertain environments (Hill and Levenhagen, 1995; Weick, 1995; Alvarez and Barney, 2007). Jantunen et al. (2005) found that higher levels of entrepreneurial orientation support the ability to identify opportunities, which, in turn, have a positive impact on dynamic capabilities. Thus, CEO entrepreneurial orientation can enhance the capability of sensing opportunities.

Second, CEOs with high entrepreneurial orientation emphasize the production, adoption, and implementation of useful and novel ideas, products, and procedures (Farr and Ford, 1990), which helps companies create, define, identify, and take advantage of new market opportunities before their competitors. Wiklund (1999) found that entrepreneurial orientation has a significant impact on the improvement of organizational culture, learning, and ability. Thus, entrepreneurial strategy is a key choice in dealing with complex environments and managing transformation (Zahra et al., 2006). By paying attention to, laying emphasis on, and exhibiting openness toward entrepreneurial behaviors and activities, and demonstrating a commitment to entrepreneurial orientation, CEOs divide their time, energy, and resources between entrepreneurial activities and actions (Keil et al., 2017). Thus, CEO entrepreneurial orientation enhances their ability to seize opportunities.

Finally, CEOs with high entrepreneurial orientation emphasize the introduction of creative ideas, as well as new methods and procedures, and have high tolerance for change, which helps their organizations adapt better. Sirmon and Hitt (2003) posited that CEOs are the core agents for change. When an organization's external environment changes dramatically, the CEO leads the top management to activate the dynamic capabilities that are embedded in the organization, strip the redundant resources that cannot adapt to the complex environment, and reconfigure the existing resources to develop capabilities in order to adapt to the enterprise's existing and new markets. Research has found a positive relationship between entrepreneurial orientation and dynamic capabilities (SubbaNarasimha, 2001; Jiao et al., 2010; Monteiro et al., 2017). Thus, CEO entrepreneurial orientation enhances the abilities to manage threats and engage in reconfiguration. Accordingly, we hypothesize as follows:

> *Hypothesis 2*: CEO entrepreneurial orientation is positively related to dynamic capabilities.

Teece et al. (1997) defined dynamic capability as the ability to investigate how an enterprise reconfigures internal and external resources through a series of behaviors, so that the enterprise can quickly adapt to environmental change, achieve competitive advantage and gain profits, and improve organizational performance. Eisenhart and Martin (2000) argued that dynamic capabilities serve as a means to change the resource base and help form new value creation strategies and obtain competitive advantage.

To explain how dynamic capabilities promote and achieve competitive advantage and firm performance, scholars have explored the operational mechanism of dynamic capabilities (Zahra and George, 2002; Helfat and Peteraf, 2003). For instance, such capabilities can improve existing business activities by selecting technical knowledge pertaining to an existing knowledge base during the evolution of business and operational technology models (Eisenhart and Martin, 2000; Zollo and Winter, 2002; Teece, 2010). Thus, dynamic capabilities enable companies to achieve outstanding performance in the long term (Teece, 2007; Wilden et al., 2013; Pezeshkan et al., 2016). Some empirical studies have supported the positive impact of dynamic capabilities on firm performance (Prange and Verdier, 2011; Protogerou et al., 2012; Lin and Wu, 2014; Fainshmidt et al., 2016; Pezeshkan et al., 2016; Zhou et al., 2021). For example, in a meta-analysis, Fainshmidt et al. (2016) found that dynamic capabilities were positively related to firm performance and that the positive relationship was stronger in industries with higher levels of technological dynamism. Lin and Wu (2014) found that both firm dynamic learning and reconfiguration capabilities were positively related to firm performance.

Considering the positive impacts of CEO entrepreneurial orientation on both firm performance (Hypothesis 1) and dynamic capabilities (Hypothesis 2), this study expects the latter to play a mediating role in the relationship between CEO entrepreneurial orientation and firm performance. That is, the positive effect of CEO entrepreneurial orientation on firm performance is achieved through the enhancement of dynamic capabilities. Therefore, this study proposes the following hypothesis:

> *Hypothesis 3*: Dynamic capabilities mediate the relationship between CEO entrepreneurial orientation and firm performance.

The Moderating Role of the Manufacturing Industry

Compared with the number of studies that have examined the moderating effect of firm ownership (Campbell et al., 2010; Zahra, 2012) and size (Ha-Brookshire, 2009; Chelliah et al., 2010), only a few have explored the moderating effect of firm industry type. This study considers it is necessary to specifically discuss the industry type of enterprises in the current stage, such as manufacturing and non-manufacturing industry, which may have a moderating effect on the relationship between CEO entrepreneurial orientation and dynamic capabilities. This is because, first, the manufacturing industry is the foundation of China's economic development and plays a vital role in the strategic adjustment of economic structure (Pan and Zhao, 2019). Second, China's manufacturing industry is at a critical stage of transformation and upgrading from "Made in China" to "Create in China." Compared with the industrial transformation and upgrading of non-manufacturing enterprises, the transformation and upgrading of the manufacturing industry encounter more severe challenges (Cheng and Song, 2016). Third, compared with non-manufacturing enterprises, manufacturing ones pay more attention to labor and property costs. With the gradual loss of China's demographic dividend and land cost advantage (Jin, 2015), manufacturing enterprises must undergo transformation and upgrading, enhance connotation development, and strengthening their dynamic capacity building approaches. Fourth, China's manufacturing industry has already formed a complete supply chain and industrial supporting system, with low prices and fast delivery speeds in order to ensure the smooth operation of the global value chain.

However, with the rapid development of information technology and the constant changes in the market environment, China's manufacturing enterprises continue face increasing environmental uncertainties (Yu et al., 2020). CEOs with high entrepreneurial orientation are more likely to play an important role in this context (Mao and Wang, 2015). As for the moderating effect of the manufacturing industry in the relationship between CEO entrepreneurial orientation and dynamic capabilities, we argue that there is a stronger positive relationship between CEO entrepreneurial orientation and dynamic capabilities in manufacturing enterprises for the following reasons.

First, compared with non-manufacturing enterprises, manufacturing ones, especially the labor-intensive kind, need to strengthen the construction of enterprise dynamic capabilities in order to improve their competitiveness (Geng and Yuan, 2010). Therefore, if the CEOs of manufacturing enterprises demonstrate the pursuit of innovation, take the initiative, and dare to take risks in daily behaviors like decision making, management, and leadership, it will better meet the needs of manufacturing enterprises to strengthen their dynamic capacities.

Second, compared with non-manufacturing enterprises, manufacturing ones encounter greater uncertainties in market demand, material supply, competition, and new product technology. Leaders of manufacturing enterprises need to adopt flexible development strategies to remain consistent with the external environment, in order to ensure high profits and sales performance (Chang et al., 2002; Singh et al., 2013). When the CEO of manufacturing enterprises has a high degree of entrepreneurial orientation, it is easier to stimulate the inner capabilities of these enterprises to develop new markets, products, and technologies.

Third, for manufacturing organizations operating in increasingly uncertain environments and volatile markets, dynamic capabilities can be considered a major competitive weapon, providing organizations with the ability to quickly identify market opportunities, manage threats, and respond to market competition (Singh et al., 2013). Therefore, manufacturing enterprises may pay more attention to the construction of enterprise dynamic capabilities. When CEOs in manufacturing enterprises show high commitment to entrepreneurial orientation, the influence of CEO entrepreneurial orientation on the dynamic capabilities may be stronger.

Finally, compared with non-manufacturing enterprises, digital transformation is becoming important for manufacturing enterprises with the introduction of digital technology in production systems (Lin et al., 2020a). Digital transformation refers to the application of digital technology and is a key driver of manufacturing transformation (Lin et al., 2020b). Lin et al. (2020b) found that dynamic capabilities are essential in order to remain competitive in a rapidly changing industrial environment in the course of enterprise transformation. CEOs of manufacturing enterprises with high entrepreneurial orientation tend to emphasize on the introduction of new technologies, methods, and procedures, and simultaneously, on digital transformation and the construction of enterprise dynamic capabilities. In light of the above analysis, we propose as follows:

> *Hypothesis 4*: Enterprise industry type moderates the positive relationship between CEO entrepreneurial orientation and dynamic capabilities: Compared with non-manufacturing enterprises, the positive relationship between CEO entrepreneurial orientation and dynamic capabilities is stronger in manufacturing enterprises.

Thus far, this study has proposed to examine the positive impact of CEO entrepreneurial orientation on firm performance and has proposed that dynamic capabilities play a mediating role between CEO entrepreneurial orientation and firm performance and that manufacturing industry type plays a moderating role between CEO entrepreneurial orientation and dynamic capabilities. There may be a potential theoretical hypothesis underlying these assumptions. That is, the manufacturing industry type may moderate the indirect effect of CEO entrepreneurial orientation on firm performance through dynamic capabilities. Therefore, this study proposes the following:

> *Hypothesis 5*: Firm industry type moderates the indirect influence of CEO entrepreneurial orientation on firm performance through dynamic capabilities. This indirect effect is stronger and weaker among manufacturing and non-manufacturing firms, respectively.

MATERIALS AND METHODS

Participants and Procedure

Considering that the research questions in this paper mainly involve variables at the firm level, we collect data at the firm level by surveying top executives. We employed a quantitative research approach and collected data from firms based on the convenience sampling method. We collected data from four economic and technological development zones in Guangdong, Anhui, Jiangsu, and Tianjin, in China from March to September 2017. To ensure the quality and reliability of the collected data, we asked officials of the Administrative Committee of these four zones to help administer the survey.

To rule out common method bias, we adopted the pairing method for data collection. We invited two vice presidents each from 300 firms to participate in our study. We asked one VP to rate the CEO entrepreneurial orientation, and the other to rate the dynamic capability and firm performance. Both of two VPs rated CEO demographics and firm characteristics. In all, 210 firms returned the questionnaires after filling them. After deleting the unmatched observations, we obtained 188 matched data. The final effective response rate was 0.937.

Sample Characteristics

Of the 188 CEOs, 91.5% were male with an average age ranging between 45 and 50 years. The average education level was master's degree including MBA and EMBA. Their average tenure (months) was 60.79 (S.D. = 56.94). Out of 188 firms, 102 were private firms; 30 were state-owned enterprises; 40 were foreign firms; 16 were others; 110 were small- and medium-sized enterprises; 100 were manufacturing firms; and 88 were non-manufacturing firms. The average established years were 15.53 (S.D. = 13.59).

Measures

CEO Entrepreneurial Orientation

We employed the 9-item scale developed by Liu and Xi (2021) to measure CEO entrepreneurial orientation including innovativeness, proactiveness, and risk taking. A sample item for innovativeness was "Our CEO emphasizes on finding innovative solutions to problems." A sample item for proactiveness was "In the face of market competition, our CEO emphasizes on being proactive rather than reactive." A sample item for risk taking was "Our CEO is willing to take higher risks in pursuit of higher returns." Vice presidents were asked to rate CEO entrepreneurial orientation based on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The Cronbach's coefficient of CEO entrepreneurial orientation was.937.

Corporate Dynamic Capability

Following previous studies (Helfat and Peteraf, 2003; Teece and Pisano, 1994; Jantunen et al., 2005; Jiao et al., 2010), we employed a 14-item scale to measure corporate dynamic capabilities. A sample item was "Our company has a rapid organizational response to market changes." Vice CEOs were asked to rate dynamic capabilities based on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The Cronbach's coefficient of dynamic capabilities was 0.942.

Firm Performance

This study employed an 8-item scale developed by Katsikeas et al. (2006) to measure firm performance. Vice CEOs were asked to assess their firm's performance relative to other firms in the industry based on a 7-point Likert scale that ranged from 1 (very low) to 7 (very high). These items pertained to sales, financial, and customer performance. The Cronbach's coefficient of firm performance was 0.916.

Firm Industry Type

We asked vice presidents to report whether their companies were manufacturing firms. Accordingly, there were manufacturing (1) and non-manufacturing firms (0).

Control Variables

We controlled for the CEO's demographic variables, including gender, age, education level, and tenure (by months), and firm characteristics including firm ownership structure (1 = private and 0 = others), firm size (1 = small- or medium-sized enterprise with under 500 employees and 0 = large-sized enterprise with over 500 employees), and established years that were found to correlate with firm performance (Hambrick and Mason, 1984; Hambrick and Finkelstein, 1987; Hambrick, 2007).

Analytical Approach

Given that all the variables were collected at the firm level, we employed conditional process analysis in SPSS to test our hypotheses (Hayes, 2013).

RESULTS

Table 1 presents the means, standard deviations, and correlations of the variables. Consistent with our theoretical assessment, CEO entrepreneurial orientation was positively related to dynamic capability ($b = 0.552$, $p < 0.01$) and firm performance ($b = 0.382$, $p < 0.01$). Dynamic capability was positively related to firm performance ($b = 0.458$, $p < 0.01$).

Hypothesis Testing

Table 2 presents the results of the regression analysis for dynamic capabilities and firm performance.

According to **Table 2**, CEO entrepreneurial orientation positively resulted in firm performance ($b = 0.217$, se = 0.057, $t = 3.834$, $p < 0.001$; Model 3) and corporate dynamic capability ($b = 0.242$, se = 0.034, $t = 7.199$, $p < 0.001$; Model 1). According to Model 4, when both CEO entrepreneurial orientation and dynamic capability were added, the influence of CEO entrepreneurial orientation on firm performance was no longer significant. However, the influence of dynamic capability on

TABLE 1 | Descriptive statistics and correlations among the variables.

Variables	Mean	S.D.	1	2	3	4	5	6	7	8	9	10
1. CEO male	0.94	0.29										
2. CEO age	4.49	1.67	−0.024									
3. CEO education	4.01	1.26	0.121	−0.105								
4. CEO tenure	60.67	57.09	0.055	0.117	0.038							
5. Private	0.54	0.50	0.094	−0.192**	0.076	0.276**						
6. Manufacturing	0.53	0.50	−0.285**	0.199**	−0.401**	−0.165*	−0.262**					
7. Firm size	0.59	0.50	0.115	−0.103	0.180*	0.065	0.267**	−0.357**				
8. Firm age	15.53	13.63	0.069	0.131	−0.304**	−0.100	−0.270**	0.255**	−0.341**			
9. CEO EO	5.07	1.31	0.022	−0.284**	−0.110	0.130	0.096	−0.191*	−0.073	−0.151*		
10. Dynamic capabilities	5.80	0.66	0.036	−0.196**	−0.167*	0.116	−0.085	−0.083	−0.180*	−0.035	0.552**	
11. Firm performance	5.22	0.99	0.009	−0.211**	−0.039	0.097	0.086	−0.183*	−0.170*	−0.164*	0.382**	0.209**

*N = 188; CEO, Chief Executive Officer; and EO, Entrepreneurial Orientation. *p<0.05; **p<0.01.*

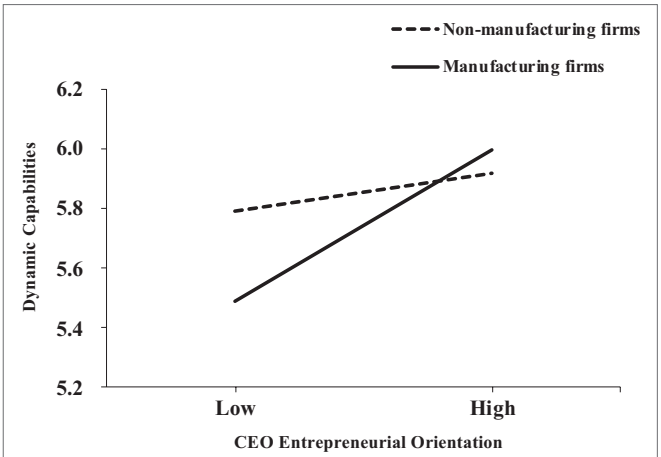

FIGURE 2 | The moderating effect of firm industry type in the relationship between CEO entrepreneurial orientation and dynamic capabilities.

firm performance remained significant ($b = 0.514$, se = 0.123, $t = 4.185$, $p < 0.001$), indicating that dynamic capability played a mediating role in the relationship between CEO entrepreneurial orientation and firm performance. Through the indirect effect test of 5,000 times of bootstrapping, the indirect effect of CEO entrepreneurial orientation on firm performance through dynamic capability was significant (indirect effect = 0.124, se = 0.041, 95%CI = [0.051, 0.210]). Thus, Hypotheses 1, 2, and 3 were supported.

According to Model 2 in **Table 2**, the interaction between CEO entrepreneurial orientation and manufacturing was positively and significantly related to dynamic capability ($b = 0.143$, se = 0.064, $t = 2.219$, $p < 0.05$). The result shows that for manufacturing firms, the influence of CEO entrepreneurial orientation on dynamic capability was higher. **Figure 2** shows the moderating effect of manufacturing firms. When a firm belonged to the manufacturing category ($b = 0.306$, se = 0.047, $t = 6.625$, $p < 0.001$), the influence of CEO entrepreneurial orientation on dynamic capability was stronger than that of non-manufacturing firms ($b = 0.164$, se = 0.048, $t = 3.505$, $p < 0.001$). Therefore, Hypothesis 4 was supported.

Table 3 shows the results of the moderating mediation effect. It shows that in manufacturing firms ($b = 0.149$, se = 0.049, 95% CI = [0.060, 0.251]), the direct effect of CEO entrepreneurial orientation on firm performance through dynamic capability was stronger than that in non-manufacturing firms ($b = 0.080$, se = 0.036, 95%CI = [0.023, 0.166]). The difference in the coefficients of indirect effects between manufacturing and non-manufacturing firms was significant (difference = 0.069, se = 0.037, 95%CI = [0.012, 0.160]), supporting Hypothesis 5.

DISCUSSION

From the perspective of dynamic capabilities, we explored the mediating mechanism of how CEO entrepreneurial orientation influences firm performance through dynamic capabilities and examined the moderating effect of firm industry type on this

TABLE 2 | Results of regression analysis for dynamic capabilities and firm performance.

Variables	Dynamic Capabilities		Firm Performance		
	Model 1	Model 2	Model 3	Model 4	Model 5
Controls					
CEO male	0.136	0.117	0.232	0.162	0.044
CEO age	−0.053	−0.053*	−0.071	−0.044	−0.038
CEO education	−0.061	−0.066	−0.031	−0.000	−0.047
CEO tenure	0.002	0.001	0.001	0.000	−0.000
Private firm	−0.231*	−0.227*	0.081	0.200	0.163
Firm size	−0.174	−0.157	−0.499**	−0.410**	−0.499**
Firm age	−0.003	−0.002	−0.013*	−0.012*	−0.011*
Independent					
CEO EO	0.242***	0.240***	0.217***	0.092	0.072
Mediator					
Dynamic Capabilities				0.514***	0.485***
Moderator					
Manufacturing		−0.083			−0.365*
Interaction					
CEO EO* Manufacturing		0.143*			0.034
R^2	0.369	0.390	0.219	0.292	0.314
R^2 change	0.192	0.021	0.067	0.073	0.022

*N = 188; CEO, Chief Executive Officer; and EO, Entrepreneurial Orientation. *p < 0.05; **p < 0.01; ***p < 0.001.*

mediating mechanism. Using matched data from 188 Chinese firms, we found that CEO entrepreneurial orientation had a significant positive impact on dynamic capabilities and firm performance; dynamic capabilities mediated the relationship between CEO entrepreneurial orientation and firm performance; and firm industry type moderated the relationship between CEO entrepreneurial orientation and dynamic capabilities. In manufacturing enterprises, the indirect effect of CEO entrepreneurial orientation on firm performance through dynamic capabilities was stronger. These results have important theoretical and practical significance.

Theoretical Implications

Our study makes several important contributions to the entrepreneurial orientation literature. First, it contributes to a small research stream in the existing entrepreneurial orientation literature that investigates the implications of CEO entrepreneurial orientation on firm performance (Chatterjee and Hambrick, 2007; Simsek et al., 2015; Keil et al., 2017; Liu and Xi, 2021). Most of the existing entrepreneurial orientation literature has treated entrepreneurial orientation as a firm-level construct and investigated the relationship between entrepreneurial orientation and firm performance (Higgs and Rowland, 2005; Covin et al., 2006; Rauch et al., 2009; Keil et al., 2017; Shen et al., 2021). However, the CEOs of firms are vital decision makers and facilitators of a firm's entrepreneurial activities and are ultimately responsible for the organizational outcomes (Simsek et al., 2010, 2015; Bao et al., 2020). Therefore, understanding their roles in driving entrepreneurial orientation is important. By paying considerable and consistent attention to entrepreneurship, CEOs can shape firm-wide entrepreneurial orientation and behaviors. This consistent attention to entrepreneurship is called CEO entrepreneurial orientation (Keil et al., 2017; Liu and Xi, 2021). Although we are not the first to study it (Keil et al., 2017), we are among the first to investigate its implications for performance. Our findings suggest that CEO entrepreneurial orientation positively leads to firm performance by emphasizing value-creating entrepreneurial opportunities, encouraging organizational members' innovative and pioneering behaviors, and investing efforts to anticipate demand and promote new products or services.

Second, our study helps understand of the role of dynamic capabilities in linking CEO entrepreneurial orientation and firm performance. Although only one study has investigated the linkages between CEO entrepreneurial orientation and firm value creation (Keil et al., 2017), providing a lens to support the fact that CEO entrepreneurial orientation is relevant to firm performance, the underlying mechanism has not been fully explored. Our paper is among the first to investigate the underlying mechanisms of CEO entrepreneurial orientation and firm performance. We found that CEO entrepreneurial orientation enhances the capabilities of organizational sensing and seizing of opportunities, managing threats and reconfiguration, that is, improves dynamic capabilities of the

TABLE 3 | The results of moderated mediation.

Moderators	CEO EO → Dynamic Capabilities → Firm Performance		
	Indirect effect	SE	95%CI
Non-manufacturing	0.080	0.036	[0.023, 0.166]
Manufacturing	0.149	0.049	[0.060, 0.251]
Difference	0.069	0.039	[0.012, 0.160]

CEO, Chief Executive Officer; EO, Entrepreneurial Orientation.

organization, and ultimately raises firm performance. This study integrates the literature on CEO entrepreneurial orientation and dynamic capabilities and provides a new perspective on the mediating mechanism in order to explore the relationship between CEO entrepreneurial orientation and firm performance.

Third, this study took an initiative to examine the moderating effect of firm industry type as a boundary condition for the "value" of CEO entrepreneurial orientation. Previous studies on manufacturing have mainly used data from manufacturing enterprises to study problems of interest (Mao and Wang, 2015; Cheng and Song, 2016; Yang et al., 2019), whereas a few have directly investigated the manufacturing industry and have treated it as a moderating variable. Against the backdrop of China's manufacturing enterprises' transformation, upgrading, and emphasis on innovation, and gradual loss of advantages in population and land cost (Jin, 2015; Cheng and Song, 2016), manufacturing enterprises must pay more attention to the improvement of innovation and dynamic capabilities in order to cope with increasing technological and market uncertainties. This study shows that when compared to non-manufacturing firms, CEO entrepreneurial orientation has a stronger impact on the dynamic capabilities of manufacturing enterprises. This study supports the idea that firm industry type can act as a moderator in the relationship between the variables of interest, just like firm ownership (Campbell et al., 2010; Zahra, 2012; Wu et al., 2014) and size (Ha-Brookshire, 2009; Chelliah et al., 2010). The finding provides a theoretical and empirical reference for future research intending to use manufacturing industry as a moderating variable.

Practical Implications

Our study has important practical implications that highlight the benefits of CEO entrepreneurial orientation and dynamic capabilities. First, our findings suggest that the CEO's attention, emphasis, and openness to entrepreneurial activities and behaviors matters for firm performance and dynamic capabilities and that boards of directors should, therefore, take CEO entrepreneurial orientation into account in the selection and succession processes. Second, our study found that dynamic capabilities are positively related to firm performance and mediate the relationship between CEO entrepreneurial orientation and firm performance. Thus, organizations should take steps to increase their dynamic capabilities. For example, as the representative of the organization, the CEO should pay greater attention to entrepreneurial activities and behaviors.

Our study has two important practical implications for manufacturing enterprises. First, it indicated that in manufacturing enterprises, improving CEO entrepreneurial orientation is more conducive to improving dynamic capabilities. This presents a new idea and transformation path for China's manufacturing enterprises in the critical period of industrial upgrading and digital transformation (Lin et al., 2020a). That is, CEOs take the initiative to pay attention to entrepreneurial activities within the industry. Second, this study found that when compared to non-manufacturing enterprises, in manufacturing enterprises, CEO entrepreneurial orientation has a stronger, indirect effect on firm performance by improving dynamic capabilities. There are two ways in which manufacturing enterprises can improve their performance. Enterprises (1) must strive to improve the level of entrepreneurial orientation, and let the CEO pay consistent attention to entrepreneurial activities and behaviors and (2) can achieve sustained competitive advantage by building and forming dynamic capabilities.

Limitations and Future Research Recommendations

Our study has a few limitations that provide intriguing opportunities for future research. First, the data we use do not allow us to determine the cause-effect relationship that is implied in the model (**Figure 1**). Causal sequences are difficult to ascertain in the investigation of the existing relationship. In this case, however, it is unlikely that dynamic capabilities influence CEO entrepreneurial orientation. The relationship between entrepreneurial orientation and firm performance has been widely supported in the literature. Thus, future research may rely on a longitudinal design to collect multi-wave data to test the cause-effect relationship.

Second, in this study, we focused on the role of dynamic capabilities in linking CEO entrepreneurial orientation and firm performance. However, the potential mediating mechanisms linking CEO entrepreneurial orientation and firm performance go far beyond dynamic capabilities. For example, organizational learning (Jiao et al., 2010; Zhao et al., 2011), entrepreneurial learning (Shen et al., 2021), human resource management system (Xi et al., 2021), absorptive capability (Zhai et al., 2018), and middle managers' cognition (Liu and Xi, 2021) may play mediating roles in the linkage between CEO entrepreneurial orientation and firm performance.

Third, we tested the proposed model with a sample of Chinese manufacturing and high-tech companies located at four economic and technological development zones, which limits the generalizability of the findings. Future research should examine whether the findings can be replicated using other samples. Besides, different cultural dimensions, such as individualism – collectivism, may influence people's behaviors (Qian and Miao, 2016). For example, in an individualistic culture, entrepreneurs are more welcome and encouraged and entrepreneurship is valued by society (Dubina and Ramos, 2016). Given that China's national culture is more collectivist, it is worth examining whether our findings can be applied to and replicated in countries that have individualistic cultures.

Finally, this study mainly examined the performance implication of CEO entrepreneurial orientation and found the mediating role of dynamic capabilities. Future research should examine the low-level consequences of CEO entrepreneurial orientation. For example, Wales (2016) called for examinations of (CEO) entrepreneurial orientation as a prerequisite for individual-level outcomes, such as employee innovative behavior.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

AUTHOR CONTRIBUTIONS

MX and XG planned the study and collected the data. YL and YJ wrote the manuscript. YL and MX analyzed the data and wrote the manuscript. All authors listed have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

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Effects of CEO Identity on Non-family Managers' Pay Dispersion in Family Firms: A Social Comparison Perspective

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The fairness of compensation has been a prominent focus for non-family managers, and pay dispersion, which reflects compensation fairness, has attracted much attention from scholars. Based on social comparison theory, this study investigates the factors that affect the pay dispersion between CEO and non-family managers. In family firms, the role of CEO, which is central in corporate governance, can be filled by either a family or a non-family member. This study provides insights into how the identity of the CEO affects pay dispersion and investigates the moderating effects of CEO tenure and institutional environment. Using the data of Chinese listed family firms from 2009 to 2015, the results show that the presence of non-family CEOs could decrease the pay dispersion between CEO and non-family managers. Empirical evidence also supports that the negative relationship between CEO identity and pay dispersion weakens when CEO tenure increases and the institutional environment matures.

Keywords: social comparison theory, family firm, non-family managers, TMT pay dispersion, CEO tenure, marketization index

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INTRODUCTION

The continuous pursuit of sustainable development makes family firms compete fiercely for talent, and recruiting non-family managers often becomes a necessity. Considering family firms, the top management teams are often composed of both family and non-family managers, and the characteristics of the two types of managers have been explored by various studies (Chrisman et al., 2014; Tabor et al., 2018). Family managers can highlight family characteristics and consolidate family control (Bach and Serrano-Velarde, 2015), generate greater job security (Cai et al., 2010; Luo and Chung, 2013), and exhibit more emotional attachment to the firm. Conversely, non-family managers are generally selected from the competitive human resource market, and most have received formal education and training (Chrisman et al., 2014). These individuals are more available for the managerial positions than the limited number of family members (Fang et al., 2021). Therefore, to attract and motivate non-family managers to act in the best interests of the holding

family, one possible action involves setting effective and fair incentive structures. Pay dispersion, as a manifestation of the fairness of incentive plans (Ding et al., 2009), could have implications for the working relationship of top management teams and became a critical human resource and corporate governance issue to be considered. Therefore, this study focused on the fairness of managerial compensation and investigated the pay dispersion among non-family managers.

Since managers have attached more importance to the fairness of compensation, factors that could affect the pay dispersion became a key issue discussed by scholars. Considering that executive compensation is mostly determined by the board of directors, most studies have tried to explore the influencing factors based on the attributes of the board of directors, such as board seat (Fredrickson et al., 2010) and ownership (Connelly et al., 2016; Keppeler and Papenfuß, 2021) on managerial pay dispersion. There are also studies examining how managerial attributes influence pay dispersion, such as managerial political ideologies (Chin and Semadeni, 2017), and morale effects (Breza et al., 2018). However, what cannot be neglected, as the leader of top management teams, the opinions of the CEO will have a degree of impact on the executive compensation arrangement. In addition, in family firms, the identity of the CEO could be a source of family firm heterogeneity (Barontini and Bozzi, 2018). The appointment of a family or non-family CEO could alter the holding families' propensity to make decisions in firm governance and operation. Although CEO identity is a common corporate governance form in family firms, the effect of how CEO identity influences the pay dispersion has not received enough attention. Thus it is important to investigate whether CEO identity impacts the compensation arrangement for non-family managers and its implications for pay dispersion.

Although non-family managers have strengths such as competence and managerial experience, these attributes also put them in a similar and competitive status, which makes non-family managers likely referents for one another, and social comparison often occurs at the same time (Festinger, 1954). Compensation, as an initial symbol of a manager's human capital value and social status (Main et al., 1993), becomes an important object of social comparison. Social comparison theory states that individuals focus on comparing their compensation to determine whether they receive fair treatment (Festinger, 1954; Fredrickson et al., 2010), and higher pay dispersion could lead to lower firm performance (Jaskiewicz et al., 2017; Patel et al., 2018; Zhang et al., 2020), or increased managerial turnover (Ridge et al., 2017; Kacperczyk and Balachandran, 2018). However, under the framework of social comparison theory, few studies have focussed on the factors that influence managerial pay dispersion in family firms. Therefore, our work adopts a social comparison perspective to investigate how CEO identity influences non-family managers' pay dispersion in Chinese family firms.

The importance of CEO identity is also highlighted through society's perceptions of individual competence and environmental informal rules. Hence, the influence of CEO identity on pay dispersion should also consider the moderating effects of certain competence and environmental factors. For competence factors, CEO tenure is an important indicator to identify a CEO's competence and experience (Chen et al., 2019). A more capable CEO will be less likely to emphasize the importance of identity, which will decrease the comparison tendency among non-family managers. In addition, environmental factors like institutional environment should also be considered. A more standardized institutional environment leads to more attention on work efficiency and fair competition, which will lead to less focus on social comparisons, and less emphasis on the importance of CEO identity. Therefore, theories that seek to increase our understanding of how CEO identity influences pay dispersion must consider more fully the moderating effects of CEO tenure and institutional environment.

Using data from Chinese listed family firms from 2009 to 2015, we investigated the antecedent factors that could influence managerial pay dispersion. This study attempts to answer two related questions. (1) How does non-family CEO identity influence the pay dispersion between CEO and non-family managers? (2) How do CEO tenure and institutional environment moderate the relationship between CEO identity and pay dispersion?

This study contributes to the prior literature in several ways. First, our paper extends the recent work on the influencing factors of managerial pay dispersion in family firms. Under the framework of social comparison theory, our paper identifies CEO identity as an important influencing factor of managerial pay dispersion, and explores how CEO identity influences pay dispersion between CEO and non-family managers in family firms. Second, our work incorporates CEO identity into the analytical framework of social comparison theory, enriching its applicability. Even though maintaining pay fairness is of great significance, the current research had not yet indicated arrangements on how to reduce pay dispersion under the framework of social comparison theory. Hence, this paper incorporates CEO identity into the analytical framework of social comparison theory and finds an effective way to deal with pay dispersion. Third, our paper makes an in-depth exploration of social comparison theory and finds factors that could affect the social comparison tendency. As a kind of individual subjective psychological feeling, social comparison can also be affected by some external factors, like individual competence and external informal rules. Hence, our paper highlights CEO tenure and institutional environment as moderators to represent how individual competence and external rules affect the social comparison tendency. Also, our paper provides practical implications: our work adopts a reference on how to motivate non-family managers effectively, and the results show that non-family managers are highly sensitive to the fairness of compensation. In addition, the compensation arrangement should also consider CEO's opinion.

The remainder of the paper is organized as follows. Section "Theoretical Background" presents a review of literature on social comparison theory and managerial pay dispersion, section "Hypotheses Development" puts forward the development of our hypotheses, section "Methodology" explains the model, data collection, and measurement of variables, section "Empirical Results" explains the statistical methods and empirical results, section

"Robustness Tests" presents the robustness tests, and section "Discussion" discusses the implications and limitations of the research and provides suggestions for future research. "Conclusion" summarizes the results and implications of the research.

THEORETICAL BACKGROUND

Social Comparison Theory

Social comparison theory was derived from the field of social psychology. As a general and fundamental feature of social life, Festinger (1954) noticed the phenomenon of social comparison, which showed that individuals had a "drive" to evaluate their opinions and abilities. The primary motive of social comparison is obtaining information from others, and then evaluating oneself. Social comparison theory argues that individuals have an intrinsic need to evaluate and compare their abilities and opinions with others within the same group or even other groups, and determine whether they receive fair treatment. Researchers have identified three motives of social comparison: evaluation, enhancement, and improvement (Taylor et al., 1996), which is also the process of social comparison. Furthermore, social comparison theory argues that the greater the difference in an individual's ability, status, and opinion, the weaker the social comparison tendency. That is, individuals commonly compare themselves with others with whom they have attributes in common, such as position, demographic characteristics, or ability (Festinger, 1954; Gerber et al., 2018).

In recent studies, social comparison always occurs within firms when managers or employees compare with their "referents" (Gartenberg and Wulf, 2017). In family firms, non-family managers bring professional knowledge and management experience to the firm. As professional personnel who are selected from the competitive human resource pool, these non-family managers are likely to be achievement-oriented, compensation-sensitive, and power-seeking (Hiebl and Li, 2020). These similar attributes led them highly competitive with each other and made them particularly prone to make social comparisons (Tariq et al., 2021). Compensation, as an initial symbol of a manager's human capital value and social status (Main et al., 1993), has naturally become an important object of social comparison. Non-family managers are likely to engage in social comparisons to compare their compensation to judge whether they are being treated fairly. If they receive far less compensation than their fellows, in other words, the pay dispersion is large, this will lead to a feeling of inequity. The assessment of inequity can lead to a feeling of injustice and jealousy, which in turn may reduce team cohesion and decrease job satisfaction (Collischon and Eberl, 2020), and even lower firm performance (Patel et al., 2018; Zhang et al., 2020). Conversely, if managers get relatively equal compensation with others, these managers may generate a perception of fair treatment, which in turn improves team collaboration and firm performance. Consequently, the comparative attributes of non-family managers have made social comparison theory beneficial in explaining executive pay dispersion issues. Most recent research on social comparison and pay dispersion focuses on how pay dispersion affects firm behavior, however, our work tries to adopt a social comparison perspective to investigate factors that could influence non-family managers' pay dispersion in Chinese family firms.

Managerial Pay Dispersion

According to Siegel and Hambrick (2005)'s work, managerial pay dispersion falls into two categories: vertical pay dispersion and horizontal pay dispersion. Vertical pay dispersion refers to the pay gap between different executive hierarchical levels, like the compensation differences between CEO and vice managers. Horizontal pay dispersion refers to the pay differences among managers within the same hierarchical level, like the compensation differences among all vice managers. In this study, we paid close attention to the group of non-family managers in family firms and focused on vertical pay dispersion between CEO and non-family managers.

By establishing a general view of managerial pay dispersion research, studies on how managerial pay dispersion influences firm behavior such as firm performance (Jaskiewicz et al., 2017; Patel et al., 2018; Zhang et al., 2020), executive turnover (Ridge et al., 2017), and firm innovation (Yanadori and Cui, 2013; Amore and Failla, 2020) have been well researched. For firm performance, Jaskiewicz et al. (2017) investigated this issue in family firms and found that pay dispersion among non-CEO top management team members could harm firm performance. For firm innovation research, Amore and Failla (2020) state that the variable pay dispersion leads to higher innovation. On the other hand, the larger dispersion in fixed pay leads to lower innovation. For managerial turnover research, Kacperczyk and Balachandran (2018) gave us a reference that vertical and horizontal pay dispersion led to different answers, that is, the horizontal wage comparisons could increase cross-firm turnover because these managers induce inequity concerns, but vertical wage comparisons could decrease the turnover across firms because they enhance self-motivation.

Given the fact that managerial pay dispersion can influence firm behavior, then a logical next question occurs: are there any antecedent factors that could affect the level of pay dispersion? Establishing a general view on the influencing factors of pay dispersion, since executive compensation is mostly determined by the board of directors, most researches have tried to explore the influencing factors based on the board of directors, such as board seat (Fredrickson et al., 2010) and ownership (Connelly et al., 2016; Keppeler and Papenfuß, 2021). Fredrickson et al. (2010) found that there was even an inversed *U* shape relationship between the proportion of top managers team who are also board members and the level of pay dispersion. Keppeler and Papenfuß (2021) stated that the ownership publicness could affect vertical pay dispersion, and the relationship was moderated by firm size. There are also researches examining how managerial attributes influence pay dispersion, such as managerial political ideologies (Chin and Semadeni, 2017) and morale effects (Breza et al., 2018). Chin and Semadeni (2017) indicate that CEOs' liberal ideologies could reduce pay dispersion both among non-CEO managers and between CEO and non-CEO managers. However, recent research has ignored one of

the most basic characteristics of CEOs in family firms—CEO identity. The appointment of a family or non-family CEO could alter holding families' propensity to make decisions in firm governance and operation. To address this, we adopt a social comparison perspective to investigate how CEO identity influences managerial pay dispersion in Chinese family firms.

HYPOTHESES DEVELOPMENT

Our research focus is to understand the relationship between CEO identity and non-family managers' pay dispersion, and the moderating effect of CEO tenure and institutional environment. **Figure 1** is the theoretical framework of this research.

Effects of CEO Identity on Non-family Managers' Pay Dispersion

Social comparison theory argues that individuals commonly compare themselves to those with attributes in common, such as status, demographic characteristics, opinions, or ability (Gerber et al., 2018). In family firms, when the CEO is a family member, they would have grown up in the firm and been influenced by the surroundings of the firm and family. These family CEOs have experience and knowledge that are specific to the firm, and their history within the firm increases their understanding of the firm (Bach and Serrano-Velarde, 2015). As family members, these family CEOs could easily get firm ownership and management rights, so they are not only the owners of the firm but also the business operators who can gain management power (Kelleci et al., 2019). In contrast, non-family managers in family firms are treated as outside professional managers, and it is difficult for them to achieve the same level of power and resources compared to family CEOs get, which creates a "power distance" between family CEOs and non-family managers (Vandekerkhof et al., 2019). As "outsiders" of the firm, these non-family managers will recognize the inaccessibility of the "power distance," so they choose to accept it, and lower their tendency to compare themselves with these family CEOs. However, with the development of the firm, an increasing number of family firms are recruiting non-family members to serve as CEOs (Fang et al., 2021). When non-family members hold the CEO position, both the CEO and non-family managers are professional personnel from the outside human resource market. Even if non-family managers served as CEOs, they couldn't get as much ownership as family CEOs due to the necessity for family control. As "outsiders" of the firm, these non-family CEOs and non-family managers have relatively similar social status and power in family firms. According to social comparison theory, the equal social status and power render non-family managers prone to compare with other non-family managers, including non-family CEOs (Lazear and Rosen, 1981). When these non-family managers recognize that they have similar status and power as these non-family CEOs, it is natural for them to compare themselves with these non-family CEOs in all aspects, including compensation. They are particularly concerned with their compensation level as well as comparing that of non-family CEOs to determine whether they get fair treatment, and a large pay dispersion is likely to create a feeling of injustice and jealousy (Collischon and Eberl, 2020).

Although CEOs could not determine the compensation arrangement of the top management teams directly, as the implementer of the firm strategies they will still have an influence on such matters. In this way, to maintain the overall harmony and working enthusiasm of the top management teams, these non-family CEOs will advise the board of directors or the compensation committee to try to reduce the pay dispersion between the CEO and other non-family managers. As a result, to retain the human capital and social capital of these non-family managers, and by considering their calls for fairness, the board of directors or the compensation committee will also choose to set a fairer compensation structure to reduce the pay dispersion between the CEO and the non-family managers as much as possible. Hence, we put forward Hypothesis 1.

Hypothesis 1: The presence of a non-family CEO is negatively associated with the pay dispersion between CEO and non-family managers.

The Relationship Between CEO Identity and Pay Dispersion With the Moderating Effect of CEO Tenure

Tenure is an important manifestation of the ability and experience of executives (Chen et al., 2019). Long-tenure CEOs have a higher likelihood of accumulating a large amount of tacit knowledge and possess a deep understanding of the firm's current situation and future development, which is beneficial to obtaining competitive advantage (Pittino et al., 2018). Considering family firms, the presence of long-tenure non-family CEOs shows that they possess idiosyncratic knowledge that is compatible with family firms' traits. They are more likely to invest a considerable amount of energy and time in reaching the required balance between the firm and family objectives and to share the same goals that these family firms are pursuing (Blumentritt et al., 2007). In addition, the long-tenure of a non-family CEO shows that their capability or human capital has been recognized by the holding family, which in turn shows increased trust from the family. In this way, the long-tenure non-family CEOs are more likely to obtain higher psychological ownership in family firms (Jiang et al., 2019). Under this circumstance, the non-family managers will recognize the value generated by these long-tenure CEOs, accept their contribution to the firm, and experience a feeling of admiration at the same time.

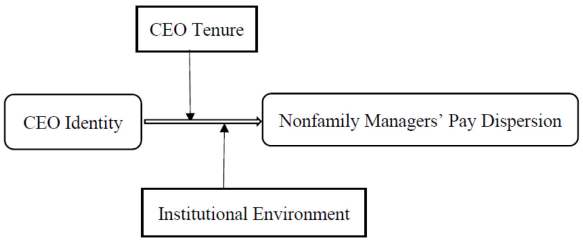

FIGURE 1 | The theoretical model.

Furthermore, as long-tenure CEOs gain increased trust from the holding family, it is possible for them to get increased decision-making power at the same time (Phan, 1991). In addition, long-tenure CEOs usually possess higher voting shares, which contribute to their increased power on the board of directors (Darouichi et al., 2021). In this case, a long-tenure CEO possesses increased psychological ownership and higher decision-making power, which further causing a "power distance" between a long-tenure non-family CEO and other non-family managers. The "power distance" allows non-family managers to recognize the difference in ability and power between that of the long-tenure non-family CEOs, and at the same time accept the "power distance" due to the difference in decision-making power and psychological ownership, which could lead to a decreased tendency for social comparison. Even if the long-tenure non-family CEOs receive higher compensation than other non-family managers, these non-family managers will not generate a strong sense of unfairness, which means the pay dispersion between the two parties will not affect the perception of fairness. As a result, these arguments suggest that the presence of a long-tenure non-family CEO decreases the likelihood of social comparisons between the CEO and non-family managers, and even if there is a large pay dispersion between them, these non-family managers will not have strong feelings of inequity. Hence, we put forward Hypothesis 2.

Hypothesis 2: CEO tenure moderates the relationship between CEO identity and pay dispersion, such that the hypothesized negative effect weakens as CEO tenure increases.

The Relationship Between CEO Identity and Pay Dispersion With the Moderating Effect of Institutional Environment

Williamson (2000) contended that the institutional environment is of great significance to organizational structure and behavior, and the maturity of the institutional environment provided policy support for firms' sustainable development. Factors of the institutional environment include formal law systems, the financial market, and government policies are closely related to business operations. In the emerging market like China, due to the differences in resource endowment, geographical location, and regional policies in different regions, the maturity of institutional environments varies greatly even within a country. In China, the marketization level can reflect the maturity of an institutional environment (Wang et al., 2018). Even if government policies and laws are much the same across the country, the difference in institutional efficiency across regions has led to differences in corporate tax rates and resource expenditure (Greer and Doellgast, 2017). The imbalance in regional development also leads to the imbalance in marketization level.

A higher level of marketization creates a market environment that emphasizes formal contracts, rules, and firm efficiency, but not relational exchanges (Banalieva et al., 2015). With the improvement of the marketization process, formal laws, norms, and regulations have gradually become the source of institutional legitimacy for family firms' survival and development. In regions with higher marketization levels, attracting external human capital and corporate investment (venture capital, strategic investors, etc.) will be more dependent on the standardization of corporate governance structure rather than simply on interpersonal networks (Xie, 2017). In areas with higher marketization levels, enterprises prefer to exhibit relatively better endowment of human capital, generate innovation and environmental protection, expand the recruiting of competent personnel and adopt a performance-based compensation system (Bin et al., 2020), which focuses managers more on their ability, as opposed to just comparing compensation. Numerous studies have shown that, in family firms, non-family managers have higher pay-performance sensitivity, which means that compensation for non-family managers is always set according to their performance (Michiels et al., 2013). In this situation, in areas with higher marketization levels, non-family managers' compensation is always set based on their contribution and output to the firm, rather than blindly comparing their compensation level with others. The explicit performance-oriented compensation system enables non-family managers to focus more on their personal ability and performance, which naturally affects managers' sense of fairness. At this time, even though non-family CEOs receive higher compensation due to their higher value of human capital, which may generate a large pay dispersion compared with other non-family managers, these non-family managers will accept the pay dispersion, and the tendency to compare compensations with each other is so weak that it would not affect the perception of fairness. Consequently, these arguments suggest that the social comparison tendency between the CEO and non-family managers will decrease as the institution environment matures, and even if there is a large pay dispersion between them, these non-family managers will not have strong feelings of inequity. Hence, we put forward Hypothesis 3.

*Hypothesis 3: Institutional environment moderates the relationship between CEO identity and pay dispersion, such that the hypothesized negative effect weakens as the institutional environment m*atures.

METHODOLOGY

The Model

We would like to test how CEO identity affects the pay dispersion between CEO and non-family managers, and the moderating effect of CEO tenure and institutional environment. The models were set as follows:

$$Pay\ Gap_{it} = \beta_0 + \beta_1 NonFamCEO_{it} + \beta_2 C_{it} + \beta_3 Year_{it} + \beta_4 Industry_{it} + \varepsilon_{it} \quad (1)$$

$$Pay\ Gap_{it} = \beta_0 + \beta_1 NonFamCEO_{it} + \beta_2 Tenure_{it} + \beta_3 NonFamCEO_{it} \times Tenure_{it} + \beta_4 C_{it} + \beta_5 Year_{it} + \beta_6 Industry_{it} + \varepsilon_{it} \quad (2)$$

$$Pay\ Gap_{it} = \beta_0 + \beta_1 NonFamCEO_{it} + \beta_2 Market_{it} + \beta_3 NonFamCEO_{it} \times Market_{it} + \beta_4 C_{it} + \beta_5 Year_{it} + \beta_6 Industry_{it} + \varepsilon_{it} \quad (3)$$

In Eq. (1), where Pay Gap_{it} indicates the dependent variable, is the pay dispersion between CEO and non-family managers; $NonFamCEO_{it}$ is the independent variable, which indicates the family or non-family identity of the CEO; C_{it} represents a set of control variables, including financial factors, managers' background, firm size, firm age, etc.; $Year_{it}$ and $Industry_{it}$ indicate the dummy variables representing year and industry, respectively; and ε_{it} is the random interference item. In Eq. (2), we added the interaction term of CEO identity and CEO tenure to test the moderating effect of CEO tenure on the relationship between CEO identity and pay dispersion. Similarly, Eq. (3) added the interaction term of CEO identity and institutional environment to test the moderating effect of institutional environment on the relationship between CEO identity and pay dispersion.

Data Sources and Variable Selection

The empirical data used in this study were derived from Chinese family firms listed on Shenzhen and Shanghai stock exchanges between 2009 and 2015. For data sources, we relied on the major dataset of China Stock Market and Accounting Research (CSMAR). The companies' annual reports were also recorded to collect data on the identified firms. Data including managers' identity, compensation, and some control variables like ROA (return on asset), financial leverage, etc. were obtained from the CSMAR database. The firms' annual reports were collected from the official websites of Shenzhen and Shanghai stock exchanges. The annual reports could provide managers' background information. The sample firms are all family firms. For the selection criteria of family firms, we adopted a threshold of 20% firm ownership by the family, as recommended by La Porta et al. (1999). Another criterion is that at least one family member, including persons related by blood connection or by marriage to the holding family, served as directors, shareholders, or managers (Anderson and Reeb, 2003). To ensure the reliability of the data, we excluded firms whose primary industry was financial services, because financial firms have different financial statement structures. Most of these firms have extraordinary debt ratios, which could lead to biased regression results.

Our dataset is an unbalanced panel data, for the following reasons. First, there were some samples in which managers were not paid by the firm or managers' compensation information was not disclosed. To prevent missing values in the dataset, we excluded these samples at certain years. Second, we excluded samples in which the firms were sold, went bankrupt, or whose controller changed during our sample period, but still reserved these sample firms before they are sold or went bankrupt. Third, since our purpose is to examine the pay dispersion under social comparison theory, we suppose that a CEO could get more compensation than other managers, which means that the CEO's compensation will be equal to or higher than non-family managers' compensation, so we excluded samples in which the CEO got less compensation than non-family managers. For these reasons, we had an unbalanced panel including 255 firms representing 1,330 firm-year observations between 2009 and 2015.

However, variables like CEO and other managers' family or non-family identity, and their baseline information like education background, age, compensation level, etc. could not be obtained directly from the database, so we manually distinguished and calculated these variables. The distinguishing and calculation process of the variables were as follows: first, to determine CEO identity, we downloaded the managers' resumes from the CSMAR database, then searched their names online to determine whether they had a familial relationship with the holding family. If there was a familial relationship, we coded them as family CEOs, and others are coded as non-family CEOs. Second, besides CEO identity, we also distinguished other managers' family or non-family identity in the same way and counted the number of non-family managers in the top management teams. Third, after calculating the number of non-family managers, we collected information on these managers' age, education, and compensation, and calculated the pay dispersion between CEOs and non-family managers.

Independent Variable

CEO identity is the independent variable. According to Kelleci et al. (2019), CEO identity is a dummy variable that is distinguished by a non-family member holding a CEO position (value = 1) from a family member holding a CEO position (value = 0). Since CEO's family or non-family identity could not be determined directly from the database, we manually distinguished the variable by seeking CEO resumes from the annual reports and by searching CEOs' names online to determine whether they had a familial relationship with the holding family.

Dependent Variable

Pay dispersion, which represents the compensation gap between CEO and non-family managers, was the dependent variable. Pay dispersion (Pay Gap) was measured by a CEO's cash compensation divided by the average cash compensation of all non-family managers (Siegel and Hambrick, 2005). These non-family managers were designated as second-level executives. In most cases, we assume that CEO would get more compensation than other second-level managers, so the pay dispersion is usually greater than 1 (value $\geq$ 1). The greater the value, the larger the pay dispersion between CEO and non-family managers (Siegel and Hambrick, 2005). There was another measurement of pay dispersion (Pay Gap 2), which was measured by the logarithmic value of a CEO's compensation minus the average compensation of all non-family managers. The second measure was used in the robustness test.

Moderators

Two variables were utilized as moderators. The first was CEO tenure. According to the research of Chen et al. (2019), CEO tenure is defined as the number of years since the CEO took office. We searched for information about the year in which the manager

took the position of CEO, and the variable was calculated by the current year minus the year when the manager took the position of CEO.

The second moderator was the institutional environment. The marketization level can represent the maturity of the institutional environment in China (Ruan et al., 2019). In our work, we used the "marketization index of China's provinces" presented by Chinese economists Xiaolu Wang et al. (2018) to represent the maturity of the institutional environment in different regions. Since the policy of reform and opening-up began in 1978, the marketization level in China has been continuously increasing. However, the unbalanced regional economic development in China has led to wide differences in marketization levels in various regions. Wang, Fan, and their team have compiled a series of indices to represent different marketization levels for different provinces in China. The following five factors are used to calculate the marketization level: the relationship between government and market, the development of the non-state sector, the development of the product market, banking sector marketization, and the development of the legal environment (Wang et al., 2018). The index not only calculates the regional institutional development level of each province horizontally but also provides a series of indices annually to obtain a relatively complete set of panel data to measure the marketization process in different years and regions.

Control Variables

Consistent with the previous study (Jaskiewicz et al., 2017), we controlled for several possible determinants of pay dispersion. These variables fell into three categories: firm characteristics, managerial attributes, and corporate governance characteristics. For firm characteristics, we controlled for firm age, firm size, and firm performance. We defined firm size as the logarithm of total sales in the current year because managers in larger firms have a greater job variety than in smaller firms, which may result in different compensation levels among managers with different job classifications. Firm age is defined as the number of years since the firm was founded. Past firm performance was also controlled using the return on assets of the previous year because managers' compensation is closely correlated with firm performance (Fredrickson et al., 2010). We controlled for ROA of the previous year ($year_{t-1}$) because managers' compensation is always set based on firm performance of the previous year, rather than the current year. The financial leverage ratio, which is used as a measure of financial risk, was also controlled.

For the variables of managerial attributes, the traits of CEO and non-family managers may influence the level of pay dispersion (Fredrickson et al., 2010). First, we controlled for CEO age, average non-family managers' age, CEO education, and average non-family managers' education. These demographic factors could have an impact on executive compensation. Managers' stockholdings are also a determinant of their compensation level, so we also controlled for CEO's shareholding and non-family managers' shareholding. Furthermore, we controlled for CEO duality. CEO duality took a value of "1" when the CEO holds the position of chairman of the board simultaneously.

Lastly, managerial pay dispersion is also likely to be affected by corporate governance characteristics. Thus, since the board of directors has the authority to determine managers' compensation level, the board characteristics could affect the pay dispersion to some extent. In this way, we controlled for the size of the board and independent directors. Board size was measured by the number of board members. Independent directors were measured by the proportion of independent directors in the board of directors, which reflects board effectiveness.

In addition, we controlled for the industry using a dummy variable representing manufacturing sectors and other sectors, because there are a large proportion of Chinese family firms engaged in manufacturing sectors. Firms in manufacturing sectors were coded as "1" for each variable, and firms in other industries were coded as "0". In addition, a series of dummy variables were used to measure the year in which the data were collected (2009 to 2015) to control for the possibility of periodic fluctuations. The variable summary is listed in **Table 1**.

EMPIRICAL RESULTS

Descriptive Statistics of the Variables

Table 2 presents the descriptive statistics of the variables. The average pay dispersion between the CEO and non-family managers was 1.811 with a maximum value of 12.05, indicating that the pay dispersion exists between CEO and non-family managers. For CEO identity, the value was 0.547, indicating that 54.7% of CEOs in the sample were non-family members. The average age of family firms in our sample was 16.73 years. Additionally, the average value of CEO tenure was 6.799, with a maximum value of 28. The mean value of CEO education and non-family managers' education were 3.238 and 3.052, respectively, which indicated that CEOs had higher education levels than non-family managers.

Correlation Analysis

The correlation matrix of variables is listed in **Table 3**. As indicated in the table, the correlation coefficient between CEO identity and pay dispersion is negatively significant ($\beta = -0.101$, $p < 0.05$). The data showed that the presence of a non-family CEO was negatively related to the pay dispersion between the CEO and non-family managers, which is consistent with Hypothesis 1. Combining the correlations among all these variables, we found that the correlation coefficients between independent variables and most control variables were small. VIF (variance inflation factor) could be an indicator of multicollinearity. VIF values higher than 10 indicate that these variables suffer from multicollinearity, and VIF values lower than 10 indicate that multicollinearity is not significant within these variables. In our model, the VIF values were all less than 1.8, indicating that multicollinearity is not a significant problem in our research.

Hypotheses Tests

In this study, STATA13.0 was used for data processing to test the hypotheses. Due to the multi-level nature of our

TABLE 1 | Variables summary.

Category	Variables	Symbol	Measure
Dependent variable	Non-family managers' pay dispersion	Pay gap	Pay gap = CEO's cash compensation/non-family managers' average cash compensation.
Independent variable	CEO identity	Nonfam CEO	A binary variable; non-family members hold CEO position are coded as 1, otherwise 0.
Moderators	CEO tenure	Tenure	The number of years since CEO took office.
	Institutional environment	Market	The marketization index of China's provinces presented by Wang et al. (2018)
Control variables	Firm age	Firm age	The number of years since the family firm was established.
	Firm size	Firm size	The natural logarithm of total sales at the end of each year.
	Firm performance	ROA	Return on asset of the previous year.
	Financial leverage ratio	Leverage	Financial leverage of the previous year.
	BETA	Beta	Beta at the end of the year.
	CEO age	CEO age	CEO's age in the current year.
	Non-family managers' age	TMT age	Average non-family managers' age.
	Non-family managers' education background	CEO edu	1 = Middle school; 2 = Junior college; 3 = Bachelor degree; 4 = Master degree; 5 = PhD.
	CEO's education background	TMT edu	1 = Middle school; 2 = Junior college; 3 = Bachelor degree; 4 = Master degree; 5 = PhD.
	CEO's shareholding	CEO share	Shareholding ratio of the CEO.
	Non-family manager's shareholding	TMT share	Average shareholding ratio of non-family managers.
	CEO duality	CEO duality	A binary variable, coded 1 if the CEO also served as the chairman of the board of directors, otherwise 0.
	Board size	Board	The natural logarithm of number of board members.
	Independent directors ratio	Independent	The percentage of independent directors in the board of directors.
	Year	Year	Dummy variables, the sample spans from 2009 to 2015 (7 years), so we have 6 dummy variables of each year.
	Industry	Industry	A binary variable: firms from manufacturing sectors are coded 1, otherwise 0.

theoretical model and data, the hypotheses were tested with the random-effects model. According to the previous family firm research (Cruz et al., 2014), the random-effects model is widely used in the researches on family firm corporate governance, because this method can reduce heteroscedasticity. Before estimating our model, the Hausman test was performed, and the result supported that of the random-effects model. Furthermore, to ensure the model's consistency and validity, the data was processed as follows. First, to avoid the impact of outliers, Winsorize was applied at a 1% level for all continuous variables. Second, variables in the interaction items were centralized to avoid the influence of multicollinearity.

TABLE 2 | Descriptive statistics.

Variables	Obs	Mean	Std. Dev.	Min	Max
Pay gap	1,330	1.811	0.863	1.007	12.05
NonfamCEO	1,330	0.547	0.498	0	1
Market	1,330	7.974	1.485	−0.300	9.950
Tenure	1,330	6.799	5.336	1	28
Firm size	1,330	7.529	1.118	2.565	11.29
Firm age	1,330	16.73	7.463	3	63
ROA	1,330	0.0497	0.0592	−0.507	0.399
Leverage	1,330	3.170	7.300	0.079	132.0
Beta	1,330	1.035	0.199	0.191	1.743
CEO age	1,330	48.72	6.379	28	73
CEO edu	1,330	3.238	0.954	1	5
CEO duality	1,330	0.332	0.471	0	1
CEO share	1,330	0.081	0.148	0	0.691
TMT age	1,330	44.49	4.027	33.33	63
TMT edu	1,330	3.052	0.524	1.400	4.333
TMT share	1,330	0.011	0.0293	0	0.300
Board	1,330	2.123	0.169	1.386	2.708
Independent	1,330	0.371	0.053	0.200	0.667

The regression results were shown in **Table 4**. In the first step, as a base model, only the moderator and control variables were included in Model 1. The results showed that the attributes of CEOs and non-family managers, such as their age and education, exerted significant effects on pay dispersion. The coefficients of CEO age ($\beta = 0.015$, $p < 0.01$) and CEO education ($\beta = 0.144$, $p < 0.01$) were significantly positive, which indicated that the presence of an older and higher educated CEO could lead to a higher level of pay dispersion between the CEO and non-family managers. Conversely, the coefficients of non-family managers' age ($\beta = -0.017$, $p < 0.05$) and education ($\beta = -0.205$, $p < 0.01$) were significantly negative. The results showed that the presence of older and higher educated non-family managers is negatively related the pay dispersion. In step two, CEO identity (Nonfam CEO) was added as the independent variable in Model 2. After controlling for all these control variables, a CEO's non-family identity is negatively related to the pay dispersion between the CEO and non-family managers ($\beta = -0.255$, $p < 0.01$), which suggested that the presence of a non-family CEO will decrease the pay dispersion

TABLE 3 | Correlation analysis (*$P < 0.1$, **$P < 0.05$, and ***$P < 0.01$).

Variables	1	2	3	4	5	6	7	8	9
1. Pay gap	1								
2. NonfamCEO	−0.101**	1							
3. Market	−0.034	−0.038	1						
4. Tenure	−0.055**	−0.398*	0.034	1					
5. Firm size	−0.035	0.007	−0.024	0.028	1				
6. Firm age	−0.043	0.053*	0.026	0.038	0.038	1			
7. ROA	−0.012	−0.001	−0.101***	0.019	0.191***	−0.059**	1		
8. Leverage	−0.013	0.001	0.061**	0.046	0.015	0.025	−0.161***	1	
9. Beta	−0.011	0.021	0.129***	0.018	−0.119***	0.029	−0.175***	0.048*	1
10. CEO age	0.074***	−0.097***	−0.095***	0.272***	−0.021	0.113***	0.038	0.063**	−0.019
11. CEO edu	0.027	−0.017	0.057**	0.086***	0.055*	−0.084***	0.056*	−0.054*	−0.007
12. CEO duality	0.067**	−0.528***	−0.004	0.298***	−0.082***	0.007	−0.055*	0.018	0.057**
13. CEO share	0.029	−0.443***	0.039	0.306***	−0.089***	−0.055*	0.048	−0.057**	0.052*
14. TMT age	−0.036	0.104***	−0.019	0.057**	0.086***	0.117***	0.052*	−0.015	−0.059**
15. TMT edu	−0.074***	0.039	−0.083***	0.055**	0.071**	0.036	0.028	−0.008	−0.027
16. TMT share	−0.087***	−0.072**	−0.096***	0.147***	−0.001	0.083***	0.081***	−0.048*	0.084***
17. Board	−0.051*	−0.137***	0.123***	0.358***	0.133***	0.115***	0.011	0.029	0.039
18. Independent	0.007	−0.131***	−0.006	0.165***	−0.008	0.029	0.019	−0.011	0.002
	10	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
10. CEO age	1								
11. CEO edu	−0.179***	1							
12. CEO duality	0.204***	−0.046*	1						
13. CEO share	0.098***	−0.042	0.514***	1					
14. TMT age	0.115***	−0.0078	−0.009	−0.018	1				
15. TMT Edu	0.021	0.260***	0.042	−0.039	−0.076**	1			
16. TMT share	0.027	−0.042	0.043	0.192**	−0.053	−0.008	1		
17. Board	0.095***	0.036	0.013	0.115**	−0.068**	0.133**	0.009	1	
18. Independent	0.092***	0.019	0.226**	0.215**	0.033	0.103**	−0.079**	0.070**	1

between the CEO and non-family managers, and thus Hypothesis 1 was supported.

Two moderators (CEO tenure and institutional environment) were entered in step three (**Table 4**, Models 3 and 4). Models 3 and 4 tested Hypothesis 2 and Hypothesis 3, respectively. The interaction terms between the independent variable and moderators were also included in this step. In Model 3, the interaction term of CEO identity and CEO tenure (NonfamCEO × Tenure) was added. The results showed that the coefficient of this interaction term was positively significant ($\beta = 0.030$, $p < 0.05$), which suggested that CEO tenure can moderate the relationship between CEO identity and pay dispersion, and the hypothesized negative effect weakens as CEO tenure increases. Hypothesis 2 was established. The interaction item of CEO identity and institutional environment (NonfamCEO × Market) was added into Model 4, and the coefficient of CEO identity and institutional environment was positive and significant ($\beta = 0.096$, $p < 0.05$). This result indicated that the institutional environment negatively moderated the relationship between CEO identity and pay dispersion, and the hypothesized negative effect weakens as the institutional environment matures, so Hypothesis 3 was also established. Furthermore, Model 5 is the full model, which means that the independent variable, two moderators, and all the control variables were included in this model. The results in Model 5 showed that all the hypotheses were supported.

To further facilitate the interpretation of the moderating mechanism, we plotted the moderating effects of CEO tenure and institutional environment in **Figures 2**, **3**. As shown in **Figure 2**, the downward slope became much gentler when the CEO has longer tenure, which is consistent with Hypothesis 2. In support of Hypothesis 3, **Figure 3** shows that the downward slope became much gentler when the marketization level is higher, which is also consistent with Hypothesis 3.

ROBUSTNESS TESTS

We performed several additional tests to ensure the robustness of our results. First, we changed the measurement of the independent variable. The presence of a non-family CEO could reflect family firms attaching more importance to professionalization. In the robustness test, we use the percentage of non-family managers in top management teams to substitute the previous independent variable (Fang et al., 2021), because the percentage of non-family managers can also represent a

TABLE 4 | Regression model results.

Variables	Pay Gap				
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
NonfamCEO		−0.255*** [0.086]	−0.210** [0.088]	−1.025*** [0.359]	−0.969*** [0.359]
NonfamCEO × Tenure			0.030** [0.015]		0.030** [0.015]
NonfamCEO × Market				0.096** [0.044]	0.095** [0.043]
Market	0.003 [0.028]	−0.002 [0.027]	−0.000 [0.027]	−0.068* [0.041]	−0.066 [0.041]
Tenure	−0.017** [0.008]	−0.024*** [0.008]	−0.036*** [0.010]	−0.023*** [0.008]	−0.035*** [0.010]
Firm age	0.000 [0.006]	0.001 [0.006]	0.001 [0.006]	−0.000 [0.006]	0.000 [0.006]
Firm size	0.026 [0.035]	0.019 [0.035]	0.018 [0.034]	0.017 [0.034]	0.016 [0.034]
ROA	−0.459 [0.461]	−0.487 [0.460]	−0.497 [0.459]	−0.525 [0.459]	−0.534 [0.458]
Leverage	−0.017 [0.022]	−0.016 [0.022]	−0.013 [0.022]	−0.013 [0.022]	−0.010 [0.022]
Beta	−0.022 [0.132]	−0.015 [0.132]	−0.002 [0.132]	−0.009 [0.131]	0.004 [0.131]
CEO age	0.015*** [0.005]	0.016*** [0.005]	0.015*** [0.005]	0.016*** [0.005]	0.015*** [0.005]
CEO edu	0.144*** [0.038]	0.139*** [0.038]	0.143*** [0.038]	0.138*** [0.038]	0.143*** [0.038]
CEO share	0.001 [0.003]	0.000 [0.003]	0.001 [0.003]	0.000 [0.003]	0.001 [0.003]
CEO duality	0.196** [0.082]	0.096 [0.088]	0.112 [0.089]	0.096 [0.088]	0.112 [0.088]
TMT age	−0.017** [0.008]	−0.015* [0.008]	−0.016** [0.008]	−0.014* [0.008]	−0.016* [0.008]
TMT edu	−0.205*** [0.070]	−0.185*** [0.070]	−0.182*** [0.070]	−0.177** [0.070]	−0.174** [0.070]
TMT share	−1.854 [1.349]	−1.763 [1.343]	−1.933 [1.344]	−1.851 [1.341]	−2.018 [1.342]
Board	0.004 [0.006]	0.004 [0.006]	0.006 [0.006]	0.005 [0.006]	0.006 [0.006]
Independent	0.528 [0.621]	0.579 [0.618]	0.665 [0.619]	0.525 [0.618]	0.610 [0.618]
Industry	Control	Control	Control	Control	Control
Year	Control	Control	Control	Control	Control
_cons	1.591** [0.664]	1.693** [0.662]	1.762*** [0.662]	2.227*** [0.703]	2.287*** [0.703]
Wald χ^2	50.33	59.51	64.00	64.64	69.00
N	1,330	1,330	1,330	1,330	1,330

*$p < 0.1$; **$p < 0.05$; and ***$p < 0.01$.

concern for professional management in family firms. We ran the main effect and moderating effects again to show the robustness of the new independent variable, and the overall results were listed in **Table 5**. Compared with the results in **Table 4**, the statistical results in **Table 5** were not remarkably different. To simplify the results, control variables were not listed in **Table 5**. In the first step, only the moderators and control variables were included in Model 1. In step two, the percentage of non-family managers (NonfamTMT Rate) was added as the independent variable in Model 2. The main effect of non-family managers' percentage and pay dispersion was negatively significant (β = −0.867, $p < 0.01$). Similar to **Table 4**, two interaction variables were added to the model (Models 3 and 4, **Table 5**). In Model 3, the interaction of non-family managers' percentage and CEO tenure (NonfamTMTRate × Tenure) was positive and significant (β = 0.080, $p < 0.05$). In Model 4, the interaction of non-family managers' percentage and institutional environment (NonfamTMTRate × Market) was also positive and significant (β = 0.509, $p < 0.01$). Model 5 is included all the independent variables, moderators, and control variables, and the results in **Table 5** are also significant.

Second, we changed the measurement of the dependent variable. We used another measurement of pay dispersion between CEO and non-family managers as the new dependent variable (Pay Gap 2), which is measured by the logarithmic value of a CEO's cash compensation minus the average cash compensation of all non-family managers [In (CEO compensation – the average compensation of non-family managers)]. The results were shown in **Table 6**. In Model 1, only moderators and control variables were added. Model 2 examined the main effect, which was significantly negative (β = −0.205, $p < 0.05$), which means Hypothesis 1 was also supported. Similar to **Table 4**, the interaction term of CEO identity and CEO tenure was added in the model (Model 3, **Table 6**), and the results are significantly positive (β = 0.030, $p < 0.05$). In Model 4, the interaction term of CEO identity and institutional environment was also significantly positive (β = 0.079, $p < 0.1$). Compared with the results in **Table 4**, the results shown in **Table 6** did not show a remarkable difference. In all cases, we obtained results that were consistent with the main results reported above, and show that our conclusions are robust.

DISCUSSION

In family firms, the similarity in social status and competence have naturally lead to non-family managers making social comparisons between themselves and their counterparts. Compensation, as an initial symbol of a manager's human capital value and social status (Main et al., 1993), has become an important object of social comparison. Non-family managers are likely to engage in social comparisons to compare their compensation with other managers to judge whether they get fair treatment (Collischon and Eberl, 2020). Hence, the fairness of compensation structure has been a prominent focus for non-family managers, and factors that could influence the pay dispersion have also attracted the attention of scholars. Family firms have either a family CEO or a non-family CEO, and their different characteristics alter non-family managers' tendencies of social comparison. Despite being a basic and important corporate governance form in family firms, the effect of CEO identity has not received sufficient attention. Therefore, our work adopts a social comparison perspective to investigate how CEO identity influences non-family managers' pay dispersion in family firms. In addition, the importance of CEO identity is mainly highlighted by society's perceptions of competence

and environmental informal rules. Our work also adopted CEO tenure and institutional environment as moderators to consider certain competence and environmental factors.

Using data from Chinese listed firms from 2009 to 2015, we hypothesize and find that that the presence of a non-family CEO can reduce the pay dispersion between the CEO and non-family managers. When non-family members held the CEO's position, both the CEO and non-family managers have relatively similar social status and power, which renders non-family managers prone to compare with other non-family managers. To maintain the overall harmony of the top management team, the non-family CEOs will offer suggestions to the board of directors or the compensation committee to try to reduce the pay dispersion. Consequently, having a non-family CEO leads to a decreased level of pay dispersion between the CEO and non-family managers. By considering the moderating effects, since CEO tenure is a manifestation of ability and experience, a more capable CEO will be less likely to emphasize the importance of identity. CEOs with longer tenures are expected to obtain higher decision-making power and psychological ownership (Pittino et al., 2018), which would create a "power distance" between the CEO and non-family managers, and decreases their comparison tendency. In addition, environmental factors like institutional environment should also be considered. The more standardized and mature institutional environment leads to more attention to efficiency and fair competition, which will be less likely to emphasize the importance of CEO identity, thereby decreasing the comparison tendency. The results showed that both CEO tenure and institutional environment could moderate the relationship between CEO identity and pay dispersion, such that the negative effect of CEO identity on managerial pay dispersion weakens when CEO tenure increases and the institutional environment gets mature.

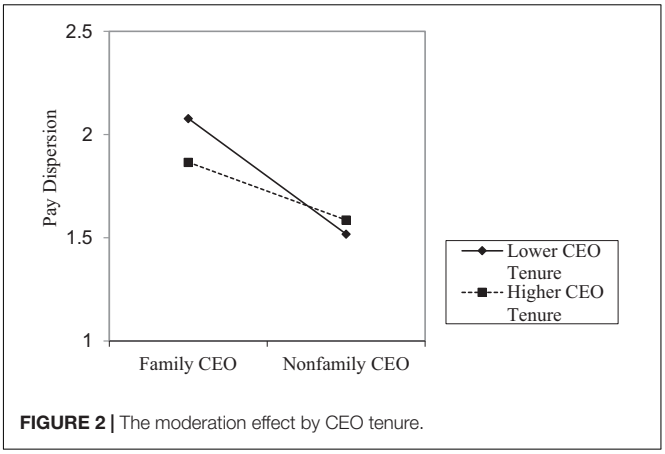

FIGURE 2 | The moderation effect by CEO tenure.

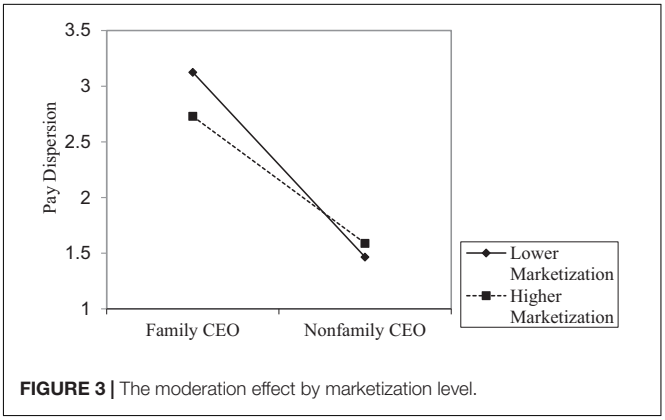

FIGURE 3 | The moderation effect by marketization level.

Theoretical Implications

The current findings provide theoretical implications in three ways. First, our paper extends the recent research on the influencing factors of managerial pay dispersion in family firms and enhances the understanding of pay fairness in top management teams. Though the current research on pay dispersion influencing factors are mostly focused on the board level, our research begins by investigating the basic attributes of the top management teams, and highlighted CEO identity, a basic and important corporate governance form in family firms, as an important influencing factor of non-family managers' pay dispersion. Under the framework of social comparison, our paper explores how CEO identity influences pay dispersion between CEO and non-family managers in family firms. Accordingly, we hypothesize and find that the presence of a non-family CEO can decrease the social comparison tendency between the CEO and non-family managers, and thereby lower the pay dispersion.

Second, in our work, CEO identity is first incorporated into the analytical framework of social comparison theory, which enriches the applicability of social comparison theory. Establishing a general view of the research on pay dispersion and social comparison theory, existing studies have shown that maintaining a reasonably low level of pay dispersion or maintaining pay harmony among top management teams has become a common outcome (Feldman et al., 2018). Even though maintaining pay fairness is of great significance for family firms, under the framework of social comparison theory, the current research does not indicate arrangements on how to maintain pay fairness or reduce pay dispersion. Hence, our paper highlights CEO identity to explore how CEO's family or non-family identity influences the social comparison tendency of managers, and thereby influences pay dispersion. The results show that focusing on CEO identity in family firms could be an effective way to reduce pay dispersion between CEO and non-family managers. Therefore, this paper incorporates CEO identity into the analytical framework of social comparison theory and finds an effective way to deal with the pay dispersion, which enriches the applicability of social comparison theory.

Third, our paper makes an in-depth exploration of social comparison theory and finds some external factors that could affect individuals' social comparison tendency. As a kind of individual subjective psychological feeling, social comparison can also be affected by some external factors, like individual competence and external informal rules. To specifically indicate them, our paper highlights CEO tenure and institutional environment as moderators. At the same time, the importance of CEO identity also depends on society's perception of competence and external informal rules. For competence factor, CEO tenure is an important indicator to identify CEO's competence and

TABLE 5 | Robustness test: Substitute independent variable.

Variables	Pay Gap				
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
NonfamTMT rate		−0.867*** [0.243]	−0.558** [0.232]	−0.588*** [0.229]	−0.517** [0.231]
NonfamTMTRate × Tenure			0.080** [0.039]		0.089** [0.041]
NonfamTMTRate × Market				0.509*** [0.148]	0.529*** [0.148]
Tenure	[−0.017]**	−0.020*** [0.008]	−0.015*** [0.007]	−0.017*** [0.007]	−0.026** [0.026]
Market	−0.003 [0.028]	−0.002 [0.027]	−0.005 [0.026]	−0.026 [0.026]	−0.005 [0.026]
Control variables	Control	Control	Control	Control	Control
_cons	1.591 [0.664]	0.570 [1.121]	0.525 [1.121]	0.588 [1.116]	0.497 [1.117]
Wald χ^2	63.73	63.73	72.82	80.99	86.75
N	1,330	1,330	1,330	1,330	1,330

*$p < 0.1$; **$p < 0.05$; and ***$p < 0.01$.

experience (Chen et al., 2019), and higher competence leads to a reduced emphasis on identity. A more capable CEO will be less likely to emphasize the importance of identity, which will decrease the comparison tendency among non-family managers. Environmental informal factors like institutional environment should also be considered. A more standardized institutional environment led to more attention on efficiency and fair competition, which will be less likely to emphasize CEO identity, thereby decreasing the comparison tendency among managers. Consequently, our paper makes an in-depth exploration of social comparison theory and finds some external factors that could affect the social comparison tendency.

TABLE 6 | Robustness test: Substitute dependent variable.

Variables	Pay Gap 2				
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
NonfamCEO		−0.205** [0.088]	−0.329*** [0.111]	−0.801** [0.356]	−0.879** [0.359]
Nonfam CEO × Tenure			0.030** [0.014]		0.027** [0.014]
Nonfam CEO × Market				0.079* [0.043]	0.070 [0.043]
Tenure	−0.004 [0.008]	−0.004 [0.008]	−0.020** [0.011]	−0.004 [0.008]	−0.015 [0.099]
Market	0.032 [0.031]	0.035 [0.032]	0.034 [0.030]	−0.020 [0.043]	−0.012 [0.043]
Control variables	Control	Control	Control	Control	Control
_cons	5.632*** [1.317]	6.085*** [1.133]	6.149*** [1.298]	6.401*** [1.333]	6.575*** [1.335]
Wald χ^2	98.98	102.58	105.04	98.55	102.33
N	1,330	1,330	1,330	1,330	1,330

*$p < 0.1$; **$p < 0.05$; and ***$p < 0.01$.

Practical Implications

First, recruitment of capable non-family managers is inevitable when family firms pursue a formal management structure and sustainable development. In the context of family firm professionalization, retention and motivation of professional managers are some of the most important issues. The results of this study show that non-family managers are highly sensitive to the fairness of compensation in family firms. Therefore, when designing the compensation mechanism for non-family managers, family firms should not only pay attention to the compensation level but also consider the fairness of the compensation to facilitate the stability of these members.

Second, though the compensation arrangement for the top management teams is generally determined by the board of directors or the compensation committee, our findings consider that CEOs also have the ability and motivation to determine top managers' compensation, which will impact managerial pay dispersion. Therefore, the fairness of compensation among non-family managers should also consider the impact of CEOs when setting the compensation for non-family managers.

Limitations and Future Research

Our study has several limitations that generate opportunities for future research. First, the data on managerial pay dispersion were only related to cash compensation and ignored other compensation forms like stock-based compensation. The reasons are as follows: first, since the phenomenon of managers "holding zero stock" generally exists in China, there are a certain number of missing values of stock-based compensation, which would have an impact on our regression results. Second, to keep family control, family firm owners are reluctant to offer stock-based compensation for non-family managers (Michiels et al., 2013). Third, the fluctuation of stock price will lead to fluctuations in managers' stock-based compensation, which will greatly increase the difficulty of calculating the pay dispersion, and reduce the

accuracy of data. However, since option incentives and dividends are gradually being adopted in managerial incentive systems in Chinese listed firms in these years, we will try to focus on diverse compensation types in future research.

Second, for the moderating effects, we only included factors of CEO tenure and institutional environment, but factors related to family firms' attributes were ignored. The reasons are as follows. Moderating variables are used to highlight or dilute the impact of CEO identity on pay dispersion. However, since CEOs are the core leader of the top management teams, some variables related to family firms like family ownership or second-generation involvement have little influence on the decision-making power exerted by CEO identity, and so has little influence on the relationship between CEO identity and pay dispersion. In addition, the empirical results show that multicollinearity exists between CEO identity and these variables. Hence, our future research will try to explore some other variables related to family firms. These variables could be included not only in the context of family firms but also in the influence of CEO identity and managerial compensation, which remain unexplored.

CONCLUSION

This research is primarily to study how CEO identity influences the pay dispersion between CEO and non-family managers in family firms, and the moderating roles of CEO tenure and institutional environment. The findings of this study contribute to the research on influencing factors of managerial pay dispersion by highlighting CEO identity as an important factor to influence non-family managers' pay dispersion in family firms. Prior studies have considered the influencing factors at the board level, whereas our study considered these effects in one of the basic top management team attributes: CEO identity in family firms. The research also enriches the applicability of social comparison theory by bringing CEO identity into the analytical framework of social comparison theory. The findings also suggest that to retain non-family managers' human and social capital, it is important to focus on fairness when setting compensations structures for these managers. Furthermore, the fairness of compensation should not ignore the role of CEOs. The study also has several limitations that generate opportunities for future research. Due to data availability and accuracy, our paper does not consider stock-based compensation when measuring pay dispersion. Also, some family firms attributes are ignored. Future research should further focus on diverse compensation forms and explore more family firm attributes factors.

DATA AVAILABILITY STATEMENT

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found below: https://www.gtarsc.com/.

AUTHOR CONTRIBUTIONS

WZ: collected and analyzed the data and drafted the manuscript. LC: reviewed the manuscript and revised the manuscript. J-aZ: designed the research protocol and contributed in literature review. All authors have read and agreed to the published version of the manuscript.

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Leaders' Windows of Tolerance for Affect Arousal—and Their Effects on Political Decision-making During COVID-19

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The recent 'affect revolution' in strategic decision-making research has placed greater emphasis on the role of stress and emotions in decision-making, with new theorizing to highlight how leader decisions often differ from rational choice expectations. However, while existing theories add to our understanding of the interplay between affect and cognition, they have not yet explained why affect drives decisions in some situations and not others. Undertheorized connections between leaders' neurobiological windows of tolerance to affect arousal and their self-regulatory capacity—their capacity to regulate stress and emotions so that these phenomena do not drive resulting decisions—may hold the key to explaining this variation in affect's influence on decision-making. Furthermore, this article considers how leaders' windows of tolerance have unique ripple effects in their social environments, thereby affecting their groups' *collective* window of tolerance. While regulated leaders can convey a calming and creative influence in their organizations that helps the group access strategic decision-making, dysregulated leaders are likely to convey stress and emotion contagion—which may erode the group's ability to cooperate, adapt, and learn. It illustrates this argument using evidence from the upper echelons of governmental decision-making, comparing New Zealand Prime Minister Jacinda Ardern's and US President Donald Trump's responses to the coronavirus pandemic in their respective nations. It concludes by offering hypotheses for testing the argument in future empirical research.

Keywords: leaders, emotion, stress, decision-making, self-regulatory capacity, Donald Trump, Jacinda Ardern, COVID-19

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INTRODUCTION

As the coronavirus (COVID-19) pandemic spread across the globe in early 2020, New Zealand Prime Minister Jacinda Ardern turned to scientists. She solicited input from leading experts, worked with her cabinet to forecast New Zealand's future, and communicated directly with the public. In briefings and Facebook Live discussions, Ardern promoted a clear-eyed strategy of strength and kindness, bluntly assessing the threat the virus posed

and introducing the required lockdown measures. Cabinet officials, several opposition leaders, and almost all New Zealanders bought into her approach. Along with her 'team of five million,' Ardern led one of the most successful fights against COVID-19 to date, with just 27 total deaths and an average daily case rate below 20 (World Health Organization, 2021a).

US President Donald Trump took a different approach. He inconsistently called upon and dismissed the advice of experts, rejected the perspectives of anyone deemed disloyal, and used Twitter and press briefings to deliver erratic and impromptu messaging to the US public. His inner circle was plagued by toxic in-fighting, while Americans were confused and distrusting of official guidelines. With more than 663,000 COVID-19 deaths to date, the United States continues to have an average daily case rate of more than 156,000 (World Health Organization, 2021b).

What explains this difference in how these two leaders chose to respond to the shared experience of the COVID-19 pandemic? Certainly, these cases differ in physical context: New Zealand is a small island nation with greater ease for enacting a quarantine, while the more populous United States has many ports of entry and is a hub for international travel. Ardern's and Trump's responses could partially be explained by these differing contexts, as well as by varying political institutions (parliamentary vs. presidential democracy) or individual variables, such as personality traits and gender. Nonetheless, recent advances in the decision-making literature would suggest that affect—including stress arousal, emotions, and moods (Gross, 2015)—should have had equal impact on the two leaders' decision-making, given that they faced the same complex threat. Why did it not? We suggest that at least some of their difference can be attributed to overlooked elements in the decision-making literature: the leaders' neurobiological windows of tolerance to affect arousal and their self-regulatory capacity.

This article proceeds as follows. The first section reviews existing theories about leaders' affect arousal, including its direct effects on their strategic decision-making and its indirect effects on their groups. The second section offers a theory designed to explain the intersection of emotion and stress—and how they together influence both individual and collective decision-making and behavior. We introduce the concept of leaders' neurobiological windows of tolerance for affect arousal and explore how this window can directly affect leaders' capacity to make effective decisions. We also consider how leaders' windows have unique ripple effects in their social environments, thereby indirectly affecting their groups' *collective* window of tolerance. The third section offers a formal illustration of the argument, comparing Ardern's and Trump's responses to the COVID-19 pandemic, to show how leaders' windows can affect their decision-making and their group's collective performance. The final section develops specific hypotheses and offers recommendations for systematically testing this new idea in empirical research.

LEADER AFFECT AROUSAL

Over the last two decades, there has been growing interest in the intersection of emotions and government (e.g., Crawford, 2000; Redlawsk, 2006; Neuman et al., 2007; Groenendyk, 2011; Halperin et al., 2011), especially regarding how affect conditions political decision-makers' strategic choices (e.g., Bar-Joseph and McDermott, 2008; Dolan, 2016; Renshon et al., 2017; Stanley, 2018). Drawing on recent advances in social and organizational psychology—including psychological constructionism (Barrett, 2009, 2017), cognitive appraisal theory (Smith and Ellsworth, 1985; Frijda, 1986; Moors, 2013), basic emotion theory (Ekman, 1972; Ekman and Cordaro, 2011), and the somatic marker hypothesis (Damasio, 1994; Verweij and Damasio, 2018)—this literature examines how leader affect complements (and often directly shapes) cognitive processing, with varying effects on the leader's own decision-making and their subordinates' decisions and behaviors. Yet, this research generally fails to consider how leader self-regulatory capacity intersects with leader affect.

While the various theoretical perspectives have differing views about affect and its relationship with cognition, this field takes as a common foundation that affective experiences can work in tandem with cognition to shape how individuals think, act, and make decisions—with affect shaping decisions and behavior *via* goal motivation, the content of thought, and the depth of thought, among other functions (Druckman and McDermott, 2008; Renshon and Lerner, 2011; Lerner et al., 2015; Cristofaro, 2019, 2020). Affect shapes individuals' cognitive processing by influencing "what kind of information people recall, attend to, select, interpret, and learn" (Forgas and George, 2001, p. 8)—with concomitant effects on attentiveness, memory retrieval, information searches, and risk/utility calculations (for a review, see Cristofaro, 2019, 2020; see also Forgas and George, 2001; Pham, 2007; Seo and Barrett, 2007; Angie et al., 2011). Often, though not universally, 'positive' affect (i.e., positive moods; emotions such as joy and contentment) is argued to promote top-down, flexible processing rooted in approach/continue behaviors—in turn facilitating action tendencies related to creativity, motivation, cooperation, resilience, open attention, and a reliance on existing schema (Isen et al., 1987; George, 1991; Bless, 2000; Fredrickson, 2001; Seo et al., 2004; Amabile et al., 2005; Fredrickson and Branigan, 2005). In contrast, 'negative' affect (i.e., negative moods; stress; emotions such as anxiety, sadness, and anger) is argued to motivate avoidance—in turn facilitating pessimism, antagonism, defensiveness, resistance, enhanced selective attention, and cognitive rigidity in decision-making (Sinclair and Mark, 1992; Conway and Giannopoulos, 1993; Elsbach and Barr, 1999; Finucane, 2011; Robinson et al., 2011).

Of course, whether affect enhances or maladaptively impedes leaders' strategic decision-making is highly context-specific across both space and time, as the leadership literature shows (Humphrey et al., 2016; Cristofaro, 2019). For instance, under significant time constraints, happy managers have been shown to be *less* creative and make worse decisions, while sad managers make better ones (Treffers et al., 2020). In related research, decision-makers experiencing happiness and anger may have

difficulties processing decision-relevant information, while those experiencing moderate fear are more likely to make rationally strategic choices (Coget et al., 2011; Bachkirov, 2015). Likewise, in political environments, recent evidence finds that individual citizens experiencing anger are motivated toward political participation (Valentino et al., 2011) and support for aggressive security policies, including war declarations (Lerner et al., 2003; Huddy et al., 2005; Halperin, 2011). In contrast, anxiety has been shown to motivate information-seeking about political candidates (Redlawsk et al., 2007; Valentino et al., 2008), while sadness has been shown to motivate depolarization of ideological schema (Gur et al., 2021). Other research illuminates the varied effects of positive affect—with joy driving political leaders to devalue risk perceptions and embrace objectively riskier strategies, and contentment driving leaders to resist strategic change (Dolan, 2016).

One important body of research focuses on various forms of physiological arousal, finding relationships between measures such as electrodermal activity and political preferences and behaviors [though there are inconsistencies in replications; see Smith and Warren (2020) for a review]. Other experimental research about bargaining behavior demonstrates that affective arousal—regardless of valence—inhibits decision-makers' deliberative processes and short-circuits their ability to make optimal cognitive choices (Renshon et al., 2017). These experimental findings corroborate empirical evidence that increased physiological and emotional arousal undermines leaders' crisis decision-making (Bar-Joseph and McDermott, 2008) and exacerbates other war-lengthening dynamics, helping to explain why longer wars are harder to end (Stanley, 2018).

In addition to its direct effects on the leader's own decision-making, leader affect also indirectly influences the perceptions, decisions, and behaviors of their subordinates. Several models explain such contagion. The first model follows the logic of affect-as-information—wherein followers glean information about a situation from their leaders' emotions and moods, which they then use to make cognitively-informed assessments (Schwarz and Clore, 1983; Petty et al., 1994; Van Kleef, 2008). The second model follows the logic of appraisal theory, wherein followers' own affective responses to their leaders' emotions provide information for their cognitive assessments (Parkinson, 2011). A third model posits contagion as an automatic, unconscious, and unintentional transference of affect between leaders and followers (Hatfield et al., 1994). Leader affect evokes similar physiological processes in followers, such that they automatically mimic their leader's verbal and non-verbal cues and converge with their emotions (Neumann and Strack, 2000; Bono and Ilies, 2006; Johnson, 2008; Spoor and Kelly, 2009; Clarkson et al., 2020).

Multiple tests of these mechanisms confirm emotion contagion from the leader can impact followers' individual and collective decision-making and behavior (for reviews, see Cristofaro, 2019, 2020; see also Newcombe and Ashkanasy, 2002; Gaddis et al., 2004). For instance, leaders in positive moods engender followers with positive and/or less negative moods, while leaders in negative moods engender followers with negative and/or less positive moods (George, 1995; Sy et al., 2005). These mood shifts then impact followers' behavior: Those who received positive contagion exhibited greater effort, coordination, and creativity, improved decision-making, and better overall performance (Sy et al., 2005; Bono and Ilies, 2006; Johnson, 2009; Visser et al., 2013; however, for an alternative perspective, see Barasch et al., 2016). In contrast followers who received negative contagion demonstrated varied behaviors, from less willingness to perform, to greater reliance on analytical approaches and increased effort (Johnson, 2009; Visser et al., 2013; Koning and Van Kleef, 2015; Lindebaum et al., 2016). At the same time, affective contagion has been shown to shape group decision-making dynamics—although these effects may be moderated by the affective context (e.g., group norms around affect; for a review, see Cristofaro, 2019).

In the political context, leaders' positive and negative emotional displays have been shown to be "easily recognized and function as effective information processing cues" for their followers, who then alter their political attitudes and behaviors (Masters et al., 1991, p. 378; see also Rosenberg et al., 1986; Bucy and Bradley, 2004; Stewart and Svetieva, 2021). Other empirical evidence has supported the automatic contagion model, finding that Americans shared arousal reactions congruent with a president's facial displays of emotion—irrespective of their attitudes toward that president (Lanzetta et al., 1985; McHugo et al., 1985; Masters, 2001).

Beyond these direct and indirect effects of leader affect arousal, research has explored some factors that mediate how emotions are experienced by leaders and caught by followers—thereby influencing decision-making for both. These factors include personality traits (Bartone, 2006; Van Kleef et al., 2010); gender (Lewis, 2000; Newcombe and Ashkanasy, 2002); the processes of sensegiving and sensemaking (for a review, see Cristofaro, 2021); and epistemic motivation (Sy et al., 2005; Van Kleef et al., 2009). Yet, this research generally fails to consider the mediating factor of leader self-regulatory capacity.

Affect regulation, like the umbrella term of affect itself, encompasses varying efforts to influence affect arousal (Westen, 1994; Gross, 2015). Leaders experience individual differences in their capacity to regulate their affect, which mediates how affect influences their own decision-making as well as how they might spread their affect arousal to followers. For example, one form of affect regulation—emotion regulation (ER)—refers to the processes that individuals use to influence which, how, and when emotions are experienced, and has five unique strategies (see Gross, 1998, 2015; Suri and Gross, 2016). Of these five ER approaches, which strategies are available (and selected) depend on the context, emotional intensity, and the individual's executive functioning capacity (Heatherton and Wagner, 2011; Hofmann et al., 2012; Suri and Gross, 2016).

Alternatively, the ability to regulate stress arousal happens through allostasis, which relies on interactions between the brain, endocrine system, immune system, and autonomic nervous system to vary internal conditions—such that they galvanize the appropriate energy and focus for coping well before, during, and after a challenge (McEwen and Lasley, 2002; Stanley, 2019). When allostasis is functioning appropriately, stress arousal is an immediate response intended to handle change or crisis,

followed by recovery and a return to baseline equilibrium. When an individual experiences chronic stress, however, they do not complete recovery; instead, they remain in an activated state. Over time, the internal systems involved with allostasis become dysregulated, in the process building allostatic load (Stanley, 2019).

Thus, all leaders' capacity to use ER and allostasis to regulate their affect—to ensure that stress and emotions do not drive their own decision-making and, in turn, their followers' decision-making—may not be equal. Like other leader-specific factors explored in the literature, leader self-regulatory capacity likely mediates how and when affect influences strategic decision-making, as some recent co-evolutionary organizational research has suggested (for a review, see Cristofaro, 2019; see also Ashkanasy, 2003; Fink and Yolles, 2015). Yet, most literature about affect and cognition in decision-making fails to engage with this idea—instead treating affect as a relatively constant influence on cognition and decision-making. To address this gap, we present an argument that incorporates leaders' neurobiological windows of tolerance to affect arousal and their self-regulatory capacity as mediating factors that shape the interrelationships between affect, cognition, and strategic decision-making.

THE MECHANISMS OF LEADER SELF-REGULATORY CAPACITY: NEUROBIOLOGICAL WINDOWS OF TOLERANCE

In this section, we explore how leaders' self-regulatory capacity can impact their organizations, in at least two ways. First, we review the logic of dual systems decision-making, introduce the concept of leaders' neurobiological windows of tolerance for affect arousal, and survey how this window can directly affect leaders' own decision-making. Then, we consider how leaders' windows can indirectly affect the collective performance of their groups.

Leaders make decisions drawing upon two networked systems, System 1 and 2. Most applications of the dual systems decision-making model in the organizational literature have focused on System 1 guiding emotion and intuition, while System 2 steers cognition (for a review, see Cristofaro, 2020). Approaching this model from the stress and trauma neurobiological perspective, however, System 1 ("thinking fast"; Kahneman, 2011) is designed to deploy *neuroception*: an unconscious process that quickly scans both the inner and outer world for opportunities and threats (Porges, 2011; Stanley, 2019). As a result of this process, System 1 activates neurotransmitters and stress hormones, which then produce physical sensations and emotional cues associated with approaching opportunities or avoiding threats. System 1 is guided by these fast, automatic, and unconscious assessments, rather than conscious thought (Stanovich and West, 2000; Kahneman, 2003), and cultivates *implicit memory* by unconsciously interpreting and generalizing from every experience. System 1 implicit learning occurs predominantly in the amygdala during all levels of affective arousal, with the greatest learning occurring at high arousal levels (Bremner, 2002; Sapolsky, 2004; Scaer, 2005; Stanley, 2019).

System 2 ("thinking slow"; Kahneman, 2011) is the slower and more effortful pathway characterized by conscious thought. System 2 includes executive functioning, which allows us "to focus, pay attention, and recall task-relevant information, while holding distractions at bay" (Stanley, 2019, p. 99). System 2 also enables top-down conscious control to modify or override System 1's bottom-up nonconscious assessments (Stanovich and West, 2000). System 2 employs *explicit memory*, which can be intentionally accessed to situate information in space and time—and which supports System 2 explicit learning, located primarily in the hippocampus (Scaer, 2005; Stanley, 2019).

An individual's situational ability to access System 2 processes is influenced by where they find themselves along an inverted U-shaped affect arousal curve, known as the Yerkes-Dodson curve (McEwen and Lasley, 2002). When individuals experience low arousal levels, they may not have enough activation to engage System 2 into becoming alert and motivated to complete tasks at hand. Conversely, when individuals experience high arousal levels, they may find their attention and energy diverted from tasks to focus on the arousal itself—undermining System 2's top-down control. As distress worsens, performance degrades steadily, eventually reaching a point of overwhelm or freeze. An individual's neurobiological *window of tolerance* is the interval within which they are capable of regulating their arousal levels upwards or downwards, to remain alert but not so activated that they enter distress (Stanley, 2019). This moderate arousal zone is where System 2 processes are most effective, facilitating concentration, focus, and explicit memory formation, consolidation, and retrieval (Bremner, 2002; Sapolsky, 2004; Scaer, 2005; Porges, 2011).

Individuals inside their unique window of tolerance are more likely to engage in accurate neuroception and integrate System 1 and 2 processes successfully. Even during some affective arousal, they are able to regulate that arousal so as to keep System 2 processes fully online. (See **Figure 1**) Thus, they are more likely to perceive relevant internal and external cues; obtain and absorb adequate and appropriate information; and objectively assess and integrate that information. At any decision-point, they are more likely to search for all possible options; evaluate each option in terms of costs and benefits, by planning and considering its likely future effects; and then choose the strategically optimal decision best aligned with their values and goals (Stanley, 2018, 2019).

In contrast, when individuals experience stress or emotional arousal outside their window of tolerance, they are more likely to engage in *faulty* neuroception, such as neurocepting threat when a situation is truly neutral or safe, or neurocepting safety when a situation is truly dangerous (Porges, 2011; Stanley, 2019). Outside their window, individuals may also lose their capacity to use System 2 to modify or override System 1 assessments. In turn, stress and emotions are more likely to drive information search, assessment, and decision-making—resulting in impulsive and reactive behavior. Simultaneously, System 2 processes degrade. Indeed, System 2's degradation

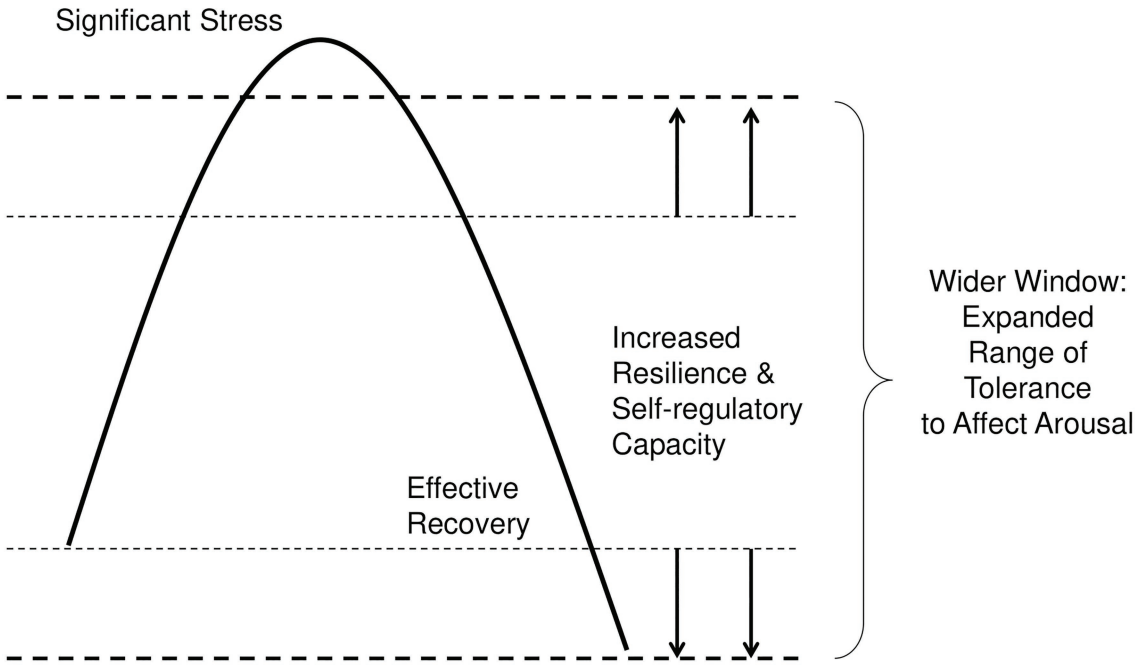

FIGURE 1 | Widening the Window through Complete Recovery. This figure depicts how individuals can widen their neurobiological window of tolerance to affect arousal. When they experience affect arousal outside their comfort zone, followed by a complete recovery, they create a wider window. The wider their window, the greater their self-regulatory capacity, and the greater their capacity to integrate System 1 and System 2 processes during challenges.

at high arousal levels is one reason why memories of extremely stressful or traumatic experiences are often incomplete, contradictory, disordered, or fragmented (Bremner, 2002; Sapolsky, 2004; Scaer, 2005; Porges, 2011; Stanley, 2019).

As System 2's top-down regulation worsens, individuals outside their window are also more likely to engage in maladaptive coping, such as alcohol/substance use and adrenaline-seeking, violent, or self-harming behaviors. Problematically, such coping techniques may then *further* degrade System 2's regulatory capacity, lowering individuals' inhibitions and increasing their likelihood of making unethical or reactive choices (Stanley, 2019; Stanley and Larsen, 2021). Thus, outside their window, an individual's executive functioning, explicit memory, ability to relate effectively to others, and deliberate decision-making become degraded—showing just how important that window is in mediating the relationship between affect, cognition, and strategic decision-making.

What, then, determines the width of a leader's unique window? Individual differences are initially wired through interactions between genetic traits and someone's early caregiving environment. In addition, individual windows can narrow *via* three pathways over time: chronic stress or developmental trauma during childhood; shock trauma; and chronic stress or relational trauma during adulthood (Stanley, 2019; See **Figure 2**).

First, parents with insecure attachment styles and narrow(ed) windows are more likely to create the environmental conditions for their children to wire an insecure attachment style and develop a narrow window, too. When parents' own capacity for regulating affect is compromised by narrow(ed) windows, it detrimentally influences their children in developing capacity for regulating affect as well (Ogden et al., 2006; Neigh et al., 2009; Siegel, 2012)—impairing the child's ability to down-regulate stress and negative emotions during stressful experiences in the future. Indeed, substantial empirical research demonstrates how early life adversity can lead to long-term dysregulation and hypersensitization of several neurobiological systems reflective of a narrow window (for reviews, see Neigh et al., 2009; Stanley, 2019).

The second pathway to a narrow window is shock trauma. This occurs when individuals experience too much arousal too quickly. As an individual perceives helplessness, powerlessness, and loss of control, the acute emotional intensity and physiological arousal overwhelm their window—pushing them to the far-right end of the Yerkes-Dodson curve (Stanley, 2019). Importantly, shock trauma can occur with any large, abrupt change in arousal, whether that be a major event (e.g., mass shooting, terrorist attack, natural disaster, war) or a minor event (e.g., medical procedure, car accident). Such trauma is more common among those with already narrowed windows (Ogden et al., 2006; Stanley, 2019).

The third pathway to narrowing the window is chronic stress arousal (e.g., workaholism, tense relationships, chronic sleep deprivation, emotional labor) and "everyday" relational trauma (e.g., discrimination, harassment, abusive relationships). Without adequate recovery, these stressors induce low-level, long-term arousal that deplete the system, such that their cumulative effects build allostatic load (Stanley, 2019). Stressors on this

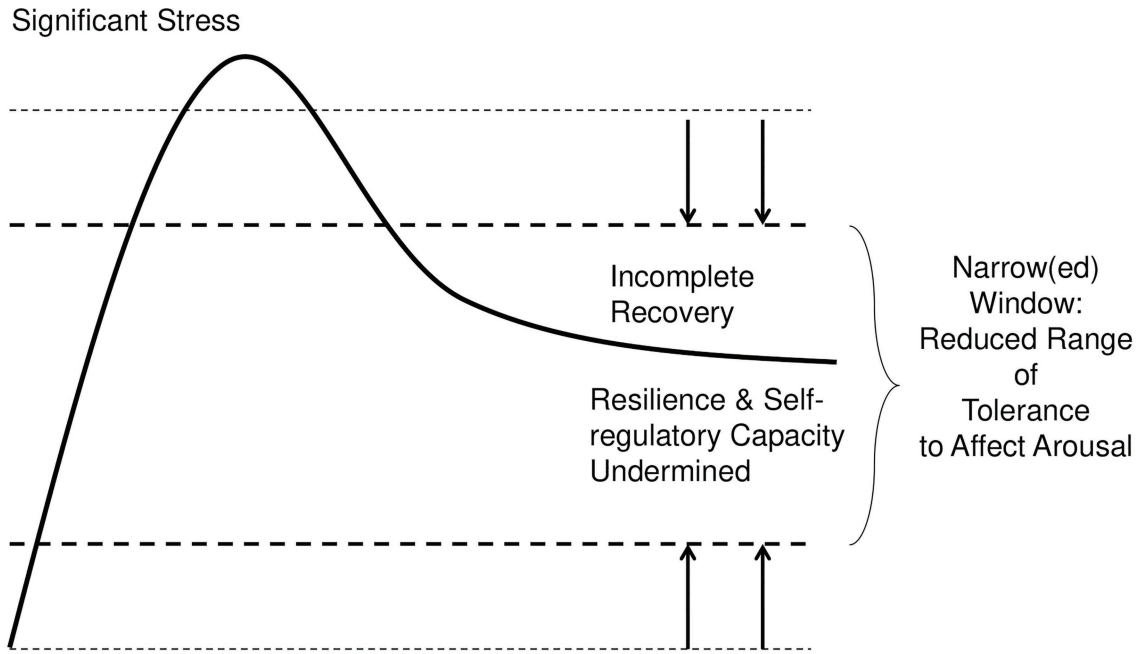

FIGURE 2 | Narrowing the Window through Incomplete Recovery. This figure depicts how individuals can narrow their neurobiological window of tolerance to affect arousal. Their window can narrow *via* three pathways when they accumulate allostatic load without adequate recovery. The narrower their window, the more likely during challenges that System 2 processes will be operating in a degraded manner while System 1 processes drive decision-making and behavior.

pathway also include common culturally-sanctioned yet maladaptive coping strategies—compartmentalization, emotion suppression, the use of self-medicating substances, and adrenaline-seeking, addictive, violent, or self-harming behaviors (for reviews, see Stanley and Larsen, 2019, 2021)—that add to allostatic loads and narrow an individual's window further.

These three pathways, alone or in combination, can narrow individuals' windows—meaning that individuals may move outside their window because of multiple obvious *and nonobvious* arousal experiences. Regardless of pathway, the fundamental outcome is the same: as an individual's allostatic load increases, they become more dysregulated and their window narrows (Stanley, 2019). The narrower their window, the more likely that System 1's faulty neuroception—and stress arousal and emotions—drive the individual's decisions, and the less likely they are able to access System 2's deliberative cognitive decision-making capacities.

Thus, whether stress and emotions directly affect a leader's strategic decision-making relies upon several factors: their current allostatic load; the current width of their window—and the self-regulatory capacity that window's width allows; and their current affect arousal level (Stanley and Larsen, in press). When leaders' arousal level pushes them outside their window, System 2's executive functioning and cognitive capacity will be degraded; System 1's stress and emotions will be more likely to drive their decisions; and integrative System 1/System 2 strategic decision-making will be corrupted. Leaders with particularly narrow windows may therefore have such compromised self-regulatory capacity that they are unable to make *any* decisions without being driven by their stress arousal, emotions, and impulses. On the other hand, leaders with particularly wide windows may be able to experience significant stressors, even shock trauma, but still be able to regulate their stress and emotions and execute System 2 processes effectively (Stanley and Larsen, in press).

In addition to windows directly affecting leaders' own decision-making, the width of a leader's window (and whether they are currently outside of it) also has indirect effects on their social environments—thereby affecting their groups' *collective* window of tolerance. Leaders set the social and emotional tone for their group, often called the "command climate." Affect contagion is an automatic, unconscious, and unintentional transference of affect; such contagion is most powerful in relationships that involve attachment bonds and/or power differences (Hatfield et al., 1994). Importantly, the relationship between a leader and their followers includes both characteristics, making them a likely source of affect contagion. Leader affect evokes similar physiological processes in followers, such that they automatically mimic their leader's verbal and non-verbal cues and converge with their emotions (Neumann and Strack, 2000; Bono and Ilies, 2006; Johnson, 2008; Spoor and Kelly, 2009; Clarkson et al., 2020).

Leaders strongly influence how their subordinates will respond during stress, uncertainty, and change. Leaders can affect how their subordinates will interpret and make sense of stressful or challenging experiences (Weick, 1995; Bartone, 2006; Helms Mills et al., 2010; see also Cristofaro, 2021 for a review of how leaders can influence sensemaking in their organizations). At the same time, when leaders are perceived as competent, honest, trustworthy, and attuned to their subordinates' physical,

intellectual, emotional and social needs, they earn their subordinates' trust and, by extension, boost their resilience (Catignani, 2004; Stanley, 2019).

The wider the leader's window, the more likely that leader will be inside their window during stressful or challenging events. Leaders inside their windows are more likely to enact the constructive and cooperative relational strategies associated with secure attachment—to accurately perceive social and emotional cues from others, respect boundaries, communicate expectations clearly, speak honestly and openly, give and receive social support during stressful situations, and attune to the needs of their subordinates. These leader behaviors convey a calming and creative influence on their followers. In turn, through the principles of contagion, followers too feel comfortable exploring, learning, innovating, making mistakes, and growing. Followers learn that they can take risks, speak their minds, participate in group decisions, and confront difficulties with their leader's support. In other words, the leader's wide window helps endorse group behaviors that build collective resilience and widen the collective window (Stanley, 2019). With a wider collective window, the group is more likely to engage in accurate situational awareness, creative problem-solving, improvisation, adaptability, and connection with others. They are also less likely to experience affective arousal during interrupted plans or unexpected events (Weick, 1995; Stanley, 2019).

In contrast, a leader with a narrowed window is more likely to find themselves dysregulated outside their window. In this situation, the leader is likely to convey their affect arousal to their followers. The leader may convey hyper-aroused states (e.g., anger, fear) or hypo-aroused states (e.g., apathy, despair, victimhood, powerlessness), which are then 'caught' by followers. Such stress and emotion contagion increases the likelihood that all group members will resort to the insecure relational strategies associated with insecure attachment, including violence, conflict avoidance, gossip, defensiveness, disrespect, bullying, lying, bigotry, apathy, withdrawal, and indecision (Ogden et al., 2006; Siegel, 2012; Stanley, 2019). They are also more likely to engage in unethical and transgressive behavior (Stanley, 2019).

A dysregulated leader who is outside their window is also more likely to withdraw, limit information flow, involve fewer people in their decisions, and engage in micromanagement and other rigid control structures. These leader behaviors can increase uncertainty within the organization, fueling anxiety and exacerbating followers' feelings of apathy and powerlessness (Stanley, 2018, 2019). These leader behaviors can also facilitate mistrust within the group, such that followers feel like they are competing with each other (Markman, 2021). In turn, coworkers are more likely to compete for the leader's attention, take credit, and sow blame on others—fueling interpersonal tension within the group. These dynamics also undermine information sharing and cooperation, leaving the entire group less resilient and adaptable during change, uncertainty, or unexpected events. As a result, the leader's dysregulated state can erode the group's ability to cooperate, adapt, and learn—undermining followers' resilience and narrowing the collective window (Stanley, 2019).

Of course, subordinates have their own windows of tolerance that predate interacting with and working for a well-regulated or dysregulated leader. However, because of the ripple effects of the leader's window on the social environment, over time the leader's window will begin to influence their followers' individual windows, as well. For instance, the longer a wide-windowed subordinate works for a dysregulated leader who is outside their window, the more likely that subordinate will be subject to the toxic working conditions just described. In turn, that environment will create conditions for that subordinate to narrow their own window *via* the third pathway, through chronic stress arousal and relational trauma from repeated exposure to the environment the leader has created. Conversely, the longer a narrow-windowed subordinate works for a well-regulated leader who is inside their window, the more repeated experiences that subordinate will have of experiencing their leader enacting the relational strategies of secure attachment. Just as securely-attached parents set the conditions for their children to wire wide windows in childhood (Ogden et al., 2006; Siegel, 2012), leaders with wide windows can help their followers cultivate the traits that widen the followers' individual windows, as well as the group's collective window (Stanley, 2019).

A FORMAL ILLUSTRATION OF WINDOW EFFECTS: COMPARING ARDERN'S AND TRUMP'S COVID-19 RESPONSES

We formally illustrate this argument using two leaders who represent the theory's mechanisms. This illustration considers whether our novel theory's expectations match reality, to establish whether there is a sufficient basis for a deeper causal analysis. Such plausibility probes are an important step between theory-building and larger-scale empirical assessment, particularly when theories are new and/or resource intensive to test (Eckstein, 1992; Kaarbo and Beasley, 1999). Specifically, we explore how the width of Prime Minister Ardern's and President Trump's respective windows directly affected their decision-making and indirectly affected their nations' collective windows of tolerance during the early months of the COVID-19 pandemic.

We wanted our formal illustration to have contemporary policy relevance, which propelled our selection of the COVID-19 pandemic as the common decision-making environment. Then, we selected these two leaders for the pandemic illustration based on three factors. First, we sought to identify two countries for which the leaders shared a common first language (English), and for which there would be a sufficient number of news sources available in that language. Doing so ensured there would be enough data available to interpret sources consistently (without translation) and to illustrate the cases effectively; the United States and New Zealand satisfied this criterion. Second, we sought to identify two countries that held similar values and institutions, as a means of establishing that their leaders and societies would share reasonably similar decision-making environments. The United States and New Zealand have been

directly compared in other studies for this reason; though their specific policies may differ, their pluralist "settler societies" share deeply held commitments to personal freedom, human rights, and the rule of law (Fischer, 2012, p. 32; see additional comparative examples in Baumann et al., 2019; Noack and Mahtani, 2019). Third, given how inconsistently the COVID-19 pandemic evolved around the world, we sought to identify two countries for which the timeline of first documented cases and governmental action were approximately equivalent. The first cases documented in the United States and New Zealand fell between January and February of 2020, and both countries took their first major governmental lockdown actions within a week of each other in March 2020 (World Health Organization, 2021a,b).

After establishing that the United States and New Zealand satisfied all three criteria, we collected information for both illustrative cases *via* an intensive search of available primary sources (including interview and speech transcripts, as well as subjects' personal social media statements) and secondary sources (including biographies and accounts published in reputable news sources, often based on interviews with the subjects' closest associates). We extracted data from this narrative review when it included (1) evidence of Ardern's/Trump's window wiring and/or width throughout their lifespan, and (2) evidence of Ardern's/Trump's decision-making during the first year of the COVID-19 pandemic. In line with the motivations behind a plausibility probe, information was included whether or not it satisfied the window theory's expectations; full case narratives were written that included all collected information. Upon review, we determined those cases showed no disconfirming evidence, but that some of the confirming evidence was repetitive. For the sake of clarity, we therefore excluded some of the duplicative confirming evidence. The remaining evidence follows in the illustrations below.

Prime Minister Jacinda Ardern's Relatively Wide Window

Evidence from Ardern's life suggests that she developed a relatively wide window throughout her lifespan. In line with the first pathway, Ardern's primary caregivers appear to have had a strong, loving relationship and been well-regulated themselves. Ardern describes her school cafeteria worker mother as "the epitome of kindness" (Blackwell, 2020, p. 32), who "instilled in her and her sister a strong sense of service" (Lester, 2019, para. 5). Until she was eight, Ardern lived in the poor, predominantly Maori, forestry town of Murupara, known for its crime, poverty, and addiction. While she was "relatively insulated from the injustice around her" (Chapman, 2020, p. 2; see also Duff, 2019), Ardern observed her police officer father deescalate many altercations—something she credits for teaching her interpersonal diplomacy and negotiation skills (Chapman, 2020). The Mormon family consumed no alcohol, caffeine, or tobacco (Duff, 2019; Chapman, 2020), and though Ardern left the Mormon Church later, she praises her upbringing for helping her develop a sense of optimism, service, and responsibility (Roy, 2018).

After moving to Morrinsville, 12-year-old Ardern was elected student council president, where she discovered she "was very good at being in charge" and "had a spontaneous and genuine interest in advocacy" (Chapman, 2020, p. 3). She served as a prize-winning debater, the sole elected student representative to the school's Board of Trustees, and leader of the local Students Against Drunk Driving chapter (Chapman, 2020). Ardern's parents have told reporters they always thought she could be prime minister someday; as her mother said, "She was mature beyond her years and had incredible common sense" (quoted in Duff, 2019, p. 41). These childhood experiences suggest through her early social environment, Ardern likely developed a secure attachment style and secure relational strategies, allowing her to wire a wide window.

Ardern would later experience a shock trauma event during her tenure as prime minister—though her response, per the second pathway, provides further evidence of a wide window. On March 15, 2019, mass shootings at two mosques in Christchurch killed 51 people; it was New Zealand's deadliest shooting in modern history, and its first since 1997 (Fattal, 2019). Although in shock, Ardern's immediate response was widely recognized for its decisiveness and compassion (Duff, 2019; Lester, 2019; Chapman, 2020). She addressed the nation several times, used inclusive language, wore a head-scarf, and met with Christchurch survivors and community leaders (Duff, 2019; Lester, 2019; Chapman, 2020). As one journalist explained, "she listened to people who were grieving and reacted with kindness. Her actions dismantled the notion that leaders have to be emotionless and uncaring to retain authority" (Duff, 2019, pp. 146–147). Within the week, her government enacted sweeping changes to New Zealand's gun laws by banning all assault rifles and military-style automatic weapons (Lester, 2019). She also hosted an international summit to bring world leaders and technology companies together to ratify the "Christchurch Call"—a global pledge to keep internet platforms from being used to spread hate (Duff, 2019; Mahtani and Fifield, 2019; Chapman, 2020).

Per the third pathway, Ardern has experienced chronic stress and relational trauma, but again shows evidence of a wide window. She became a Labor member of parliament (MP) at just 28, then twice ran against (and lost to) National's Nikki Kaye for an elecorate seat—which the media widely reported on using sexist terms, such as the "Battle of the Babes" (Duff, 2019, p. 102; Chapman, 2020). In 2017, Arden became an electorate MP and rose to the rank of Labor Party deputy leader. When the party leader stepped down seven weeks before the election, she became party leader and then prime minister, garnering even more media sexism: News shows described her as a "pretty little thing" who would "look good" as prime minister, while commentators painted her as vacuous and superficial, asking if she "really has what it takes" and calling her Labor's "show pony" (Duff, 2019, pp. 109–114; see also Chapman, 2020).

Ardern learned she was pregnant during her negotiations to form a coalition government, adding another chronic stressor to her load (Duff, 2019; Chapman, 2020). She "carried on as normal, forming a government and doing her best to not let

world leaders see that she was trying not to throw up while speaking with them" (Chapman, 2020, p. 110). Ardern became the second world leader to give birth while in office; the first to take maternity leave; and the first to bring her breastfeeding infant to the United Nations General Assembly (Duff, 2019; Chapman, 2020).

Ardern may have mitigated any potential window-narrowing effects of these stressors through her strong social support; consummate relationship-building skills; and unprecedented openness and connection with her followers. First, she reports a strong relationship with her romantic partner Clarke Gayford, noting "I can only do everything because I have help, by which I mean Clarke" (quoted in Chapman, 2020, p. 131). Second, throughout her career, Ardern has been a "master networker" (Chapman, 2020, p. 27); it has been said that "building relationships has always been Ardern's greatest strength" (Duff, 2019, p. 110). This provided her a large web of friends and allies, and helped her establish a coalition government (Chapman, 2020). Third, since 2008, Ardern has connected directly with her followers, using Facebook Live and social media to allow voters to have their questions answered immediately (Chapman, 2020). On her way to being sworn in as prime minister, she told Radio New Zealand that she wanted citizens "to feel that [the government is] open, that it's listening, and that it's going to bring kindness back" (quoted in Duff, 2019, p. 156). In all her communications and media interviews, she demonstrates "genuine empathy and a sense of humor" (Chapman, 2020, p. 91) and presents herself as authentic, "self-deprecating and down to earth" (Duff, 2019, p. 187)—even making her first policy pronouncement as prime minister *via* Facebook Live from her home, while on maternity leave (Duff, 2019).

Inside the Window: Ardern's and New Zealand's Response to COVID-19

Ardern's decision-making during the early stages of the COVID-19 pandemic provides a particularly apt illustration of her wide window. While she earned some criticism for choices regarding vaccine rollout (BBC, 2020; Hollingsworth, 2021), Ardern's wide window enabled her to make effective decisions and to influence the entire nation's successful pandemic response.

Reporting indicates Ardern was able to access System 2 executive functioning and cognitive processes, regulate her stress and emotions, make effective decisions, and update her decisions as new information arose. She actively sought out and incorporated input from epidemiologists, independent experts, and business and community leaders, all to ensure her government had the best science and health advice (Wilson, 2020). In a November 2020 survey, three quarters of New Zealand scientists believed their policymakers were taking scientific evidence into account during the pandemic—the highest national approval among more than 25,000 scientists surveyed worldwide (Rijs and Fenter, 2020). After making Christchurch anniversary event plans in line with existing scientific evidence, then receiving new information, Ardern immediately cancelled the event and instituted self-isolation policies (BBC, 2020). All of these decisions provide evidence of her wide window allowing for successful integration of Systems 1 and 2; in contrast, there are thus far no reported examples of stress or emotions detrimentally influencing Ardern's pandemic decision-making.

In line with the theory's expectations, Ardern's wide window also appears to have shaped New Zealand's collective pandemic performance. Ardern appealed directly to the public with simple, consistent, and emotionally intelligent messaging. During her regular Facebook Live chats, she used easily understood language to translate risk and uncertainty (Friedman, 2020; Wilson, 2020)—offering citizens a clear view of the future and the stakes involved, rather than minimizing the virus' true threat (Radio New Zealand, 2020; Wilson, 2020). She appeared jointly with the Director-General of Health to promote apolitical public health guidance, and introduced a straightforward four-level alert system to help the public understand when, how, and why the government would implement policy responses (Chapman, 2020; Wilson, 2020).

At the same time, her messaging was emotionally intelligent. She deliberately repeated her simple and encouraging catchphrases during all public communications: "Go hard, go early. Stay in your bubble. Team of five million. Be strong but be kind" (Chapman, 2020, p. 207). She used identifiable examples, such as telling fellow parents that she understood how hard it would be to avoid playgrounds (Friedman, 2020), and humor, declaring the tooth fairy and Easter bunny 'essential workers' who could still visit families (Chapman, 2020). As one biographer notes, Ardern does not "use fear to motivate; instead, her weapon was inclusivity" (Duff, 2019, p. 155). Promoting kindness and empathy, she emphasized that "we are all now putting each other first. And that is what we as a nation do so well" (quoted in Dada et al., 2021, p. 7). Ardern also encouraged citizens to make phone trees to check on each other (Mayer and May, 2021) and included resources about kindness on the COVID-19 governmental website (Wilson, 2020). As one scholar noted, Ardern sought to "use the bully pulpit to cue society toward [their] better angels" (quoted in Friedman, 2020, para. 11).

The successful impact of Ardern's wide window on her decision-making and New Zealand's collective window manifested in three ways. First, in October 2020, Ardern's Labour Party was re-elected in a landslide that allowed for a single-party government, the first time since 1996 (CNBC, 2020)—a "historic shift" that was "one of the biggest swings in New Zealand's electoral history" (Menon, 2020, para. 3). Second, leaders who might have otherwise opposed Ardern's policies bought into them and amplified her message further: Opposition leaders urged residents to follow officials' recommendations, mayors of regions experiencing repeated lockdowns adopted her messaging, and businesses around the country encouraged customers to stay positive and "be kind, stay safe" (Blackwell, 2020, p. 15; see also BBC, 2020). Third, New Zealand has been globally recognized as a pandemic success story. To date, New Zealand has lost 27 lives to COVID-19, with an average daily case rate below 20 (World Health Organization, 2021a). When rare cases have reappeared, New Zealanders readopt quarantine measures and once again adhere to guidelines (Perry,

2020, 2021). There have been no major protests of New Zealand's COVID-19 policies (Chapman, 2020), and by early 2021, seven of ten New Zealanders said they thought the country was "heading in the right direction" (Roy Morgan Research, 2021).

President Donald Trump's Relatively Narrow Window

In contrast to Ardern, evidence from Trump's lifespan suggests that he built allostatic load and narrowed his window. During Trump's presidency, a group of clinical psychologists and psychiatrists at a Yale symposium argued it was their moral and civic "duty to warn" the public about Trump's psychopathology—a duty which they argued supersedes the American Psychological Association's "Goldwater rule," inhibiting mental health professionals from diagnosing public figures they have not personally examined (Lee, 2019). Drawing on evidence in the public record, contributors argued that Trump exhibits symptoms of malignant narcissism, present hedonism, compulsive impulsivity, and attention deficit/hyperactivity disorder, as well as early signs of dementia or Alzheimer's. The analysis here builds on this earlier debate, providing evidence from Trump's lifespan to explore how he narrowed his window over time.

In line with the first pathway, Trump's mother Mary was reported by his niece—a clinical psychologist—to be "the kind of mother who used her children to comfort herself rather than comforting them. She attended to them when it was convenient for her, not when they needed her. Often unstable and needy, … she frequently put herself first" (Trump, 2020, p. 23). When Trump was a toddler, Mary had multiple emergency surgeries and hospital stays, and Trump's father Fred became the default primary caregiver. Fred was a "high-functioning sociopath" and workaholic, who focused almost completely on business and exhibited "a lack of empathy, a facility for lying, an indifference to right and wrong, [and] abusive behavior" (Trump, 2020, p. 24). Fred rebuffed his children's desire for soothing and care; as a result, for Trump and his younger brother, "'needing' became equated with humiliation, despair, and hopelessness" (Trump, 2020, p. 25).

Parents' lack of emotional and physical availability may wire insecure avoidant attachment styles in their children, creating chronic stress arousal and disconnections between the child's inward states and outward behaviors (Ogden et al., 2006; Siegel, 2012; Stanley, 2019). This may have been the case for Trump, as his niece highlights that he "began to develop powerful but primitive defenses, marked by an increasing hostility to others and a seeming indifference to his mother's absence and his father's neglect" (Trump, 2020, p. 27). Accounts of Trump's childhood behavior exhibit many other signs of avoidant attachment as well, including difficulty reading social cues, tormenting his younger brother, bullying other children, arguing with teachers, and eventually being kicked out of his private school and sent to a military academy "as a way to rein him in" (Trump, 2020, pp. 43–49). These experiences of early childhood abandonment, neglect, abuse, and chronic stress arousal likely narrowed Trump's window, with lifelong implications.

Trump also endured a shock trauma event during adulthood that may have further narrowed his window *via* the second pathway: the early death of his older brother Freddy. Although their father's demanding, unyielding, and highly competitive streak was "doubled in Donald" (Kirk and Wiser, 2017), Freddy turned instead to alcoholism under the stress of Fred's criticism, humiliation, and preferential treatment of Trump—and died of a heart attack at 42 (Trump, 2020). Trump had a contentious relationship with Freddy, often scolding him for his behaviors, but later lamented that he had not understood Freddy's struggles (Horowitz, 2016).

Per the third pathway, Trump's lifestyle exhibits chronic stress arousal. A self-described workaholic, Trump claims that for many years he has only slept 3–5 h per night, a habit he developed in business (United States Office of the Press Secretary, 2018; Le, 2019). As a result, he exhibits many symptoms of chronic sleep deprivation, including impulsivity, poor concentration, difficulty processing information, and difficulty regulating emotions (Egan, 2016; Devega, 2018). Trump also drinks "upward of twelve Diet Cokes a day" and "has a horrible diet and does not exercise," preventing recovery and likely exacerbating his everyday allostatic load (Trump, 2020, p. 13). Also reflecting and exacerbating his narrowed window, Trump had a documented history of maladaptive coping, including inappropriate, adrenaline-seeking, and even violent behavior. In addition to alleged serial philandering, since 1995 Trump has been publicly accused of rape, sexual assault, sexual harassment, or inappropriate touching by 16 women, many with multiple contacts corroborating their allegations (Kelly, 2017; Trump, 2020).

Evidence of impulsive and reactive behavior continued during his presidency. The Trump Administration, which saw record-breaking departures of Cabinet-level officials, was reportedly plagued by "paranoia, insecurity and scheming—and of an inner circle gripped by fear of Trump's spasms" (Rucker and Costa, 2019, para. 7). As one senior administration official wrote, "meetings with him veer off topic and off the rails, he engages in repetitive rants, and his impulsiveness results in half-baked, ill-informed and occasionally reckless decisions that have to be walked back" (Taylor, 2018, para. 14). This is further reflected in his presidential Twitter use, wherein many tweets appeared to be almost-instantaneous responses to programs that Trump was watching; one journalist determined that Trump took, on average, six minutes to compose and post a tweet after seeing topics covered on television (Altman, 2019). As his niece characterized it, "Donald today is much as he was at 3 years old: incapable of growing, learning, or evolving, unable to regulate his emotions, moderate his responses, or take in and synthesize information" (Trump, 2020, p. 197).

Outside the Window: Trump's and the United States' Response to COVID-19

Trump's pandemic decision-making offers a clear illustration of the impact of his narrow window. Some might suggest that Trump's approach of claiming credit, avoiding blame, sowing division, and fostering anti-government messaging was a

'rationalist' strategy based on what had made him successful in the past (Kapucu and Moynihan, 2021). Though that strategy's behaviors and the behaviors of a narrow window are admittedly very similar, the fact that Trump kept "instinctually returning" to that strategy, even as it undermined his failed 2020 reelection effort, suggests this 'rationalist' approach may not completely explain his pandemic behavior (Kapucu and Moynihan, 2021, p.10). Instead, the consistency between the window theory's expectations and the observed realities suggest it is a powerful alternative explanation for his decision-making.

The pandemic began in earnest during Trump's first impeachment trial, which threatened to remove him from power after several years of high-profile criticism of his leadership. Trump may have neurocepted this political environment as threatening, which—in concert with an already narrowed window—implies his self-regulatory capacity was likely diminished when COVID-19 decision-making started. For instance, although the Central Intelligence Agency had warned about a potential pandemic from China in November 2019 (Rutledge, 2020)—and experts across the intelligence and public health communities agreed by January 2020 (Lipton et al., 2020)—Trump told aides at the start to "stop panicking" and that he suspected 'Deep State' actors within the administration were trying to mislead him pre-election (Lipton et al., 2020, para. 88; see also Kapucu and Moynihan, 2021).

Evidence of the impact of this narrow window on his pandemic decision-making abounds. First, Trump inconsistently considered scientific advice and often rejected alternative viewpoints—reflecting the narrowed attentional focus, limited information flow, and rigid control structures of a leader outside their window (Stanley, 2018, 2019). Although Trump eventually allowed the convening of a White House coronavirus task force, his "inability or unwillingness to absorb warnings coming at him" meant that when that task force announced severe virus mitigation recommendations, Trump lashed out at the team for scaring people unnecessarily and replaced the task force leadership (Lipton et al., 2020, para. 35). Trump also sidelined several other pandemic officials, including the agency leader responsible for developing COVID-19 vaccines, after they said Trump's claims "lack scientific merit" (quoted in Shear and Haberman, 2020, para. 4). Trump further illustrated this rigid commitment to his narrow perception by emphasizing that he was "inclined not to speak with anyone who is insufficiently appreciative of his administration's efforts" (Olorunnipa et al., 2020, para. 9).

Second, dysregulated emotions, especially impatience, appeared to drive many of Trump's pandemic decisions. After Trump finally announced a nationwide lockdown, he told Congress to "just stay calm, and it will go away" and informed Americans the country would open by Easter (Rutledge, 2020, p. 507). By mid-April, Trump grew publicly impatient with the recommendations he had grudgingly endorsed; instead, he and his team "convinced themselves that the outbreak was fading, that they had given state governments all they needed to contain its remaining 'embers,' and that it was time to ease up on the lockdown" (Shear et al., 2020, para. 4). Accordingly, daily briefings with Trump ended in late April, and the task force barred infectious disease specialist Dr. Anthony Fauci from making television appearances, "lest he go off message and suggest continued high risk from the virus" (Shear et al., 2020, para. 49). However, when reports the task force *itself* would end in May provoked outrage, Trump changed course and insisted its daily meetings would not end (Lipton et al., 2020; Shear et al., 2020).

Trump's narrowed window also indirectly shaped the United States' collective pandemic performance in three ways. First, Trump engaged in erratic, inconsistent, factually untrue, and often impulsive messaging, which stoked public uncertainty, anxiety, and confusion. In January 2020, Trump quickly downplayed the threat on television (Lipton et al., 2020; Rutledge, 2020); then, when it became clear a lockdown was needed, Trump praised emergency workers, encouraged social distancing, and discouraged large gatherings. However, "he also, at different times, more forcefully promoted the opposite of these messages," such that "his staff ultimately decided they were doing more harm than good" (Kapucu and Moynihan, 2021, p. 10). Indeed, Smith (2020) notes that Trump at times derided masks as "politically correct" (para. 28), then suggested they were "patriotic" (para. 1). Likewise, he said schools needed to reopen or risk losing funding (Baker et al., 2020), then said this would not apply for all schools (Binkley, 2020). Against scientific consensus, Trump offered varied, off-the-cuff remarks about hydroxychloroquine, remdesivir, and other 'remedies' such as ultraviolet light and disinfectant injections (Broad and Levin, 2020; Niburski and Niburski, 2020). White House officials acknowledged that these impromptu statements were neither scripted nor in line with policy positions (Lee et al., 2020).

Second, Trump's impatience created a "leadership vacuum" that undermined state and local leaders' attempts to respond successfully to the virus (Shear et al., 2020, para. 17). While many state officials warned the pandemic was far from under control, Trump agitated to lift the lockdown and pushed states to reopen their economies. He "began criticizing Democratic governors who did not 'liberate' their states" (Shear et al., 2020, para. 10), transmitting hyperarousal to his followers *via* Twitter and media appearances by enthusiastically encouraging protests at state capitals and calling state leaders dictators (Shear et al., 2020). One particularly radical result of this contagion was the planned kidnapping of Michigan Governor Gretchen Whitmer, in what investigators say was a plot by anti-government extremists who were angry over her "tyrant" coronavirus policies (Snell and Burke, 2020, para. 2).

Third, Trump's dysregulated leadership and erratic messaging disrupted the decisions of his inner circle. His principal aides followed his tendency to reject alternative perspectives, by adopting "a similar strategy of issuing threats or isolating their rivals, undermining efforts to manage the outbreak" (Diamond, 2021, para. 18). At various points, White House Chief of Staff Mark Meadows, Trump's son-in-law Jared Kushner, the Vice-President's Chief of Staff Mark Short, and others were reported as yelling, complaining, and exploding in anger at other officials—with reporters indicating that the White House had become "a toxic environment in which no matter where you turned, someone was ready to rip your head off or

threatening to fire you" (quoted in Diamond, 2021, para. 23). The discord sowed by Trump's inconsistencies, rejections, and erraticism meant that beyond his own dysregulated decision-making, "no one was in charge of the [pandemic] response… there was no accountability, and the response was rudderless" (Diamond, 2021, para. 30).

The negative impact of Trump's window on his own decision-making—and on the United States' collective approach—manifested in several ways. First, public anxiety, confusion, and distrust became widespread. By August 2020, 58% percent of Americans reported being confused by the US government's messages; 46% reported believing social order had worsened; and 47% reported expecting a second lockdown (State Policy Network, 2020). In October 2020, two-thirds of American adults said they were worried they or someone in their family would get sick from COVID-19, while 55% said they thought Trump was intervening in the Federal Drug Administration's scientific process of reviewing and approving a vaccine (Kaiser Family Foundation, 2020). Second, Trump lost re-election, as exit polls showed Americans who viewed the pandemic as the most pressing issue facing the country favored his opponent Joseph Biden (Medina and Russonello, 2020). Third, and perhaps most importantly, the United States' pandemic response was widely deemed a failure. The country has suffered more than 663,000 COVID-19 deaths, with a continued daily case rate of more than 156,000 (World Health Organization, 2021b).

DISCUSSION: DEVELOPING TESTABLE HYPOTHESES

This preliminary illustration underscores the potential impact of leaders' windows of tolerance on their decision-making, and future research should prioritize testing a number of hypotheses to causally evaluate the theory's validity. We present two sets of hypotheses to be tested. The first are *direct hypotheses*, specific predictions about the direct effects of leaders' windows on their own decision-making. The first direct hypothesis posits that leaders who have accumulated allostatic load *via* any of the three pathways explored herein are likely to have narrower windows of tolerance than those who have not accumulated such load—and thus, will have diminished capacities to engage in strategically optimal System 2 decision-making.

The second direct hypothesis posits that all leaders who face acute crises may initially experience affect arousal that extends beyond their window, but leaders with relatively wide windows will have the self-regulatory capacity to down-regulate that arousal and access System 2 decision-making. The wider the leader's window, the more quickly they should be able to regulate arousal and access optimal decision-making. In contrast, leaders with narrow(ed) windows may be unable to down-regulate their affect arousal—and therefore may find System 2 processes degraded, and stress and emotions driving their decisions, for the crisis duration.

The third direct hypothesis is that all leaders facing prolonged conflicts will experience some narrowing of their window, but leaders with wide windows will have greater self-regulatory reserves to guard against such depletion and protect their System 2 processes. In contrast, leaders with narrow(ed) windows will have fewer regulatory reserves and, as such, may remain outside their window for the duration of the prolonged stressful event, with concomitant detrimental effects on their decision-making.

In addition to these direct hypotheses regarding the window's impact on leader decision-making, we also present two *indirect hypotheses* that predict how leaders' windows shape the collective decision-making of their groups. According to the first indirect hypothesis, leaders who are inside their windows will transmit a calming, adaptive, and balanced decision-making process to their followers. Specifically, when leaders are inside their window and effectively integrating Systems 1 and 2 on a regular basis, their followers will cognitively and affectively appraise that they can take risks, speak their minds, confront difficulties, and engage in creative problem-solving. In contrast, leaders who are outside their window are likely to convey their stress arousal and negative emotions to their followers, such that the resulting contagion will push followers to insecure and defensive relational strategies that impede the group's ability to effectively cooperate, adapt, and learn.

The second indirect hypothesis builds on recent theorizing integrating the interrelationships of affect, cognition, and sensemaking within groups. Sensemaking occurs when "the current state of the world is perceived to be different from the expected state of the world" (Weick et al., 2005, p. 409). Recent research shows how sensemaking is both driven by body-based affective states and subject to cognitive and affective contagion—with such contagion moderated by leaders' sensegiving influence (for a review, see Cristofaro, 2021). Furthermore, Weick suggests that the more rigid and well-organized an individual's and/or an organization's expectations and response sequences are, the greater affective arousal they will experience at having those expectations and response sequences interrupted, in turn stimulating the sensemaking process (Weick, 1995).

With this context in mind, the second indirect hypothesis is that leaders who are inside their windows should experience more capacity for flexibility and improvisation when their expectations and response sequences are interrupted. They are less likely to perceive such interruptions as threatening and, in response, less likely to experience high levels of physiological and/or emotional arousal. In turn, they are more likely to convey a calming and creative influence on their followers' sensemaking, as well. In contrast, leaders who are outside their windows are more likely to experience high affect arousal levels at having their expectations and response sequences interrupted. They are more likely to experience difficulty in identifying other courses of action when their preferred, expected course has been thwarted. In turn, their higher arousal levels are more likely to shape their own sensemaking and—*via* contagion during sensegiving to their followers—shape their followers' sensemaking, as well.

These hypotheses offer the conceptual guidelines to effectively test the window theory, but there are also several practical considerations for future research. First, studies should consider a diversity of decision-making environments for testing the theory. The argument put forth here draws on large-scale political decision-making environments that are particularly effective incubators for affect and decision-making—but evaluating the theory's consistency across the upper echelons of smaller-scale corporate decision-making environments is essential for establishing its reliability. Second, future research should also seek to examine multiple leaders across multiple time periods, as a means of establishing the consistency and durability of the window theory's key hypotheses. Third, prospective tests of the window theory should prioritize both quantity and quality of primary source material for their assessments. Establishing detailed life histories, symptoms, and coping styles of leaders is essential to accurately evaluating the width of their windows and ensuring the findings are not overly deterministic.

Finally, future research must develop effective tests for establishing the comparative influence of the window and leaders' self-regulatory capacity against other factors that influence decision-making. For instance, classic studies comparing the structural differences of democratic systems find that the separation of powers in presidential systems leads to greater divisions in authority than the relatively centralized decision-making processes of parliamentary systems, which may translate into presidential systems experiencing a greater breakdown in decision-making, fewer commitment problems, and more durable decisions—though evidence for both systems is mixed (e.g., Lijphart, 1992; Moe and Caldwell, 1994; Tsebelis, 1995). At the same time, research exploring individual-level traits finds that gender influences the types of policies that leaders support, leaders' openness to policy change, and their inclusivity in decision-making (e.g., Weikart et al., 2007; Swers, 2020). Integrating these and other factors into any future window theory research will be essential to assessing the relative explanatory leverage of the window theory against alternative arguments. When these recommendations are applied in concert with the theory and hypotheses herein, they will ensure that the 'affect revolution' continues to nurture our understanding of strategic decision-making in a range of environments.

CONCLUSION

Theories about the relationship between affect, cognition, and political decision-making have made many advances, but have neglected affect arousal, allostatic load, and self-regulatory capacity in their efforts to explain decision outcomes. As we explore, this under-theorization largely results from their failure to consider when the deliberate cognitive strategies of System 2 decision-making may be inaccessible. Furthermore, existing theories fall short in connecting the dots between leaders' own self-regulatory capacity and its ripple effects onto their groups' decision-making and behavior. In response, we have introduced the neurobiological window of tolerance and leaders' self-regulatory capacity to clarify when affect might drive decisions for one leader but not for another.

We formally illustrated the theory's mechanisms by comparing Prime Minister Ardern's and President Trump's responses to the coronavirus pandemic in their respective nations. Ardern's relatively wide window not only directly shaped her own effective decision-making, but also indirectly affected New Zealand's successful collective response. In contrast, Trump's relatively narrow window allowed stress arousal and emotions to drive much of his decision-making, while also indirectly undermining the United States' collective response.

As noted above, using the COVID-19 pandemic to illustrate these mechanisms has some limitations—despite the important policy relevance of this example. Beyond the two nations' fundamental geographic differences (e.g., land mass and international borders) and demographic differences (e.g., population size and urban density), other factors may have influenced their respective pandemic outcomes, above and beyond the influence of the leaders' windows of tolerance. For instance, although COVID-19 vaccines were available in the United States roughly 2 months earlier than in New Zealand, the United States encountered more anti-vaccination sentiment, disinformation, and media distrust than New Zealand (Baumann et al., 2019; Myllylahti and Treadwell, 2021). The two countries' differing healthcare system enrollments—universal healthcare in New Zealand, and a private/public insurance system in the United States—may also have lowered Americans' willingness to engage with medical services for COVID-19 vaccination or treatment (Kelly et al., 2021). Furthermore, while political polarization has increased in both countries, this increase in the United States is at least three times larger than that in New Zealand—which may have influenced their respective citizens' likelihood of following government guidelines (Boxell et al., 2020).

Despite these limitations, however, this illustration offers insight into the potential explanatory power of the window theory and its application to political leadership. While the previous section outlined theoretical implications and questions for future research, important policy implications also flow from this illustration. For instance, as this illustration shows, leaders who take active steps to keep their own window wide will have more capacity for effective decision-making during crises. At the same time, leaders who prioritize self-care to stay regulated themselves—such as through getting enough sleep and cardiovascular exercise—signal to their followers that self-regulation is a critical aspect of successful performance. As a result, the entire group may come to prioritize self-regulatory behavior, which can widen the collective window. Furthermore, understanding leaders' windows and their self-regulatory capacity could (and should) aid in political leader selection in the first place, since leaders' self-regulatory capacity can play a significant role in shaping the policies that govern citizens' lives. Indeed, as the COVID-19 pandemic shows, political leaders' self-regulatory capacity

might actually influence who lives and who dies in a country's crisis response.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

KL researched and initially drafted the literature review and COVID-19 illustration sections. ES researched and initially drafted the Ardern and Trump leader window sections, as well as the theory and hypotheses sections. All authors were involved in assembling and revising the complete manuscript.

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Distributed Leadership and New Generation Employees' Proactive Behavior: Roles of Idiosyncratic Deals and Meaningfulness of Work

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New generation employees have become the main force of the organization, and their proactive behavior directly affects the organization's future development. How to effectively stimulate the proactive behavior of new generation employees has become a hot topic in the field of organizational management. Based on the integrated perspective of social exchange and self-enhancement, we constructed a multistep mediation model to explore the influence mechanism of distributed leadership on the proactive behavior of new generation employees. We designed a three-stage research method of supervisor-employee pairing to collect data from 26 supervisors and 304 new generation employees in a new energy vehicle company in East China. Results indicated that (a) distributed leadership is positively related to proactive behavior of new generation employees; (b) idiosyncratic deals and meaningfulness of work mediated the linkage between distributed leadership and new generation employees' proactive behavior; (c) idiosyncratic deals and meaningfulness of work play a multistep mediation role between distributed leadership and new generation employees' proactive behavior. These findings have theoretical implications for the proactive behavior literature and managerial implications for practitioners.

Keywords: distributed leadership, idiosyncratic deals, meaningfulness of work, proactive behavior, multistep mediation

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INTRODUCTION

New generation employees born in the "post 1980s" and "post 1990s" have gradually become the backbone and protagonist of a company, and their proactive behavior directly affects the company's future development (Fang et al., 2019). In this vein, organizations enhance the requirement of employees' proactive behavior. Managers expect employees to break the work limits, and independently identify, analyze, and solve problems, to help organizations resist external risks and maintain a competitive advantage (Riivari et al., 2020). However, with the economic development of society and changes in work methods, the traditional authoritative style of leadership can no longer adapt to the psychological characteristics of new generation employees, who use new work concepts, techniques, and social rules (Fang et al., 2019). Therefore, how to effectively managing new generation employees and fully inspiring their proactive behavior has become a new challenge for the organization managers.

Parker et al. (2010) argue that proactive behavior refers to changes made by individuals, which needs organizational and individual power and support. The motivation for new generation employees' proactive behavior largely depends on the leadership style of the leader (Fang et al., 2019). Distributed leadership is based on the concept of "respect and empowerment" in organizational management and it can adapt to the independent needs of new generation employees. Distributed leadership differs from other types of leadership where it emphasizes leadership as a practice that focuses on influence and agency through interpersonal interactions rather than formal roles, responsibilities, and actions, which has significant advantages in optimizing organizational decision-making (Quek et al., 2021). Distributed leadership means that leaders and employees can exchange roles according to the characteristics of tasks at different stages, and individuals with heterogeneous knowledge and skills could dynamically assume and replace leadership functions (Bolden, 2011).

There are many studies regarding the results of distributed leadership. In education research, scholars have found that distributed leadership positively affects teachers' attitudes and behaviors (e.g., teachers' job satisfaction, self-efficacy, and organizational commitment; Sun and Xia, 2018; Liu and Werblow, 2019). In organizational management research, scholars have proven that distributed leadership has positive impacts on individuals, teams, and organizations (e.g., it promotes employees' taking charge behavior, team performance, and organizational change; Wang et al., 2014; Butler and Tregaskis, 2018; Canterino et al., 2020). Despite these encouraging findings (Crant, 2000; Den Hartog and Belschak, 2012; Lan et al., 2020; Bohlmann and Zacher, 2021), a notable omission is the proactive behavior of new generation employees. Therefore, the first goal of this research is to explore how distributed leadership can effectively promote the proactive behavior of new generation employees.

Parker et al. (2010) pointed out that an individual mainly considers two motivational states ("can do" and "reason to") when deciding whether to implement proactive behavior. Based on the proactive behavior incentive model, the second goal of this study was to analyze the influence mechanism of distributed leadership on new generation employees' proactive behavior. First, in the workplace, new generation employees generally have needs for self-growth and development, which means they need a condition for interacting with leaders and organization contexts. In this vein, idiosyncratic deals, as work agreements reached by employees and leaders through negotiation (Huang and Chen, 2021), play an important role motivating employees' initiative (Hornung et al., 2010). Idiosyncratic deals embody employee-oriented leadership behaviors (Hornung et al., 2011), and are affected by social culture, organizational flexibility, and active family support for employees' work (Tang and Hornung, 2015; Liao et al., 2016; Tuan, 2016). In addition, idiosyncratic deals also affect employees' attitudes and behaviors (Wang et al., 2018; Ding and Chang, 2020; Kong et al., 2020). Liao et al. (2016) proposed that leadership style affects the negotiation of idiosyncratic deals. In the context of distributed leadership, each member plays an important and unique role (Torres, 2019). Distributed leadership is not only a tool for collecting scattered and professional knowledge, but also a means for further cultivating talent and tapping the potential of organizations. Obviously, previous studies have neglected the mediating role of idiosyncratic deals between distributed leadership and proactive behavior. According to social exchange theory, individuals will repay the value obtained from social interaction by positive behaviors that are beneficial to the counterparty. Therefore, in terms of the "can do" path, we propose the path of "distributed leadership influences proactive behavior through idiosyncratic deals."

Second, according to self-enhancement theory, individuals generally have the demand for self-enhancement (Alicke and Sedikides, 2009; Hepper et al., 2010), that is, the psychological motivation to construct and maintain positive self-intentions (Kwang and Swann, 2010; Vecchione et al., 2013). Generally, meaningful work can be understood as a fundamental human need, which all persons require to satisfy their inescapable interests in freedom, autonomy, and dignity (Yeoman, 2014). In reality, new generation employees have special pursuits for meaningfulness of work tasks and positive self-recognition (Mihelič and Aleksić, 2017). In this vein, distributed leadership stimulates intrinsic motivation by enhancing employees' positive awareness and affirmation of meaningfulness of work (Carton, 2018), inducing them to engage in proactive behavior. Scholars have explored the measurement methods of the meaningfulness of work (Lysova et al., 2019), dimensions (Steger et al., 2012), influencing factors (such as decent work and hope; Allan et al., 2019a,b), and consequences (such as happiness, exhaustion, and engagement Martela and Pessi, 2018; Bailey et al., 2019; Vogel et al., 2020). Some scholars are concerned that the meaningfulness of work as a boundary condition affects the impact of context on employee' positive behavior (Sa'nchez-Cardona et al., 2020; Sawhney et al., 2020). However, empirical research on the role of meaningfulness of work as mediating role between distributed leadership and new generation employees' proactive behavior is very rare. Therefore, in terms of the "reason to" motivational state, we propose the path of "distributed leadership influences proactive behavior through meaningfulness of work." Furthermore, idiosyncratic deals are not only channels for exchanging important resources with employers, but may also create greater sense of value and meaningfulness (Ding and Chang, 2020). Because social exchange is an established approach to studying idiosyncratic deals, we predict incremental effects of the self-enhancement approach: "distributed leadership influences proactive behavior through idiosyncratic deals and meaningfulness of work." The third goal of this research is to test a multistep mediation model.

We used empirical research methods to carry out research work, and found that distributed leadership positively influenced new generation employees' proactive behavior through idiosyncratic deals and meaningfulness of work. In summary, this research has made contributions in three aspects. First, we have contributed to the literature about distributed leadership by studying the proactive behavior of new generation employees. We promoted the theoretical research of distributed leadership in organizational management research. Second, we conducted theoretical analysis and testing on the mediating roles of

idiosyncratic deals and meaningfulness of work. We provided insights into how managers can stimulate the proactive behavior of new generation employees through the two paths of "can do" (sign agreements) and "reason to" (create and enhance meaningfulness). Third, we explored the multistep mediation role of idiosyncratic deals and meaningfulness of work between distributed leadership and new generation employees' proactive behavior through the integrated perspective of social exchange and self-enhancement. Our research enriches and expands the content of previous research on the proactive behavior incentive model, and provides guidance for managers to promote the proactive behavior of new generation employees from the two paths of "can do" and "reason to."

CONCEPTUAL FRAMEWORK AND RESEARCH HYPOTHESES

Distributed Leadership and New Generation Employees' Proactive Behavior

According to social exchange theory, distributed leadership allows new generation employees to assume leadership functions dynamically based on their heterogeneous knowledge and skills, which generates a basis for reciprocity for the organization and employees. This positive leadership style, in turn, promotes new generation employees' proactive behavior. First, the "principle of reciprocity" in social exchange theory emphasizes that employees who are recognized and supported by the organization will have a sense of reward, making positive behaviors to achieve organizational goals (Gouldner, 1960). Previous studies have shown that new generation employees prefer to actively undertake tasks rather than blindly accept a superior's orders (Fang et al., 2019). This makes the role exchange of leaders and employees affect new generation employees' job satisfaction and positive work attitudes (Liu et al., 2013; Sun and Xia, 2018). Positive work attitudes are conducive to promoting positive behaviors, and new generation employees will make an effort to burden proactive behavior, which can improve the organizational environment to repay the psychological benefits gained from the organization.

Furthermore, because new generation employees who advocate freedom and equality prefer a relaxed, free, and active working atmosphere, distributed leadership emphasizing shared goals and responsibilities will create an organizational atmosphere of trust, respect, and cooperation for members, enhancing new generation employee' perceived organizational support (Yang and Yang, 2020). It is worth noting that perceived organizational support is an important condition for stimulating employees' proactive behavior (Parker et al., 2006). According to social exchange theory, new generation employees with a high sense of organizational support will actively perform the "reciprocal obligation" and actively undertake proactive behavior to improve the organizational environment (Liu et al., 2013). Finally, new generation employees pursue self-direction and self-management, emphasizing their value in career development. At the same time, a distributed leader will focus on the value of each member, and encourage members to use their knowledge and skills to identify and deal with organizational problems. An open and self-organized leadership style increases the extra work engagement of new generation employees, providing the necessary prerequisites for their proactive behavior (Chiaburu et al., 2014). Therefore, we propose the following hypothesis:

> *Hypothesis* 1: Distributed leadership has a positive impact on new generation employees' proactive behavior.

Distributed Leadership and Idiosyncratic Deals

Social interaction will bring individuals benefit and value, enhancing their sense of identity, degree of attachment, and willingness to maintain an autonomous relationship with the counterparty of social interaction (Gouldner, 1960). When an organization is willing to invest in the growth of employees, employees will make corresponding efforts in return for the organization. Idiosyncratic deals are non-standardized work agreements reached by employees and organizations based on voluntary negotiation (e.g., development idiosyncratic deals and flexible idiosyncratic deals; Rousseau et al., 2006), including special training opportunities, flexible work schedules, telecommuting opportunities, and tailored compensation packages. Previous research has shown that social exchange theory can effectively explain the myth of idiosyncratic deals (Hornung et al., 2010; Rosen et al., 2013). In this study, distributed leadership meets the social exchange norms of bilateral leadership (leader and employees), interaction (mobility to assume leadership responsibilities in a dynamic context), and reciprocity (meeting the needs of leaders and employees). Therefore, we expect to explain that distributed leadership can promote mutually beneficial idiosyncratic deals between leaders and employees from the perspective of social exchange theory, and further induce new generation employees' proactive behavior. Distributed leadership implies "actively brokering, facilitating, and supporting the leadership of others" (Harris, 2013). This research believes that distributed leadership is conducive to the achievement of idiosyncratic deals. First, in a distributed context, the leader provides resources (leadership) to employees, and employees give back resources (professional knowledge and skills) to the leader. According to social exchange theory, this exchange relationship will evolve into trust, loyalty, and mutual commitment over time (Cropanzano and Mitchell, 2005), and shape an open and trusting organizational culture (Heikka et al., 2013), which provides a basis for the relationship and culture for leaders and employees to equally negotiate idiosyncratic deals. Second, Johnson (2004) pointed out that distributed leadership can be regarded as an organizational resource, but a pure organizational perspective can easily fall into "new managerialism" and reduce organizational efficiency. It is also necessary to realize the organization's daily operation from the perspective of individuals (agents). Therefore, the interaction between leaders and followers in the context of the situation is crucial to the practice of distributed leadership. When leaders are supportive and considerate, employees are more likely to successfully negotiate idiosyncratic deals regarding career

development opportunities and scheduling flexibility (Hornung et al., 2011). Third, Woods (2004) pointed out that distributed leadership is democratic, and democratic leadership can use individual potential to serve the organization. The new generation of employees in a democratic atmosphere is more likely to believe that their ideas and suggestions will be more easily accepted and adopted by the organization or the leader (Frese et al., 1997). In other words, distributed leadership provides space for the implementation of idiosyncratic deals. Finally, in "distributed" practice, organizations and managers need to strive to achieve higher efficiency, flexibility, and competitiveness (Thorpe et al., 2011). Faced with the above pressure, Chernyak-Hai and Rabenu (2018) proposed that organizations should adapt to the diversified labor force of the "new era" and introduce a unique human resource management approach that can consider different employee preferences and abilities. Previous organizations have implemented idiosyncratic deals to adapt to the individual situation of their employees (Rousseau et al., 2006). Thus, we propose the following hypothesis:

> *Hypothesis* 2: Distributed leadership has a positive impact on idiosyncratic deals.

Mediating Role of Idiosyncratic Deals

Idiosyncratic deals not only meet the personalized psychological needs of new generation employees (Hornung et al., 2008), but also improve their precepted organization image and evaluation (Ng and Feldman, 2010), and ultimately encourage them to undertake proactive behavior (Huo et al., 2014). For example, in terms of psychological needs, idiosyncratic deals enhance employees' competence, autonomy, and relationship satisfaction, and promote employees' proactive professional behaviors. For the perception of organizational image and evaluation, idiosyncratic deals can promote employees' proactive behavior through perceived organizational support and organizational-based self-esteem (Liu et al., 2013). Considering the autonomous work values of new generation employees, this study believes that the contextual characteristics of distributed leadership (bilateral, interactive, and reciprocal) are conducive to the negotiation of idiosyncratic deals between leaders and new generation employees, which in turn stimulates new generation employees' proactive behavior.

First, the organization signs idiosyncratic deals with a new generation employee, indicating that the organization respects the subjective preference of the employee for work content, and accepts that the employee makes more efforts in the direction of their own identity (Strauss et al., 2012). In other words, this kind of work autonomy is conducive to promoting new generation employees' proactive behavior for improving themselves. Second, for an organization, idiosyncratic deals are low-cost incentives that can indirectly motivate employees who advocate the organization's vision (Owens and Hekman, 2012), and inspire employees to engage in positive behaviors to improve the organizational environment. Finally, idiosyncratic deals allow employees to reorganize and configure various work tasks and resources, providing organizational support for employees' proactive behavior. For example, Hornung et al. (2010) mentioned that idiosyncratic deals could improve work flexibility and controllability, reduce work pressure, and promote employees' proactive tendency and work participation.

In summary, social exchange theory suggests that employees who obtain value and benefits from the organization will engage in proactive behavior conducive to achieving organizational goals. Thus, this study believes that distributed leadership has an impact on new generation employees' proactive behavior through idiosyncratic deals, proposing the following hypothesis:

> *Hypothesis* 3: Idiosyncratic deals will mediate the effect of distributed leadership on new generation employees' proactive behavior.

Distributed Leadership and Meaningfulness of Work

Previous studies have widely argued that the meaningfulness of work includes "bipartite value" (subjectivity and objectivity; Yeoman, 2014), and three dimensions (positive meaning at work, meaning creation at work, and strong friendly motivation; Steger et al., 2013). In this study, we formally define "meaningfulness of work" as employees' beliefs that their work has at least one distinct purpose that they also consider personally significant.

Self-enhancement depicts that people generally have a tendency to maximize their good experience and make positive evaluation of their experiences (Alicke and Sedikides, 2009), which not only enhances individuals' psychological benefits (Kurman, 2003), but also affects individuals' self-conception (Hideg and Ferris, 2014), attitudes, and emotions (Dufner et al., 2019). According to self-enhancement theory (Korman, 2012), an employee's self-enhancement motivation is most likely when he or she is in a work environment that provides both the opportunity and the encouragement to attain goals that reflect positive self-feelings and individual effort. For new generation employees, distributed leadership is conducive to evaluating the importance and value of their work, enhancing their sense of meaningfulness of work.

First, new generation employees have a psychological need for self-vale (Yang and Yang, 2020). Distributed leadership behavior indirectly shows that the organization is confident that the employee can apply his or her new skills/knowledge for the betterment of the organization. This kind of affirmation and respect from the organization will make new generation employees believe that they are individuals with independent meanings, increasing their meaningfulness of work. Second, affected by the development of the internet and the Chinese one-child policy, new generation employees often have a relatively vague job role position after entering the workplace (Zhu and Warner, 2018). Distributed leadership helps employees establish a clear career development direction. As new generation employees' sense of work direction and purpose continues to be clear, their subjective feelings and psychological experience of work will be more positive, which indirectly promotes the improvement of meaningfulness of work. Finally, new generation employees yearn for a positive working relationship and gain the trust and understanding of those around them (Xu et al., 2020). In this vein, distributed leadership can establish an atmosphere of trust between leaders and employees, encouraging new generation employees to actively cooperate, communicate,

and share with each other. This positive working relationship is more likely to increase new generation employees' meaningfulness of work (Bailey et al., 2019). Thus, we propose the following hypothesis:

Hypothesis 4: Distributed leadership has a positive impact on meaningfulness of work.

Mediating Role of Meaningfulness of Work

Self-enhancement theory suggests that when employees perceive themselves as important and of valuable positive signals from the organization, they may become more engaged and motivated to actively solve organizational problems (Liu et al., 2013). As a psychological experience of new generation employees, meaningfulness of work has a positive predictive effect on their proactive behavior. First, individuals can better obtain resources from the environment to achieve their goals and values when environmental attributes can better meet their psychological needs (Kristof-Brown et al., 2005). Employees who perceive positive psychological meanings from their work will respond positively to the environment (Lam et al., 2016). Second, the meaningfulness of work and life is always inseparable, and work is an important source of meaning in life (Steger et al., 2013). To be able to incorporate the meaningfulness of work into our lives, we must become valuers, that is, cocreators of values and meanings. Previous studies have shown that work can help individuals deepen their understanding of themselves and the world around them, promote their growth, and provide psychological capital for changing the environment and themselves (Allan et al., 2016). Finally, new generation employees have a strong and friendly motivation. They always try to achieve their greater value and make broader contributions to undertake positive behavior, such as introducing new working methods, improving work processes, actively seeking feedback, and influencing organizational strategies (Furstenberg et al., 2020).

In summary, distributed leadership promotes new generation employees' proactive behavior by increasing their meaningfulness of work. On the one hand, distributed leadership is open and equal to each team member's suggestions and ideas, which prompts employees to believe that they are individuals with independent meaning, thereby generating higher intrinsic motivation and actively engaging in work (Tu et al., 2020). On the other hand, distributed leadership respects the value and contribution of each team member. Employees will have a strong sense of identity and belonging when they are respected in the work environment. In turn, new generation employees will show repay for the organization in positive behavior. Therefore, we propose the following hypothesis:

Hypothesis 5: Meaningfulness of work will mediate the effect of distributed leadership on new generation employees' proactive behavior.

A Multistep Mediation Model

Self-enhancement is a common need in individuals (Dufner et al., 2019), which reflects that individual will be more positive in evaluating their value in the desired characteristic dimension (Cai et al., 2011). Organizational context and work forms are important exogenous factors affecting individuals' self-enhancement (Ajzen, 2002; Korman, 2012). In this research, we believe that idiosyncratic deals, as a representation of a new work form, positively impact the psychological perception of new generation employees' work significance.

Idiosyncratic deals can bring positive work results to organizations (Singh and Vidyarthi, 2018), enhancing the meaningfulness of work for new generation employees. First, flexibility idiosyncratic deals refer to special arrangements for work schedules (Hornung et al., 2010), which provides a space for coordination of work-family related issues and reduces work-family conflicts (Hornung et al., 2014). In other words, flexible idiosyncratic deals can meet the needs of new generation employees for work-life balance, and enhance their positive experience of meaning in life. Second, as for the formation mechanism of meaningfulness of work, job design is an important influencing factor of meaningfulness of work, and optimized work design methods can create more rewards and meaning (Hornung et al., 2019). Idiosyncratic deals, as a supplement and adjustment to traditional "top-down" and "bottom-up" work design methods (Grant and Parker, 2009; Hornung et al., 2010), are bound to affect individuals' perception of meaningfulness of work. Finally, self-enhancement theory shows that individuals with self-enhancement motives will always attract group members that are friendly to them. In the workplace, being kind to others often leads to positive working relationships, which may influence members' meaningfulness of work (Bailey et al., 2019). Therefore, idiosyncratic deals have an impact on meaningfulness of work for new generation employees.

Based on the above discussion, we believe that there is a multistep process "distributed leadership→ idiosyncratic deals-meaningfulness of work→ proactive behavior." Therefore, we propose the following hypothesis:

Hypothesis 6: Idiosyncratic deals will enhance new generation employees' proactive behavior both directly and indirectly through increased meaningfulness of work.

MATERIALS AND METHODS

Sample and Procedure

The samples in this study were from the same one company. And the differences between units within the company were small. Therefore, we obtained data through cluster sampling technique. To minimize the impact of common method variance (CMV) on the research conclusions (Podsakoff et al., 2003), this research designed a supervisor-employee paired questionnaire, using a three-point survey method to ensure that the research reached a scientific and reliable conclusion. At the same time, based on previous studies (Fida et al., 2018), there is a 1-month interval between each data collection. Before the formal survey, the research team negotiated with the research company to explain the research details. This survey was anonymous, the research results were only used for scientific research, and we promised to keep the information obtained

in the research strictly confidential. Finally, we two parties communicated the time for data collection. First, we marked the code for supervisors and new generation employees; then, they filled out the paper questionnaire, and only those who completed the previous survey could enter the next survey. Finally, the completed questionnaire was placed in a sealed envelope and collected by the staff. In the end, the sample of this study included 304 new-generation employees and 26 supervisors, and the effective recovery rates of the two were 87.61 and 83.33%, respectively. At time 1, new generation employees filled out the basic information and distributed leadership questionnaire; at time 2, new generation employees filled in the personalized work agreement and work meaning questionnaire; and at time 3, supervisors evaluated the proactive behavior of new generation employees. Among the 304 new generation employees, 65.37% were women, 58.05% were aged 18–25 years, 55.12% had a college degree, and 68.29% had worked less than 3years.

Measures

To improve the accuracy of expression, based on existing research (Brislin, 1970), each measurement item of key variables has been carefully modified in accordance with the translation and back-translation procedures. In this survey, new generation employees assessed three variables (i.e., distributed leadership, idiosyncratic deals, and meaningfulness of work), and supervisors assessed new generation employees' proactive behavior. A five-point Likert scale was used for the four variables scales, ranging from 1 (strongly disagree) to 5 (strongly agree).

Distributed leadership was measured through a 20-item scale (Hairon and Goh, 2015). A sample items is "My leader cares about the opinions of subordinates." Cronbach's α was 0.876. A six-item scale was adapted to measure idiosyncratic deals (Hornung et al., 2008). A sample items is "The start and the end time of work can be adjusted flexibly." Cronbach's α was 0.857. The meaningfulness of work was measured with a five-item scale (Bunderson and Thompson, 2009). A sample items is "The work I do is important." Cronbach's α was 0.890. The supervisors were required to evaluate the new generation employees' proactive behavior through seven-item scale (Frese et al., 1997). A sample item is "I actively solve problems." Cronbach's α was 0.929.

Control Variables

Following previous studies (e.g., Fang et al., 2019), we controlled for demographic variables, such as participants' gender, age, education, and job tenure that may influence proactive behavior.

RESULTS

Data Analysis

According to the research of Naz et al. (2021), PLS-SEM can be used as an effective technique for evaluating models, while avoiding the problems of data normality and sample size. Therefore, we used Smart PLS 3 to test the hypothesis. In addition, we also used PLS algorithm and bootstrapping method to test internal consistency reliability, path coefficients, and mediation effects.

Common Method Variance Test

We used the CMV test to avoid possible bias. First, we adopted the method of supervisor-employee pairing in the research design, and tracked the questionnaire data longitudinally at three-time points. Second, we conducted a confirmatory factor analysis by applying the Harman single-factor test. The result shows that the variance contribution rate explained by the first principal component was 15.859%, which did not exceed the standard 40%. Third, according to research design of Podsakoff et al. (2003), we further controlled for an unmeasured latent "method" factor to confirm Harman's single-factor test. Finally, according to the research of Kock (2015), existing work attempts to estimate CMV by the variance inflation factor (VIF) calculated by the complete collinearity test. When the VIF score is higher than 3.3, it means that the estimation model may be accompanied by CMV problems. The results of this study showed that the VIF scores of the four potential variables were all lower than 3.3, thus claimed that the data were not contaminated by the errors of CMV. As shown in **Table 1**, the four-factor model provided a better model fit than any other competition model, indicating that CMV was within an acceptable range.

Confirmatory Factor Analysis

Table 1 shows the results of confirmatory factor analysis. Among them, the four-factor model has the best model fit: $\chi^2/df = 1.683$; GFI = 0.846; RMSEA = 0.058; RMR = 0.044; CFI = 0.937; NNFI = 0.928; TLI = 0.928; IFI = 0.938; and SRMR = 0.048. Therefore, the four-factor model has a good discriminative validity, which provides favorable support for further hypothesis testing.

Descriptive Statistics and Correlations

Table 2 presents all the variables' descriptive statistics and correlations. According to the previous research (Fornell and Larcker, 1981; Naz et al., 2020), all the square roots of AVE

TABLE 1 | Analysis of confirmatory factors of competition model.

Model	χ^2/df	GFI	RMSEA	RMR	CFI	TLI	IFI	SRMR
Four factors (DL. ID. MW. PB)	1.683	0.846	0.058	0.044	0.937	0.928	0.938	0.048
Three factors (DL + ID. MW. PB)	2.872	0.694	0.096	0.066	0.796	0.780	0.798	0.068
Two factors (DL + ID + MW. PB)	3.405	0.649	0.109	0.075	0.737	0.717	0.739	0.077
Single factor (DL + ID + MW + PB)	3.721	0.623	0.115	0.079	0.701	0.680	0.704	0.081

N = 304. "+" represents two factors merged into one. DL, distributed leadership; ID, idiosyncratic deals; MW, meaningfulness of work; and PB, proactive behavior.

TABLE 2 | Statistical table of mean, SD, and correlation coefficient.

Variable	1	2	3	4	5	6	7	8
Gender								
Age	−0.043							
Education	0.117*	−0.009						
Job tenure	−0.079	0.604**	−0.305**					
DL	−0.032	−0.015	0.009	−0.041	**0.732**			
DI	−0.083	−0.023	0.025	−0.030	0.658**	**0.715**		
MW	−0.075	0.131*	−0.061	0.073	0.615**	0.589**	**0.812**	
PB	−0.059	0.086	0.061	−0.002	0.710**	0.612**	0.681**	**0.739**
M	1.652	2.529	3.333	2.147	3.517	3.334	3.493	3.627
SD	0.478	0.827	0.678	1.382	0.721	0.737	0.853	0.687

*N = 304. The diagonally bolded number is the square root value of AVE. DL, distributed leadership; ID, idiosyncratic deals; MW, meaningfulness of work; and PB, proactive behavior. *p<0.05; **p<0.01 (two-sided detection).*

TABLE 3 | Results of hierarchical regression model.

	DI			MW			PB		
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 9**
Constant	3.508**	1.066**	3.615**	0.961*	3.424**	0.968**	0.715*	0.666*	0.560*
Gender	−0.136	−0.100	−0.115	−0.075	−0.093	−0.057	−0.033	−0.033	−0.023
Age	−0.014	−0.024	0.161	0.150	0.103	0.093	0.098	0.046	0.054
Education	0.032	0.034	−0.083	−0.081	0.050	0.053	0.045	0.078	0.071
Tenure	−0.010	0.010	−0.029	−0.008	−0.033	−0.014	−0.016	−0.011	−0.013
DL		0.671**		0.729**		0.674**	0.515**	0.445**	0.383**
DI							0.237**		0.131*
MW								0.314**	0.279**
R^2	0.009	0.438	0.026	0.404	0.018	0.518	0.554	0.609	0.619
Adjust R^2	−0.011	0.424	0.006	0.389	−0.002	0.506	0.541	0.597	0.605
F value	0.446	30.868**	1.316	26.846**	0.892	42.516**	40.814**	51.045**	45.400**

N = 304. DL, distributed leadership; ID, idiosyncratic deals; MW, meaningfulness of work; and PB, proactive behavior.
**p<0.05; **p<0.01 (two-sided detection).*

for the constructs are bigger than the off-diagonal elements or coefficients in the relative columns, hence, confirming an indication of discriminant validity. The results in **Table 2** proved the satisfactory discriminant validity. As predicted distributed leadership is significantly correlated with idiosyncratic deals (r = 0.658, p < 0.01), meaningfulness of work (r = 0.615, p < 0.01), and proactive behavior and proactive behavior (r = 0.710, p < 0.01). Concerning control variables, distributed leadership was correlated with education. Otherwise, idiosyncratic deals and meaningfulness of work were correlated with job tenure.

Hypotheses Testing

To test our hypotheses, we used a hierarchical regression model in MPLUS 7.8. As shown in **Table 3**, distributed leadership positively correlated with new generation employees' proactive behavior (Model 6: β = 0.674, p < 0.01) after controlling for participants' gender, age, education, and job tenure, thus supporting hypothesis 1.

As displayed in **Table 3**, we determined that distributed leadership had a positive direct relationship with idiosyncratic deals (Model 2: β = 0.671, p < 0.01) and meaningfulness of work (Model 4: β = −0.729, p < 0.01), after controlling for employees' gender, age, and job tenure, thus supporting hypothesis 2 and hypothesis 4.

Hypothesis 3 and hypothesis 5 suggested that idiosyncratic deals and meaningfulness of work will mediate the influence of distributed leadership on new generation employees' proactive behavior. As shown in **Table 3**, the positive effect of distributed leadership on proactive behavior has been weakened, but it is still significant after adding idiosyncratic deals (Model 7: β = 0.237, p < 0.01). Similarly, the positive effect of distributed leadership on proactive behavior has been weakened, but it is still significant after adding meaningfulness of work (Model 8: β = 0.314, p < 0.01). hypothesis 3 and hypothesis 5 received support.

Following the Hayes PROCESS macro (Hayes, 2017), we applied bootstrapping (bootstrap sample size = 10,000) to obtain the bias-corrected CI to establish the significance of the mediation. Bootstrap results are shown in **Table 4**. The indirect effect of idiosyncratic deals is significant (B = 0.088, CI = [0.117, 0.162]), and the indirect effect of meaningfulness of work is significant (B = 0.132, CI = [0.080, 0.275]). Finally, the effect of distributed leadership on new generation employees' proactive behavior mediated by idiosyncratic deals and

TABLE 4 | Analysis results of multi-chain mediation.

Path	Direct effect			Indirect effect		
	Effect size	95% CI		Effect size	95% CI	
		LL	UP		LL	UP
Path 1: DL→DI→PB	0.383**	0.265	0.502	0.088**	0.117	0.162
Path 2: DL→MW→PB				0.132**	0.080	0.275
Path 3: DL→DI→MW→PB				0.071**	0.047	0.177

DL, distributed leadership; ID, idiosyncratic deals; MW, meaningfulness of work; PB, proactive behavior; LL, lower level; UL, upper level; and CL, confidence interval.
**p<0.05; **p<0.01 (two-sided detection).*

TABLE 5 | Comparative analysis of competitive models.

Model	χ^2/df	RMSEA	RMR	GFI	CFI	NFI	IFI	AIC	BIC
M1	1.943	0.079	0.021	0.977	0.966	0.965	0.971	60.000	60.120
M2	6.921	0.435	0.068	0.920	0.878	0.878	0.879	96.921	97.030
M3	4.765	0.357	0.430	0.943	0.918	0.917	0.918	85.765	85.874
M4	5.425	0.638	0.148	0.856	0.738	0.738	0.739	99.425	99.534
M5	5.398	0.248	0.026	0.971	0.960	0.960	0.961	70.398	70.506
M6	3.178	0.273	0.026	0.965	0.952	0.952	0.952	81.178	81.287
M7	5.883	0.244	0.039	0.971	0.962	0.961	0.962	68.883	68.991

meaningfulness of work is significant (B = 0.071, CI = [0.047, 0.177]), hypothesis 6 received support.

Competitive Models Analysis

This study used a competitive model strategy to verify further verify the adaptability of the research data and the theoretical model, and six competitive models were obtained, of which M1 is the initial theoretical model of this research. As shown in **Table 5**, the initial model M1 has the highest model fit. First, the load values of each factor in M1 were all >0.6 and <0.9, reaching a significant level (p < 0.01). Second, x^2/df = 1.943 < 3, RMSEA = 0.079 < 0.1, and RMR = 0.021 < 0.05, indicating that M1 fits well. Third, GFI = 0.977, CFI = 0.966, NFI = 0.965, and IFI = 0.971, all >0.9; review index, AIC = 60.000, and BIC = 60.120, which is smaller than the corresponding value of any other competition model. Overall, all the hypotheses of this study have been supported.

PLS-SEM can better handle measurement errors and provide a more accurate evaluation of intermediary relationships. In addition, PLS path analysis enables itself to fully meet the needs of application solutions, and it is relatively more advantageous to use in complex research (Naz et al., 2020). We used the software Smart PLS 3 to draw **Figure 1**. As shown in **Figure 1**, we drew a path diagram of the multistep mediation model.

DISCUSSION

We developed a multistep mediation model to examine how distributed leadership influences new generation employees' proactive behavior through the integrated perspective of social exchange theory and self-enhancement theory. The empirical results showed that distributed leadership was positively related to new generation employees' proactive behavior, which was mediated by idiosyncratic deals, meaningfulness of work, and their multistep mediation. First, distributed leadership had a positive impact on employee behavior, which was consistent with the research of Canterino et al. (2020). Moreover, we focused our research samples on new generation employees. Fang et al. (2019) explored the impact of inclusive leadership on new generation employees' innovative behavior, but they did not pay enough attention to distributed leadership. To a certain extent, we provided a supplement to the previous conclusions. Second, previous studies focused on the impact of idiosyncratic deals on employees' attitudes and behaviors (Liao et al., 2017; Singh and Vidyarthi, 2018), while ignoring the effect of idiosyncratic deals in the relationship between leadership styles and new generation employees' behavior. We provided fresh inspiration for research literature related to idiosyncratic deals. Third, meaningfulness of work was one of the psychological paths that the distributed leadership style effected new generation employees' proactive behavior. This conclusion was basically consistent with Liu et al. (2013). Recently, some scholars have paid attention to the modular meaning and mediating role of meaningfulness of work (Landells and Albrecht, 2019; Schnell and Hoffmann, 2020). However, they did not discuss the role of meaningfulness of work between leadership style and employee proactive behavior. In fact, new generation employees could effectively recognize their unique value through voluntary, equal and reciprocal work agreements, and then enhance the meaningfulness in their work. Finally, idiosyncratic deals and meaningfulness of work played a multistep mediation role between distributed

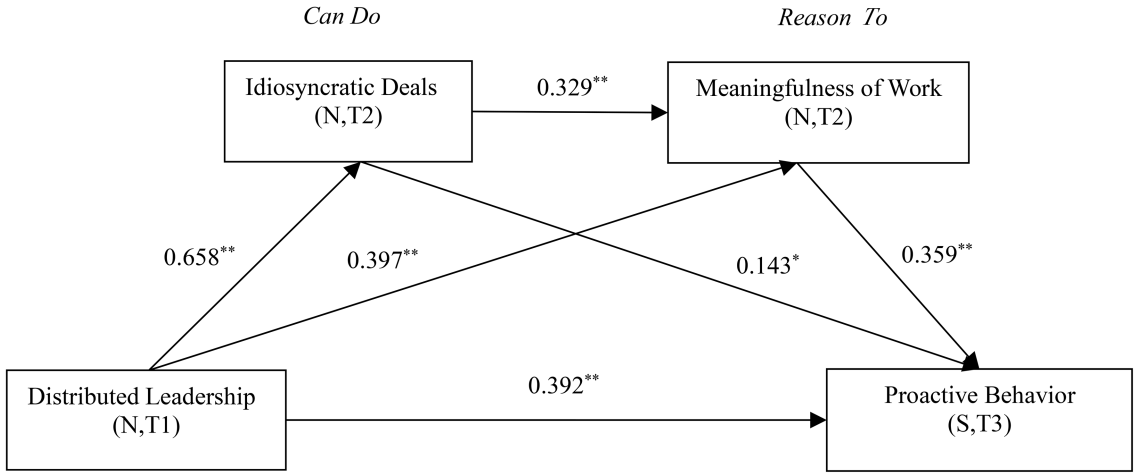

FIGURE 1 | Diagram of the path coefficients of the multistep mediation model. N = New generation employees; S = Supervisor. T1 = Time 1; T2 = Time 2; and T3 = Time 3. *$p < 0.05$; **$p < 0.01$ (two-sided detection).

leadership and new generation employees' proactive behavior. This conclusion extends the research of Hornung et al. (2011). And it supports the view that signing idiosyncratic deals between leaders and employees would not only help organizational members improve their own behavior, but also help employees build positive self-concepts as independent individuals.

Theoretical Implications

This study provides several theoretical contributions. First, our findings point to the positive effect of distributed leadership in predicting new generation employees' proactive behavior. Previous studies regarding distributed leadership mainly focus on education management (Liu et al., 2021; Or and Berkovich, 2021). Gradually, it is being favored by scholars in the field of organization management (Lumby, 2013), with a positive impact on individuals' proactive behavior (Butler and Tregaskis, 2018; Amels et al., 2020; Canterino et al., 2020), team behavior (Mehra et al., 2006; Wang et al., 2014), and organization performance (Liu and Werblow, 2019). Furthermore, previous studies have mostly explored the influence of servant leadership (Song et al., 2021) and authentic leadership (Hu et al., 2018) on employees' proactive behavior. The empirical research on the influence of distributed leadership on employees' behavior is very insufficient. It is worth noting that Fang et al. (2020) discussed the influence of leadership style on the behavior of the new generation of employees, he focused on the negative behavior (resignation behavior) of new generation employees, not positive behavior (proactive behavior). Our research has found the antecedents of the new generation of employees' proactive behavior (distributed leadership) from the leadership style, and provided a new perspective for inspiring the new generation of employees' proactive behavior.

Second, we explored how distributed leadership influenced the proactive behavior of new generation employees from the perspective of social exchange, which helped us better understand the mediation of idiosyncratic deals. Previous studies have confirmed the impact of idiosyncratic deals on employees' attitudes and behaviors from the perspective of social exchange (Liao et al., 2017; Singh and Vidyarthi, 2018; Wang et al., 2019). In terms of behavior, scholars are mainly concerned with voice behavior (Ng and Feldman, 2015), organizational citizenship behavior (Huo et al., 2014), and creativity (Wang et al., 2018). Empirical analysis of the proactive behavior of new generation employees is not sufficient. In addition, a few scholars have examined the mediation of job characteristics, social exchange, and self-improvement between idiosyncratic deals and proactive behavior (Hornung et al., 2010; Liu et al., 2013). However, they have ignored the transmission effect of idiosyncratic deals between distributed leadership and new generation employees' proactive behaviors. This research enriched and expanded the literature on the relationship between distributed leadership and new generation employees' proactive behavior by adding a substantial intermediary variable.

Third, this research responded to the viewpoint of Hornung et al. (2019) which based on the "micro-emancipatory" actions employees engage in, "bottom-up" processes create more rewarding and meaningful work experiences. It further confirmed the conclusion that idiosyncratic deals were always related to a positive work experience (e.g., meaningfulness of work). Previous research mainly used intermediary mechanisms, such as organizational-based self-esteem (Wu et al., 2019), psychological capital (Hu et al., 2018), and autonomous psychological needs (Chen et al., 2021) to study the intermediary mechanism of leadership or organizational context on employee behavior. However, from the perspective of self-enhancement, this research provided a new idea for explaining the proactive behavior of new generation employees. Distributed leadership stimulates the intrinsic motivation of new generation employees by exchanging leadership with new generation employees, enhances their self-worth and sense of work meaning, and then promotes their proactive behavior. This discovery not

only opened the black box of the new generation of employees' proactive behavior from the perspective of employee psychological experience, but also cleverly responded to emphasis of Parker et al. (2010) on the "reason to" and "can do" of the proactive behavior motivation model.

Practical Implications

Our study advances the idea that it is important to practice distributed leadership to enhance new generation employees' idiosyncratic deals, meaningfulness of work, and proactive behavior. First, our research clearly illustrates the influence of distributed leadership on the proactive behavior of new generation employees. Therefore, organizations should focus on cultivating distributed leadership and exerting the effectiveness of this leadership style in management practice. For organizational managers, the direction of leadership distribution should be carefully analyzed. Especially in the period of organizational change, managers can use distributed leadership as a strategic choice, which can help overcome the shortcomings of the pyramidal leadership structure, and better tap and release the management potential of their subordinates. At the same time, managers should also create an organizational atmosphere of openness, trust, and cooperation, and explore democratic and equal participation and decision-making mechanisms, such as brainstorming and discussion methods. Therefore, organizations should cultivate and value the positive effects of distributed leadership internally.

Second, idiosyncratic deals directly or indirectly affected the relationship between distributed leadership and new generation employees' proactive behavior. In other words, organizations should reasonably use the advantages of idiosyncratic deals in attracting, retaining, and motivating talent. For new generation employees, they had a psychological need for autonomy and respect. Managers could use idiosyncratic deals to promote and improve the resolution of complex problems, such as arranging personalized career development training for new generation employees, or regularly renegotiating work benefits with new generation employees. In addition, new generation employees pay attention to the cultivation of personal interests and work-life balance, and managers could allow new generation of employees to work remotely through negotiation. In particular, it was necessary to give play to the role of distributed management in promoting idiosyncratic deals, thereby enhancing the proactive behavior of new generation employees.

Third, distributed leadership influenced the proactive behavior of new generation employees through the meaningfulness of work. Organizations should pay attention to this discovery, encourage leaders and employees to exchange roles, assume part of the power and responsibilities within the team, and scientifically and reasonably play the role of distributed leadership in enhancing the significance of new generation employees. New generation employees have the basic needs of pursuing the meaning of work. They can enhance their sense of work meaning by gaining freedom, autonomy, and dignity in the organization. Therefore, organizations should provide employees with organizational culture, working environment, and benefits related to decent work. At the same time, the organization should adjust and improve the internal work design, give employees the necessary work autonomy, and appropriately enhance the challenges brought about by work tasks, which can effectively enhance the sense of accomplishment of employees, and cultivate and intervene in the meaningfulness of work for new generation employees.

Limitations and Future Research Directions

Although our research has certain theoretical contributions and practical implications, there are some associated limitations that might be addressed by future research.

First, this research relied only on one Chinese new energy vehicle company, which may reduce the external validity of research conclusions. Although data support all research hypotheses, this research model may not be applicable to other countries' organizations. In the future, we should add research samples from Western countries with cultural differences and perform a cross-cultural study to make the research conclusions universal worldwide.

Second, this research only explored the multistep mechanism and no moderating roles were considered, which obviously ignored the influence of contextual factors. Employees' responses to distributed leadership may vary significantly when they work in different social culture and organizational culture. Future research needs to examine the impact of social and cultural boundary conditions on distributed leadership and new generation employees' proactive behavior.

Third, there may be many specific forms of proactive behaviors in the workplace. This research did not focus on one specific proactive behavior, such as proactive change behaviors, proactive innovation behaviors, and helping behaviors. Future researches might specifically examine how distributed leadership affects other certain forms of new generation employees' proactive contribution, which could effectively deepen the conclusions of this research.

CONCLUSION

The motivation for new generation employees' proactive behavior largely depends on the leadership style of the leader. This study provides new insight into the relationship between distributed leadership and the proactive behavior of new generation employees and helps us better understand the impact of distributed leadership on proactive behavior. First, based on the integrated perspective of social exchange and self-enhancement, we constructed a multistep mediation theoretical model to explore the influence mechanism of distributed leadership on the proactive behavior of new generation employees. In China's organizational context, we find that distributed leadership has a positive effect on proactive behavior of new generation employees. Second, idiosyncratic deals play a positive role in the relationship between distributed leadership and proactive behavior of new generation employees. This finding

further deepens our understanding of the "can do" path between distributed leadership and proactive behavior of new generation employees. Third, in addition to "can do" path, meaningfulness of work lies in integrating the cognitive and evaluation aspects and plays a positive role in the relationship between distributed leadership and proactive behavior of new generation employees. This finding further deepens our understanding of the "reason to" path between distributed leadership and proactive behavior of new generation employees.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by The studies involving human participants were reviewed and approved by the Ethics Committee of Shanghai University. All participants provided active informed consent. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

SX and HZ designed the study and wrote the paper. YD collected the data and wrote the paper. LL analyzed the data. SX and JM revised and edited the manuscript. All authors contributed to the article and approved the submitted version.

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CONCEPTUAL ANALYSIS
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Intuition as Emergence: Bridging Psychology, Philosophy and Organizational Science

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Accelerating environmental uncertainty and the need to cope with increasingly complex market and social demands, combine to create high value for the intuitive approach to decision-making at the strategic level. Research on intuition suffers from marked fragmentation, due to the existence of disciplinary silos based on diverse, apparently irreconcilable, ontological and epistemological assumptions. Not surprisingly, there is no integrated interdisciplinary framework suitable for a rich account of intuition, contemplating how affect and cognition intertwine in the intuitive process, and how intuition scales up from the individual to collective decision-making. This study contributes to the construction of a broad conceptual framework, suitable for a multi-level account of intuition and for a fruitful dialogue with distant research areas. It critically discusses two mainstream conceptualizations of intuition which claim to be grounded in a cross-disciplinary consensus. Drawing on the complexity paradigm, it then proposes a conceptualization of intuition as emergence. Finally, it explores the theoretical and practical implications.

Keywords: strategic decision-making, intuition, emergence, complexity science, cross-disciplinary approach

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INTRODUCTION

"The real voyage of discovery consists not in seeing new landscapes, but in having new eyes" M. Proust

Accelerating environmental uncertainty and the need to cope with increasingly complex market and social demand, combine to create high value for the intuitive approach to decision-making at the strategic level. Nevertheless, despite the growing relevance intuition has in the context of top management decision-making, the topic is still under-investigated in terms of levels of analysis and degree of integration/interdisciplinarity.

First of all, research on individual intuition suffers from a marked fragmentation, with few interactions between groups of researchers and limited cross-disciplinary knowledge accumulation (Hodgkinson and Sadler-Smith, 2018). One reason for such fragmentation is the lack of synergies between scholars from different disciplines and, within disciplines, from different research arenas, characterized by disciplinary silos based on diverse, apparently irreconcilable, ontological and epistemological assumptions.

Advances in research on cognition, particularly the advent of bounded rationality and the increasing relevance of the affective dimension, along with the methodological developments taking place in the field of neurosciences, intensify the need for a cross-fertilization between

management and psychology. An example can be seen from the Upper Echelons Theory (UET) in its first conceptualization (Hambrick and Mason, 1984) as well as in its later co-evolutionary interpretation by Abatecola and Cristofaro, 2020, who review UET in a newfangled way. The use among upper echelon scholars of demographic characteristics of top managers as proxies for psychological ones (Finkelstein et al., 2009) is emblematic of the importance of integrating management with psychology. In view of the empirical evidence demonstrating how important psychological characteristic are (Miller et al., 1998; Samba et al., 2018), researchers find it easier to observe demographic characteristics (which can be easily measured from archival data) and draw inferences about cognitive characteristics. Recent empirical evidence suggests that such practices can lead to biased conclusions, given that demographic characteristics may not be a proxy of psychological characteristics, thus pointing to the need to integrate management studies with the most advanced psychological research acquisitions and methodologies.

As recommended by Cristofaro (2017, p. 185), a crucial challenge is to design cross-disciplinary studies which merge different approaches and provide a broader lens than those of the recent past, facing the decision-making issues from a holistic perspective.

There have been a number of attempts to develop a conceptualization of intuitive decision-making which could be testable across disciplines. The first significant attempt was Sinclair and Ashkanasy's (2005), which drew on an extensive inter-disciplinary literature review including management, psychology and neuroscience. The two authors defined intuition as "a non-sequential information processing mode, which comprises both cognitive and affective elements and results in direct knowing without any use of conscious reasoning" (Sinclair and Ashkanasy, 2005, p. 7). A couple of years later Dane and Pratt, on the basis of a comprehensive review carried out within the field of management, proposed a quite similar conceptualization of intuition—"affectively charged judgments that arise through rapid, non-conscious and holistic associations" (2007, p. 40)—that incorporates research studies from management, psychology and philosophy. This definition has been also followed by psychological scholars (Hodgkinson et al., 2008; Hogarth, 2010; Gore and Sadler-Smith, 2011). There have been other valuable reviews of intuition by Blume and Covin (2011) and Baldacchino et al. (2015), but their focus is limited to a specific of intuition, entrepreneurial intuition, and their construct consolidates the consensual elements of intuition proposed by Dane and Pratt (2007). For example, Baldacchino et al. (2015), starting from Dane and Pratt's conceptualization, propose an additional element of the conceptualization of intuition, namely domain-specific experience and expertise.

Despite the fact that Dane and Pratt (2007) present their construct as a relatively non-contentious deployment of conjectures grounded in an interdisciplinary consensus, their attempts to formulate a conceptualization of intuition which is accepted across distant disciplines do not appear to have increased conceptual integration and knowledge accumulation. In particular, despite Dane and Pratt's claim "to bridge works in psychology, philosophy and management" (2007, p. 36), there are no quotations from philosophy scholars in about 1977 works citing their 2007 article. On the whole, their cross-disciplinary conceptualization has not led to the development of a grand theory of intuition and, after more than 10 years, the matter is far from closed. Other authors who cross-disciplinarily reviewed literature on intuition, such as Carter et al. (2017), have had a limited impact to date, as proved by the limited number of quotations (22), if compared with Dane and Pratt's quotations (1977) and Sinclair and Ashkanasy (532).

In this framework, the present paper critically discusses Sinclair and Ashkanasy's construct, which has been the first significant attempt to develop a cross-disciplinary conceptualization of intuition, and Dane and Pratt's article, which has been the most influential article related to the intuition in management literature and other disciplinary fields. Dane and Pratt's article is regarded as the most comprehensive and most referenced definition of intuition (Okoli et al., 2021). Our paper analyzes the proposed intuition's attributes and assesses the degree of cross-disciplinary agreement around them, with the purpose of enhancing the intuition construct in a way that facilitates inter-disciplinary dialogue. In the light of such analysis, a definition of intuition is proposed, as "knowing that emerges out of self-organizing holistic associations," and the reasons for this emergentist account of intuition are explained in the discussion section. In the conclusive sections theoretical and practical implications are outlined as regards UET, the interaction between intuitive and deliberative processing modes, the conditions for intuition's effectiveness, the relationship with artificial intelligence, the possibility to the escalation from individual to collective decision-making. The limitations of the study as well as the avenues for future research are also highlighted.

Space permits only a brief overview of the huge literature on decision-making (the whole review is available on request), but it is sufficient to question the mainstream conjectures. We focus on the three domains which are considered in the examined articles—philosophy, psychology and organizational science/management—and identify conceptual intersections around which potential cross-disciplinary agreement on the definition of intuition can be envisaged. Drawing on complexity science, a framework to accommodate both positions is then hypothesized, which conceptualizes intuition as emergence. Finally, some implications are explored.

METHODS

In line with the aim of constructing an encompassing conceptualization of intuition, both Sinclair and Ashkanasy and Dane and Pratt propose a definition that seeks conceptual agreement across different disciplines: Sinclair and Ashkanasy (2005) include behavioral sciences (neuroscience and psychology) besides management, whilst for Dane and Pratt (2007, p. 39) the central characteristics of intuition are identified "based on their commonality to definitions across philosophy, psychology and management". In addition to their commonality,

the central characteristics also appear to be the most "core" features (p. 39), and account not just for what intuition is but also how it "differs from other decision-making approaches" (p. 40).

So, a critical revision of the mainstream definition of intuition implies checking whether such definition correctly sets out the "core" characteristics of intuition, and whether it adequately differentiates the concept from others, such as rationality, instincts, insight, and learning. In formal terms, this implies that the attributes (A) identified to define intuition (I), are necessary and sufficient conditions for inferring it; more precisely: each of the attributes (Ai) is a necessary condition for (I), and all the attributes (Ai. . .n) are, together, a sufficient condition for (I).

Such an assessment must be inter-disciplinary, since both Sinclair and Ashkanasy and Dane and Pratt target a strong inter-disciplinary agreement. Given the distance between the disciplines, various degrees of cross-disciplinary agreement are contemplated in this paper, as shown in **Table 1**, so that an agreement field is traced, showing the degree to which the different perspectives may experience interaction and build on common elements together synergistically. The table shows the following dimensions:

(a) Strong agreement: The attributes identified are necessary and sufficient conditions for intuition in the most prominent streams of research within the selected disciplinary domains;
(b) Weak agreement: There is at least one prominent stream of research in one disciplinary domain in which the attributes identified are not necessary and sufficient for intuition;
(c) Potential agreement: There are epistemological elements from which to infer that the attributes identified may be considered necessary and sufficient conditions for intuition, since they are not in contrast with the in-depth assumptions of at least one stream of research. This category allows possible cross-fertilizations to be highlighted in cases in which terms are used differently in different contexts or are not clearly defined. The alternative would be to acknowledge that no dialogue is possible;
(d) No agreement: The attributes identified are not necessary and sufficient conditions for intuition in the most prominent streams of research within the selected disciplinary domains.

TABLE 1 | Levels of cross-disciplinary agreement.

Degrees of cross-disciplinary agreement	Description
Strong agreement	The attributes identified are necessary and sufficient conditions for intuition in the most prominent streams of research within the selected disciplinary domains
Weak agreement	There is at least one prominent stream of research within each disciplinary domain in which the attributes identified are not necessary and sufficient for intuition
Potential agreement	There are epistemological elements from which to infer that the attributes identified are necessary and sufficient conditions for intuition in at least one stream of research in each disciplinary domain
No agreement	The attributes identified are not necessary and sufficient conditions for intuition in the most prominent streams of research within the selected disciplinary domains

Authors' elaboration.

It could have been sufficient to analyze Sinclair and Ashkanasy's construct, which is antecedent and similar to that of Dane and Pratt's, but Dane and Pratt's construct has been increasingly accepted in the field of management as the consensual definition; it is regarded as the most comprehensive and most referenced definition of intuition (Okoli et al., 2021): for example, Akinci and Sadler-Smith (2012, p. 115) wrote that, despite several studies flourishing throughout the years, Dane and Pratt's is the only "comprehensive, integrated account and testable research propositions". So the article has formed the basis of a number of subsequent influential literature reviews, conceptual contributions, and methodological and empirical works; drawing from it, scholars have differentiated intuition from related constructs (Hodgkinson et al., 2008, 2009a,b; Sadler-Smith, 2010, 2015, 2016; Salas et al., 2010; Blume and Covin, 2011; Akinci and Sadler-Smith, 2012, 2013, 2019, 2020; Baldacchino, 2013, 2019; Baldacchino et al., 2015; Healey et al., 2015; Pratt and Crosina, 2016; Calabretta et al., 2017; Okoli et al., 2021; Sadler-Smith et al., 2021). In addition, the article has spread over psychology and neuroscience (Hodgkinson et al., 2008; Hogarth, 2010; Gore and Sadler-Smith, 2011; Hodgkinson and Healey, 2011; Ben-Soussan et al., 2020; Keck and Tang, 2020; Korteling and Toet, 2020; Li et al., 2020; Stephens et al., 2020; West et al., 2020; Muñoz-Cobos and Postigo-Zegarra, 2021; Reynolds et al., 2021; Yu et al., 2021; Zhang et al., 2021), as well as distant disciplinary domains, such as medicine and health sciences (Glatzer et al., 2020; Cameron and Singh, 2021; Chlupsa et al., 2021) or engineering and design (Cash and Maier, 2021; de Rooij et al., 2021; Paige et al., 2021; Park et al., 2021).

In addition, compared to Sinclair and Ashkanasy (2005), Dane and Pratt's article embraces a wider interdisciplinary range which includes philosophy. This is another reason to focus attention on Dane and Pratt's article, considering that the concept of intuition (as well as many other lemmas used in managerial or psychological disciplines) has a philosophical origin, and, consequently, cross-fertilization with philosophical studies on intuition is beneficial to allow a better understanding of the historical use as well as the variety of contemporary uses of the concept of intuition.

MAPPING THE TERRITORY: CRITICAL REVIEW OF INTUITION'S ATTRIBUTES

> *"The whole object of travel is not to set foot on foreign land; it is at last to set foot on one's own country as a foreign land" G. K. Chesterton*

As mentioned in the introduction, in 2005 Sinclair and Ashkanasy proposed an overarching definition of intuition to incorporate research studies from management, psychology

and neuroscience: "a non-sequential information processing mode, which comprises both cognitive and affective elements and results in direct knowing without any use of conscious reasoning" (p. 7). A couple of years later, Dane and Pratt (2007) proposed a quite similar conceptualization of intuition—"affectively charged judgments that arise through rapid, non-conscious and holistic associations" (2007, p. 40) (p. 40)—that drew on an extensive inter-disciplinary literature review including management, psychology and philosophy. In this section, we critically evaluate the widely accepted definitions of intuition by Sinclair and Ashkanasy (2005) and Dane and Pratt (2007), with a focus on the latter. We draw on the fields of philosophy, psychology and management to identify which elements of these definitions are necessary and sufficient for a parsimonious conceptualization of intuition, on the basis of cross-disciplinary consensus (weak, strong and potential agreement, as defined in the methodological section).

Holistically Associative

According to Dane and Pratt, intuition involves a process in which disparate elements are associated with one another (2007, p. 37). Such associations are holistic, referring to whole structures or patterns, which are simplified representations of reality, implying analogical representation of information. Before Dane and Pratt, Sinclair and Ashkanasy had already included in the construct of intuition the attribute of being non-sequential/holistic, referring to information processing. In both contributions, the difference between intuitive and (what is called) rational thinking is related to the difference in type of information processing: opposed to the linear-sequential processing typical of rational thinking, the holistic-associative type is consistent with "intuitive" thinking (Barrafrem and Hausfeld, 2020; Alaybek et al., 2021; Zhang et al., 2021), so rationality vs. intuition means Fregean vs. analogical language; sequential vs. simultaneous relationships; details vs. big picture; central vision vs. peripheral vision; gaze vs. glance; text vs. context; focused attention vs. broad, open, mindful alertness.

Contrary to Dane and Pratt's assertions, our review of philosophical literature shows that the attribute of being holistically associative is not present in classical accounts of intuition, such as Descartes (1637-1998) and post-Carthusian philosophy (Spinoza, 1677–2007; Locke et al., 1690-2006), as well as the 1900s phenomenological philosophy of intuition (Husserl, 1900/01-2015). In all these, intuition does not extract one possible representation from an infinite range of possibilities but rather grasps an objective characterization of the real problem setting. An holistically associative view of intuition can be more appropriately related to emergentist or pragmatist philosophers, although these philosophical streams of thought may not expressly mention intuition.

The holistic-associative account of intuition is acknowledged by psychology scholars as well as management scholars (Agor, 1986; Dreyfus and Dreyfus, 1986; Kihlstrom, 1987; Simon, 1987; Prietula and Simon, 1989; Shapiro and Spence, 1997; Kahneman and Tversky, 2000; Betsch and Glöckner, 2010; Glöckner and Witteman, 2010). It forms the basis of spreading activation in neurological models of insight—the "aha," eureka moment of insight occurs when particular ideas fall into place, as concepts stored disparately in the brain are conjoined and the solution literally pops into consciousness. Associative reasoning represents an important feature of Type-1 processing, according to the dual-process theories of cognition.

Dual-process theories have increasingly developed in various strands of psychology research since the beginning of the new century as an attempt to capture the duality of human cognition, which is accomplished in two types of process: intuitive (Type 1), namely unconscious, rapid, automatic, and high capacity processes; and reflective (Type 2), namely conscious, slow and deliberative processes (Evans, 2010). These theories have gained legitimacy in social psychology and cognitive science over the last two decades and have been corroborated by neurosciences (Lieberman, 2007).

In the last few years, research on decision-making has tended to move progressively toward models of decision-making that acknowledge, rather than reduce, the complexity of the world, ultimately challenging the traditional hierarchical and dualistic way of thinking by proposing frameworks that comprehend and reconcile antinomies: initially there was a prevalence of the so-called *default-interventionist* of dual theories of decision-making, which assume that "a basic default position in human processing is to rely on less costly Type 1 (intuitive) processes in order to conserve the scarce cognitive resources required for Type 2 (analytical) processes, deploying the latter only as and when essential" (Hodgkinson and Sadler-Smith, 2018, p. 11); these theories have been progressively supplanted by *parallel-competitive* theories, that assume that Type 1 and Type 2 processes operate in parallel, and, in the event "of conflicts between them, they literally compete for the control of thinking and behavior" (Hodgkinson and Sadler-Smith, 2018, p. 11).

In all their various formulations, these theories regard holistic-associative as an attribute of intuitive processing. On the whole, it can be said that there is strong agreement across management and psychology that holism is a necessary attribute of intuition, but no agreement with philosophers. Therefore, Dane and Pratt's conjecture of strong cross-disciplinary agreement must be refuted, while Sinclair and Ashkanasy's conjecture, which includes only management and behavioral disciplines, is acceptable.

Affectively Charged

Dane and Pratt (2007, p. 39) state that intuitive judgments "may be thought of as affective because they are detached from rationality." So, the attribute "affective" is used because intuitive judgments appear detached from cold rationality. This argument is syllogistic: (a) intuition is detached from rationality; (b) rationality is not affectively charged; (c) intuition is affectively charged. This syllogism appears incorrect: not only does the premise (a + b) not logically imply the conclusion (c) in that "detached from" does not mean "opposed to," but the premise is not proved at all by the two authors, as their definition of rationality does not imply necessarily unemotionality.

To support their assertion, Dane and Pratt state (p.40) that "the coupling of affect and intuition has a very long intellectual history." They mention a generic "common divide in philosophy,"

which contrasts rationality/head with intuition/heart. This can be vigorously rejected. While Spinoza's concept of *amor intellectualis* (1677–2007) corroborates the idea of affective rationality, the intuition-affect association is quite extraneous to rationalistic philosophical tradition: it is present neither in the classical (Aristotle) nor in the rationalist accounts of intuition (Descartes, 1637-1998; Locke et al., 1690-2006). These remarkable philosophers regard intuition as the vehicle of apprehension of first principles and self-evident understandings that grounds all knowledge, a necessary condition for deductive thinking, since the steps in a chain of demonstrative reasoning are "intuitively grasped." Intuition is thus not in contrast to rational thinking but is the very basis on which this form of deliberative reasoning proceeds. The notion of intuition as integral to rational thinking can also be found, with all the epistemic differences, in the empiricist tradition (Bacon, 1620-1992; Locke et al., 1690-2006; Hume, 1738/40-2001), in Kant (1781-2013)) and the idealistic post-Kantian revivalin the twentieth century European philosophy (Wittgenstein, 1914-1953). It can be found, too, in the philosophy of mathematics (Russell and Whitehead, 1910; Whitehead and Russell, 1912; Hodgkinson et al., 2008; Godel, 1964/2011): intuition is considered as the basis for mathematical understanding, fundamental to rule-based reasoning and the manipulation of symbols.

As regards psychological and managerial literature, Dane and Pratt (2007, pp. 38–39) report several empirical findings from the 1980s and 1990s to support their thesis. They quote Burke and Miller's (1999) statement that "managers *often* view affect as an important input to intuition" and report Hogarth's (2001) assertion that "emotion and affect *can*, therefore, be important inputs to intuitive thought." Moreover, they refer to Bastick (1982) and Epstein (1994) to assert that emotions and affect *may* often also play a role in the intuition process itself. In light of this empirical evidence, the two authors conclude that "research suggests that affect is associated both with the intuiting process and with intuition as an outcome" (p. 39).

This conclusion is not rigorously demonstrated: the quoted studies do not prove that affect is a necessary condition for intuition since the terms used (*often*, *can*, *may*; italics added) imply possibility, not necessity. Surprisingly, Dane and Pratt themselves (2007, p. 35) report a list of definitions of intuition, of which no one includes affect or similia.

Management studies of the same period (Behling and Eckel, 1991; Isenberg, 1991; Brockmann and Anthony, 1998; Gavetti and Levinthal, 2000) also assert that affect is not a necessary condition for intuition, too. A number of studies have identified alternative forms of intuition variously incorporating hot and/or cold processes. For example, the notion of expert-based intuition does not consider affect as an essential defining feature. Recently, Cristofaro (2019; 2020; 2021) analyses in depth the role of affect in management decisions, and, in the light of a systematic literature review, synthesizes the academic research into a comprehensive framework, in which affect is an element that interacts with bounded rationality, and is always present in both intuitive and non-intuitive processes; because of that, affect cannot be a feature of just intuitive processes, rather featuring the overall management decisions in organizations (Cristofaro, 2019).

There are, in addition, a number of psychology studies of the same period that stress the cognitive nature of intuition as opposed to the affective nature of intuition (Crossan et al., 1999). Examples include the experimental psychology studies focused on the shortcomings of intuition in comparison with rationality, summarized by Nisbett and Ross (1980) and Tversky and Shafir (1992); even the two meta-analyses quoted by Dane and Pratt themselves (Osbeck, 1999, 2001) assert that affect is not an attribute of intuition.

Compared to Dane and Pratt's article, the study by Sinclair and Ashkanasy (a couple of years before) appears more balanced. The two authors propose an articulated, threefold account of the relationship between intuition and affect, where the latter may (but does not necessarily) play important roles as regards intuition. "First, in the pre-intuitive stage, affect (either trait or state) may [. . .] act as a determinant [. . .] or a moderator [. . .] of intuition. Second, during the intuitive process, some people tend to use affect as their preferred mode of reception [. . .]. In this case, affect becomes a component of the intuition construct itself. Finally, in the evaluation stage, individuals experience confirmation of the "genuine" nature of intuition through a specific feeling, such as relief or certitude [. . .]. We see this as an accompanying symptom of the intuitive process" (Sinclair and Ashkanasy, 2005, p. 358).

In conclusion, drawing on the logical considerations and empirical evidence reported above, only weak agreement across management and psychology can be proved, and no agreement at all in philosophy, so we can reject Dane and Pratt's statement that affect is a necessary condition for intuition. Obviously, this does not imply that affect cannot be an important correlate of intuition, and even if it may not be a component of the cognitive process that leads to intuition, it may well be a trigger or an accompanying symptom of it, as highlighted by Sinclair and Ashkanasy (2005). This would explain similarities across disciplines.

Unconscious, Sub-Conscious, Pre-conscious, Supra-Conscious

According to Dane and Pratt, in philosophy, the unconscious account of intuition is central. To support their arguments, they quote Osbeck (2001, p. 123), a scholar of psychology, who writes that intuition from a philosophical perspective involves direct apprehension that is "not mediated by other reasoning or representation" (Dane and Pratt, 2007, p. 37). Yet Osbeck does not mean that intuition, from a philosophical perspective, is unconscious, just "not mediated by reason."

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natures and first principles with the intellect: in her view, the best means of expressing intuition in philosophical literature is the "vision metaphor," an ancient concept maintained in contemporary discourse: it can be traced at least to Pythagoras' appeal to super-sensuous vision and to Plato's "eye of the soul," and was extended by several later scholars, such as Agostino, Descartes, Spinoza. As regards specifically the conceptual division conscious/unconscious cognition, Osbeck (2001, p. 244) observes: "this is not a relevant distinction as concerns intuition, according to the means by which this notion has been understood historically."

So, the unconscious account of intuition is not associated to the vision metaphor which is predominant in philosophy.

The concept of unconscious originated from psychological studies (Jung, 1933) and spread in management literature. However, debate still continues over how to define consciousness (Churchland, 2002) and how to establish unconscious processing, given the difficulty of separating it from conscious (Overgaard et al., 2006; Sandberg et al., 2010); in particular it remains controversial whether unconscious processes involve a rigorous all-or-none mechanism or lie on a continuum. Miller and Schwarz (2014) argue that conscious awareness of intuitive decisions builds gradually and they deny its all-or-none character. If consciousness is a fuzzy variable along an unconscious-conscious continuum, then the problem emerges of where to demarcate intuition and insight.

Management scholars appear to be aware of the debate concerning the complications of separating controlled and automatic processes, and the extent to which intuition is a conscious and/or non-conscious process. Different authors have used different labels to describe different levels of sophistication for processes that are not conscious (see Dane and Pratt, 2007): "preconscious" (e.g., Crossan and Berdrow, 2003), "subconscious" (e.g., Henderson, 1977; Khatri and Ng, 2000; Raidl and Lubart, 2001; Miller and Ireland, 2005), "unconscious" (e.g., Jung, 1933; Reber, 1992; Slaughter, 1996) and "non-conscious" (Simon, 1987; Agor, 1989; Epstein, 1994; Shapiro and Spence, 1997; Lieberman, 2000; Hogarth, 2001). Dane and Pratt use the term "non-conscious" to encompass all levels beyond an individual's consciousness. This is not original, since Sinclair and Ashkanasy in 2005 used the term non-conscious, drawing on Wally and Baum's (1997) portrait of intuition. However, there is contradictory evidence about that. For example, Strack and Deutsch (2004) provide evidence that reflective and reflexive cognitive processes co-occur, concluding, in line with other scholars (Dijksterhuis, 2004; Ham and Van den Bos, 2011), that conscious thinking is a combination of conscious and unconscious processes.

In conclusion, the term "non-conscious," used by Sinclair and Ashkanasy and then adopted by Dane and Pratt, appears more appropriate than other nuanced concepts such as "unconscious," "pre-conscious," "sub-conscious" and "supra-conscious", but it is indeed called into question by a number of empirical studies. So, Dane and Pratt's conjecture that there is strong interdisciplinary agreement about the attribute "non-conscious" as a necessary condition for intuition should be rejected, since only weak agreement can be envisioned across management and psychology, and no agreement with philosophy.

Fast and Direct

The characteristic of intuitive synthesis that has garnered the most interest among both scholars and practitioners is the speed at which it leads to choice (Patel et al., 2019). For upper echelons in particular, the speed of intuitive synthesis has great appeal and is seen as the primary driver for developing, promoting and using intuition at work (Agor, 1986; Burke and Miller, 1999; Khatri and Ng, 2000; Klein, 2003). This is indeed the element which differentiates Dane and Pratt's (2007) construct from Sinclair and Ashkanasy's (2005) construct: namely the attribute "fast" instead of "direct." To corroborate the conjecture of strong interdisciplinary agreement on the attribute "fast," Dane and Pratt (2007, p. 34) quote two philosophers, Wild (1938) and Rorty (1967), making indeed a big philosophical mistake: both philosophers use the term immediate "immediate apprehension"—but not in the temporal sense of rapidity, rather, in the logical sense of "without any mediation." In addition, Rorty reports this definition as classical philosophers' definition, not as his own, and follows Peirce's (1970) critique of intuition, according to which intuition is never immediate, it is always mediated.

While directness of intuition is central to Western philosophers, the idea of fastness as a necessary characteristic of intuition, distinguishing it from rational thinking, is not present in most philosophical accounts of intuition, such as Plato's *nous*, Aristotle's *noesis* (Zalta, 2004), Descartes (1637-1998) *intuitus mentis*, Spinoza's (1677–2007) *scientia visionis* or Husserl's 1900/01-2015 phenomenological intuition.

As regards the psychological and managerial literature, lengthy intuitive processes are evidenced in notable empirical studies. Besides Hogarth's (2001) study, quoted by Dane and Pratt, there are studies on the "unconscious thought effect" (Dijksterhuis, 2004; Dijksterhuis and Nordgren, 2006), suggesting that extended processing time may precede some forms of intuition, such as creative intuition and problem-solving intuition. These studies show that, in complex intuitive tasks, deciding after unconscious thinking for a couple of minutes produces superior performance compared to an immediate decision. The superiority of long-lasting over instantaneous intuition seriously undermines the idea of fastness as integral to the concept of intuition, suggesting that a time-consuming, non-conscious elaboration process may occur before intuition emerges.

Dane and Pratt solve this contradiction by recurring to the concept of incubation (Gilhooly, 2016) and distinguishing between "intuition," the territory of pure unconsciousness, and "insight," a concept used in psychology (Zander et al., 2016). They define insight as "conscious recognition of the logical connections" supporting a particular solution, and articulate it in two discrete steps (analytical and intuitive); yet they do not demonstrate this, and, indeed, it is hard to demonstrate, due to the ubiquitous continuity of mental activity (Chia, 1998). Dane and Pratt (2009) themselves, in a later article (2009, p. 27), warn: "researchers must also be cautious to avoid dismissing certain

forms of cognition (e.g., processes that involve incubation) as definitely non-intuitive, as doing so might minimize the power and richness of the intuition constructs"; they recognize that not only insight but also creative intuition appears to be preceded by an incubation period. So, creative intuition would be an example of slow intuition. In addition, examples of slow intuition are quite frequent in collective decision-making.

Indeed, rather than economies of time, it can be demonstrated (going back to Sloman, 1971), that economies of effort stem from holistically associative intuitive processes, which are based on analogical processing (these have to do with directness).

In conclusion, contrary to Dane and Pratt's assertion, there is no strong agreement within and between the three disciplines (and even within Dane and Pratt's scientific production itself) that the attribute fast is a necessary condition for intuition; there is only weak agreement across psychology and management. However, rather than demonstrating economies of time, it is possible to demonstrate economies of effort stemming from the analogical, synthetic nature of intuitive processing.

OVERVIEW: SEARCHING FOR INTERSECTIONS

"It is not down in any map: true places never are." H. Melville

The results of the analysis are synthesized in **Table 2**, which shows, for each proposed attribute, the sources that disagree that it is a necessary condition for intuition. Despite what declared by Dane and Pratt, for none of the attributes they identified there is full cross-disciplinary consensus: the attribute "affectively charged" is put in question by significant streams of research in the three disciplines, the attributes "non-conscious" and "fast" are questioned by significant streams of behavioral research, besides philosophy, while the attribute "holistically associative" is not in line with philosophical literature. On the whole, a strong agreement can be advocated only as regards management studies, while there is a weak agreement with psychology studies, and no intersection with philosophy: in their effort to compress the notion of intuition into mainstream psychological and managerial categories, Dane and Pratt have misinterpreted philosophical research on intuition.

Strikingly, the conceptualization provided by Sinclair and Ashkanasy 2 years before Dane and Pratt appears more appropriate: the attribute "direct" in place of "fast" appears more in line with philosophical accounts of intuition, albeit Sinclair and Ashkanasy never claim to bridge management and philosophy, while the term "knowing," conveying the idea of both a process and its outcome, appears more appropriate than the term "judgment" used by Dane and Pratt, which only focuses on the conclusive outcome, and, moreover, implies careful reflection. Furthermore, Sinclair and Ashkanasy provide a more detailed account of affect, acknowledging that it is not always an integral component of the intuitive process: in some cases, it may be involved in the antecedent or subsequent processes.

Another weakness of Dane and Pratt is that, in their attempt to provide an encompassing account of intuition, they mistakenly treat intuition's attributes as necessarily co-occurring. This has been widely accepted amongst scholars (Calabretta et al., 2017) and has inspired a number of empirical studies. Readers tend to align all of them, so that intuitive processing must be hot/non-conscious/holistic/fast, while analytical processing must be cold/conscious/sequential/slow. As a consequence of this, Dane and Pratt have dismissed certain forms of cognition (cold or slow intuition) as definitely non-intuitive, thus missing the opportunity to increase both the richness of their construct and its suitability for interdisciplinary dialogue. Surprisingly, Sinclair and Ashkanasy's 2005 conceptualization is richer in that it includes cognitive processes involving incubation, or entailing affect not as component of the intuitive process, but as trigger or symptom of it.

In conclusion, contrary to Dane and Pratt's claim, the four attributes—affective/non-conscious/holistic/fast—are not necessary features of intuition, but are simply correlate features that may occur under specific conditions.

To have an agreed definition of intuition, it would be necessary to identify defining features, namely attributes, that are cross-disciplinarily considered necessary conditions, and, all together, sufficient conditions for intuition. Indeed, managerial and psychological literature, on the one hand, and philosophical literature, on the other, appear incommensurate: they have no common denominator. Nevertheless, to benefit from interdisciplinary dialogue and cross-fertilization, it is still worthwhile searching for potential agreement across the three disciplines. So, we identified two potential intersections.

An Intuitionist View of Intuition

On the one hand, there is an intersection around the notion of intuition as immediate apprehension, which is meaningful for classical philosophers (called intuitionists) but not corroborated by the mainstream psychological and managerial literature reported by Sinclair and Ashkanasy and by Dane and Pratt. Indeed, such an intuitionist notion has potential for agreement with various types of foundational theories sharing a universalistic and ahistorical viewpoint.

More specifically, as regards management, this foundational view of intuition is epistemologically congruent with early management theories which aimed to base the grounding of knowledge (previously provided by experience) in objective scientific principles. These range from Taylor's scientific management in its various national declinations, such as German rationalism, Russian Taylorism and French rational administration and technological utopianism, to the more recent neo-Tayloristic developments of management science which have deeply shaped modern society and still do.

All these theories have an epistemological affinity with classic philosophers in being intuitively grasped and presented as truth, absolutely valid and universally applicable in any context, independently from their temporal and geographical collocation. An aspiration to escape temporality and contingency can also be found in normative theories of business ethics such as social contracts theory, stakeholder theory, utility-rights-justice-care, and deontology-utilitarianism.

TABLE 2 | Sources that disagree with the proposed attributes of intuition.

Necessary and sufficient conditions for intuition	Management	Psychology	Philosophy
Holistically associative	–	–	**Disagree** (Descartes, 1637-1998; Spinoza, 1677–2007; Leibniz, 1720-2001; Husserl, 1900/01-2015)
Affectively charged	**Disagree** (Behling and Eckel, 1991; Isenberg, 1991; Brockmann and Anthony, 1998; Gavetti and Levinthal, 2000)	**Disagree** (Nisbett and Ross, 1980; Tversky and Shafir, 1992; Crossan et al., 1999; Osbeck, 1999, 2001; Kahneman and Tversky, 2000)	**Disagree** Aristotle (Bacon, 1620-1992; Descartes, 1637-1998; Locke et al., 1690-2006; Leibniz, 1720-2001, Hume, 1738/40-2001; Kant, 1781-2013), Zalta, 2004), early (Russell and Whitehead, 1910, 1912; Wittgenstein, 1914-1953; Hilbert, 1925-1983; Godel, 1964/2011; Hodgkinson et al., 2008)
Non-conscious	–	**Disagree** (Osbeck, 1999, 2001; Dijksterhuis, 2004; Strack and Deutsch, 2004; Overgaard et al., 2006; Sandberg et al., 2010; Ham and Van den Bos, 2011; Miller and Schwarz, 2014)	**Disagree** Pythagoras, Plato (Agostino, 1387-2002, Descartes, 1637-1998; Spinoza, 1677–2007; Zalta, 2004)
Fast	–	**Disagree** (Hogarth, 2001; Dijksterhuis, 2004; Dijksterhuis and Nordgren, 2006)	**Disagree** Plato, Aristotle (Descartes, 1637-1998; Spinoza, 1677–2007; Husserl, 1900/01-2015; Zalta, 2004)

Authors' elaboration.

As regards psychology, the intuitionist view of intuition is congruent with early psychological studies of not only cognitivists but also moderate constructivists, such as Bruner (1986), Harré (1986), and Osbeck (1993), who recognize an (at least partial) ontological independence of reality from social construction.

This cross-disciplinary intersection is only potential, since most of the mentioned management and psychology scholars do not refer to the concept of intuition, but is valuable: "appeal to some versions of direct apprehension has been central to philosophy almost from its inception and the need for this appeal does not disappear in contemporary theory" (Osbeck, 2001, p. 127). Adopting an intuitionist view allows contemporary research on intuition to be aligned with historical philosophical accounts thereof, thereby highlighting its deep historical embeddedness.

An Anti-intuitionist View of Intuition

On the other hand, there is an intersection around Sinclair and Ashkanasy's conceptualization of intuition, which is far from the classical philosophical account of intuition, but compatible with an anti-intuitionist epistemology, as expressed by Wittgenstein (1953, 2017)—considered the greatest twentieth-century philosopher (Lackey, 1999)—in what is considered one of the most influential twentieth-century works in cognitive science. This author denies intuition as immediate apprehension and truth as objectively existent. In his view, which we define as anti-intuitionist, truth is not intuited by the mind but is, instead, constructed in localized contexts through linguistic processing, which occurs unconsciously under standard conditions. This automatic process, based on holistic processing, can be assimilated to the notion of intuition proposed by Sinclair and Ashkanasy, involving directness and non-consciousness as likely correlate features. Also the attribute of affect is an expected correlate feature of this conceptualization: if intuition is an act of interpretation linking the world to the intuitor, the full fabric of such an interpretative act is inclusive of feelings and emotions, which are part of the intuitor's semantic horizon.

As for the intuitionist view of intuition, the intersection around an anti-intuitionist view is only potential, yet it offers great opportunity for enriching the concept of intuition, particularly for contemplating different time spans, several mediating and moderating contextual variables, and multiple levels of analyses.

DISCUSSION: AN EMERGENT VIEW

"All journeys have secret destinations of which the traveler is unaware." M. Buber

The anti-intuitionist account differs significantly from the intuitionist alternative, as can be highlighted by expressing both in formal and compacted terms.

In the intuitionist view, X has the intuition that Y, merely on the basis of grasping Y; in the anti-intuitionist view, X has the intuition that x, based on holistic extraction of the pattern y from the space of possibilities Y.

These schematized differences can be ascribed to the opposite underlying paradigms, synthesized below.

The intuitionist interpretation of intuition is consistent with a positivist perspective, focused on a phenomenal world irreducibly and unproblematically intuited by a disinterested actor who remains external to what is being intuited and passive (the world is given to the intuitor).

The anti-intuitionist account of intuitive judgments is consistent with a constructivist perspective, where the role of the subject is active, contextually embedded, and time-situated.

In light of the above considerations, two questions emerge. Firstly, does there exist an overarching framework that encompasses the two accounts of intuition, or are the two incommensurable in a Kuhnian sense? Secondly, would such a framework offer new theorizing or would it resemble a 1:1 scale map, which includes everything and provides no additional value? To tackle these questions, an overarching framework is hypothesized, and its implications are evaluated.

Intuition as Emergence

Intuition could be conceived as emergence—a new property that emerges in a decisional space. This concept concerns the supervenience of a property within a whole system, which cannot be reduced to the properties of the individual parts and cannot be predicted before it manifests itself *de facto*.

An example is sodium chloride. Sodium is a soft, shiny metal, that is inflammable if put in the water. Chlorine is a toxic gas used as a lethal weapon during the First World War. Knowing the properties of these two components, one would not predict that their combination produces a delicious adornment to fried potatoes. The properties of the chemical combination of sodium and chlorine can be predicted after seeing what they *de facto* produce. Moreover, as a characteristic, salty explicates itself in relation to an experiencing subject and cannot be imagined in the absence of such a relationship. This suggests that supervenient properties are not simply intrinsic to the system to which they are attributed but are, instead, essential relational properties (Zhok, 2011). Similarly, intuition emerges from the relationship between the intuiting subject and a set of cues characterizing his/her task/environment: as salty explicates itself in a dynamic relationship with the perceiving subject, intuition explicates itself in a dynamic relationship with the intuitor.

The phenomenon of emergence implies non-linearity: if we admit that relationships between irreducible units produce second-order properties, we can expect discontinuities in the production of effects. Discontinuities and thresholds exist throughout our natural world: not all that happens within a system (cell, organism, etc.) transmits its effects to the superior level; below certain thresholds, nothing passes from one level to that above (which also explains why autonomous entities exist), while, over certain thresholds, a phase transition to a superior order emerges. This also occurs at the infinitesimal level: in quantum theory, energy can be transmitted or adsorbed only discontinuously, by quanta, which implies that not always and not all energetic variations produce effects.

Similar discontinuities might occur at a mental level. It can be hypothesized that the huge volume of cues—as filtered by our perceiving system from the infinite space of possibilities, and combined with the information stored in memory—forms a temporary network (the problem space) which, under external perturbations, is elaborated through iterative associations at a non-conscious level, such that several parallel processes can self-organize without being coordinated by a deliberate system. Drawing on Glöckner and Betsch (2008), we can hypothesize that self-organization is governed by simple order-generating rules, such as consistency: when an association combining several nodes (cues and options) reaches a certain threshold of consistency, intuition emerges as a stable solution which activates the option allowing the threshold to be reached.

In conclusion, the following conceptualization could be proposed: *intuition is knowing that emerges out of self-organizing holistic associations*. In this proposition, the properties of self-organization and emergence are the defining features of intuition. The concept of self-organization replaces the attribute "non-conscious," allowing the subtleties and difficulties highlighted in the previous paragraphs to be overcome; as observed, it is necessary but not sufficient, since it does not allow instincts and habits to be differentiated. Such differentiation is possible if the property of emergence is added: while in habitual or instinctive processes there is no emergence and no learning (Brown et al., 2020), in intuitive processes, new properties emerge from the interaction of individual cues which are not present in the single parts (leading to the solution of a problem, a creation—i.e., new knowledge).

Besides its philosophical meaning, the term "emergence" conveys the idea of reaching the end of a process, therefore simultaneously conveying the idea of a process and of suddenness, and so it appears more appropriate than "arise," proposed by Dane and Pratt, evoking mere occurrence.

For the same reason, instead of the term "judgment"—which is a noun—used by Dane and Pratt, the term "knowing" is preferred. Being both a verb and a noun, "knowing" conveys the idea of both a process and its outcome. In this way, the term gives the idea that intuition is never fully accomplished and stable: in fact, it is not only the output of a cognitive process but also one of the myriad cognitive inputs from whose interaction other intuitions will emerge in a seamless cognitive flow.

The attribute "holistic" has been excluded from the proposed conceptualization so as not to violate the fundamental scientific principle of parsimony (Hodgkinson and Sadler-Smith, 2018), since the philosophical concept of emergence entails the idea of holism. For the same reason other properties deriving from the emergent character of intuition need not be reported in the definition, such as unpredictability *ex ante*, situatedness, interactivity or generativity.

Alongside the above parsimonious conceptualization, stripped down to what is absolutely necessary, we can have an elaborated version of intuition with the features that are very often present, including not only those identified by Sinclair and Ashkanasy or Dane and Pratt, but also other interesting features such as experience and expertise, as proposed by Baldacchino et al. (2015) and Baldacchino (2019). Further studies are needed to assess if these attributes can be put in relation to different types of intuition (creative intuition, expert or problem-solving intuition, etc.). In the emergentist account, all intuition's attributes can also be observed in the process of insight, well understood in cognitive psychology and social cognition. The differing length of insight and intuition could be due not to differences in the nature of the process (as implied by Dane and Pratt's distinction) but rather to the quantity of exploration needed to reach a consistency threshold, or, in other words, the degree

of recursivity of holistic associations—namely, the number of iterations necessary to reach such a threshold. The wholeness of insight, which fragments under Dane and Pratt's (2007, p. 40) two-stage conceptualization based on non-conscious incubation and conscious insight, appears better denoted by the emergentist view, entailing an evolutionary path characterized by continuity (iterative holistic associations) and discontinuity (emergence).

THEORETICAL AND PRACTICAL IMPLICATIONS

From a theoretical point of view, the conceptualization of intuition as emergence appears consistent with empirical evidence, particularly relevant for upper echelons. It corroborates in particular the evidence that the intuitive information processing is not necessarily analogous to the actual use of intuitive processes (Blume and Covin, 2011; Baldacchino, 2013) since, in contrast with earlier studies (Sinclair and Ashkanasy, 2005; Evans, 2010), depends on self-organizing processes. Further research is required to explore intuition preferences at the strategic level vs. the actual use of intuitive processes, as well as their relationships with experience and various features of context. Furthermore, the emergentist conceptualization relies on a complexity narrative that, with its capacity to transcend antinomies, can accommodate opposed views in a true Hegelian fashion. In particular, the use of intuition alongside analysis should be explored, to shed light on how these two processing modes interact in shaping upper echelons' strategies, and to enhance our understanding of dual-process theories.

Moreover, the emergentist account of intuition renders futile the search for a deterministic relationship of intuition effectiveness with static antecedent conditions, such as the complexity of cognitive schemas or the structuredness of tasks. Dane and Pratt model suggests that "cognitive schemas must be domain relevant and complex to generate accurate intuitive judgments" (p. 50), while tasks must be unstructured. This proposition can be enriched by asserting that specificity and complexity of cognitive schemas must be regarded *in relation to* the specific task/environment, in line with our view that intuition emerges from the relationship between the intuiting subject and a set of cues characterizing his/her task/environment. This can be articulated by taking into account the development of behavioral research on decision-making, which focuses on the interplay between the task/environment and the decision-maker, taking the move from the seminal studies of "fast and frugal heuristics" (Gigerenzer et al., 1999), the "adaptive toolbox metaphor" (Gigerenzer and Todd, 1999), and the "adaptive behavior and cognition" (Gaissmaier et al., 2008; Newell and Bröder, 2008; Rieskamp, 2008). According to Gigerenzer, the repertoire of mental shortcuts that human mind uses to arrive at a reasonable judgment, capitalizing on its cognitive limitations as well as on environmental limitations, is not generically effective or ineffective but rather it is ecologically rational, contingent upon its match with the demands of the task and the environment. Consequently, it is insufficient to look separately at persons and tasks, rather it is important to look at their interaction: the level of expertise of a person can be evaluated in relation to a specific task, while the level of structuredness/novelty of a task depends on the decision-maker (Lichtenstein and Slovic, 2006). In other words, we could say that people are experts in particular tasks and not in others, and tasks are complex or emotion-laden for some decision makers and not for others. In this perspective, the "mental model of the task" is the key driver, thus challenging the idea that tasks/environments are objective and stable entities, and building a bridge toward philosophical research. The practical implications are notable: for example, executive team composition should be engineered to match diverse tasks' expertise with different decision-making scenarios, and career paths should be designed to acquire expertise useful for different decision-making contexts. The phenomenal plurality of intuition outcomes could be explained, too, thus providing suggestions in case of intra-personal inconsistency and possible strategies.

Conceived as emergence, intuition is unpredictable but intelligible, in the sense that it should be possible to identify its evolution pattern. That something might be irreducible does not prevent hypothesizing a theory of how this irreducibility emerges as a consequence of agent interaction: there is an inherent rationale for how the system unfolds; a generative process that transcends the connection of causes and effects. This is another important avenue for research. Barney and Felin (2013, p. 147) recommended that appeal to emergence should not be a means to obfuscate explanation "by hiding the actual mechanisms, processes, and actors that lead to the emergent outcome." In line with this, the "emergentist" view of intuition should be regarded as a reason to study the phenomenon in depth, seeking—not escaping—scientific explanations.

Such a view opens up to study the use of artificial intelligence in support of managerial decision-making, allowing investigation of whether complex domain-relevant schemes could be transferred to automated information systems, a question posed by Dane and Pratt (2007, p. 49). In fact, it allows a clear distinction between what can be automated (rational processes) and what is irreducible (intuitive processes—emergent, so not reducible). However, this distinction holds *ex ante*. The outcome of intuition cannot be predicted, but once it has emerged, the process can be automatized (transformed into a machine-compatible representation language), since machines can be "trained" and can therefore compactly store and quickly use decision models developed intuitively.

The combination of intuition and AI will be useful when the conditions of intuition's effectiveness are met, related to the effectiveness of the expertise of the human decision-maker in relation to the properties of the task. As suggested by Vincent (2021, p. 431), "if the decision maker is a novice, it may be prudent to delegate decision-making authority to AI regardless of whether the task is structured or not, since the novice will not have the capacity to supplement or correct a decision derived through extensive computation. Likewise, if the task is structured and an accurate decision can be derived through logical analysis, the decision should be delegated to AI because not even expert humans can match the speed and analytic capabilities of computer systems."

The challenge is to integrate human and IT resources so as to automate everything automatable, thus freeing human energies for intuition. The equilibrium is dynamic: as the environment evolves, with cues changing or new cues emerging, the automated system should be reassessed. Human intuition is needed for this, and broad, open and vigilant mindfulness is required. So, while advances in IT reduce the use of intuition in the workplace, human beings will always be the guiding force (Sibanda and Ramrathan, 2017).

It is important for future studies to connect the two areas of intuition and information technology, since such research has been quite limited to date (Sibanda and Ramrathan, 2017). Further studies are particularly needed regarding human resources training and development. To ensure that each level of the organization can take full advantage of available IT tools, it is important to study how to reskill the workforce. Knowledge is also required on how to create new roles (such as Chief Analytical Officer or Chief Information Officer) to act as a bridge between business and IT. To avoid deskilling from automation, studies should focus on how to develop human intuition: as Levinthal (2011) observes, it is more important to develop intuition than rationality, since analytic thinking can be supported by automation while intuitive thinking cannot.

The conceptualization of intuition as emergence is also suited to the task of analyzing intuition across levels of analysis, considering in particular the escalation from individual to collective decision-making, which are common dynamics at the basis of management decisions in organizations (Cristofaro, 2019). Although scholars have traditionally explored intuition at the individual level, it may occur at any level of a human organization: it may emerge within a group through the complex interactions among individual intuitions, thus generating a cognitive system that cannot be reduced to the intuitions of individual group members (Huber and Lewis, 2010; Healey et al., 2015). While the findings of research on individual intuition have application to group situations, research on group intuition as a unique phenomenon is quite scarce. In particular, business applications of intuitive processes at the group level have yet to be fully explored.

We need also to explore how individual and group intuition aggregates at the organizational level, including how intrapersonal and interpersonal processes combine to produce emergent phenomena, and how the organization itself, as a social context, affects and shapes individual and group intuitions. As articulated by Heath and Sitkin (2001), cited by Barney and Felin (2013), we need theories of intuition in and of organizations. As reported by Stinchcombe (1990, p. 341) and Barney and Felin (2013) argued that "any theory of organization must explain how organizations can be more rational than individuals (though of course they are not always)." We could enrich this argument by adding "and more intuitive."

CONCLUSION

"A foreign country is not designed to make you comfortable. . ." C. Fadiman

To date, the multiplicity and fragmentation of intuition studies, albeit affording much richness and breadth, have resulted in atomistic evolution of research, with few exchanges across disciplines and unrelated groups of researchers, increased replications and redundancies in fieldwork, and limited conceptual integration and knowledge accumulation.

Both Dane and Pratt and Sinclair and Ashkanasy provide a coherent integration of seemingly disparate findings and theories of intuition, bringing order to the anarchy and valuably opening a dialogue with psychology and philosophy. The openness to philosophy is beneficial to allow a better understanding of the historical use as well as the variety of contemporary uses of the concept of intuition but, notwithstanding Dane and Pratt's claims, no significant dialogue with philosophers has developed, as confirmed by the lack of philosophy scholars commenting on or quoting their work. Dane and Pratt's authoritative and conceptually appealing statements are widely employed but rarely challenged, risking the perpetuation of contestable assumptions and discouraging efforts toward a richer conceptualization of intuition. After 10 years, a grand theory of human intuition is still lacking.

Standing on the shoulders of giants, we have sought to build on these works by proposing a framework that facilitates interdisciplinary dialogue. Our critical analysis indicates that there is no strong interdisciplinary agreement on Dane and Pratt's conceptualization, which is far from offering a consolidated philosophical account of intuition.

Notwithstanding the difficulty of finding agreement between distant disciplines such as philosophy and management, we identified two areas of potential agreement—an intuitionist and an anti-intuitionist view of intuition—that can be broadly associated with the two contrasting paradigms of positivism and constructionism. Both views can be considered valuable: the first strengthens intuition's conceptual framework by reference to its epistemological heritage, thus favoring legitimacy and potential dialogue with important pieces of classic philosophy; the second directs the dialogue to twentieth-century philosophers so as to encompass a post-modern conceptualization of intuition, sensitive to both time and context.

Exploring the possibility of connecting the two contrasting positions without imposing an artificial unity, we conceptualized intuition as emergence. This account of intuition offers a theorization of a different logical type, just like binocular vision: the extra depth offered by three-dimensional vision is of a different logical type to the two-dimensional vision each eye offers to the brain (Bateson, 1979, p. 84).

An important limit of paper is that it addresses just the two definitions by Sinclair and Ashkanasy and by Dane and Pratt. Future scholars can enhance this research by including other points of view. Therefore, it is premature to posit this conceptualization as shared territory for the evolution of intuition theories, and, as shown in the previous paragraph, in-depth studies are needed to evaluate it. However, the paper undoubtedly helps to tackle a multi-faceted challenge. It provides a broader account of intuition, which encompasses

relevant cognitive processes such as cold intuitive processes or those (creative, problem-solving, insight) that are contingent on an incubation period, as well as a range of behavioral possibilities other than engaging in conscious thinking or acting immediately upon instant judgments. Besides, it recognizes the interpenetrative and indivisible character of intuitive experience, resisting the overwhelming tendency to spatialize time, which is the dominant, positivist mode of thought governing most studies on intuition, such as that by Dane and Pratt, who conceive intuition and insights as discrete moments deterministically caused by discrete antecedent factors. Finally, with awareness rising that scientific progress is likely to be enhanced from seeking a wider perspective acknowledging the potential contributions of other source disciplines, it can favor fruitful dialogue with scholars from different fields of study, particularly philosophy, thus contributing to the shared cross-disciplinary construction of a grand theory of intuition, like a multi-voice harmony in a jazz ensemble.

There is still a long way to go, and it is not an easy journey for many management scholars, who have been trained to see orderly and linear patterns, lacking the metaphors that allow them to see non-linearity. The difficulty of breaking from positivist views that have dominated our western thinking is evident from the two articles discussed: they embrace a positivist approach that sits uneasily with the epistemology that their own intuition construct implies. Undoubtedly, using emergence as a metaphorical device requires stepping out of the metaphysical comfort of positivism.

AUTHOR CONTRIBUTIONS

Both authors wrote, reviewed, and commented on the manuscript, read, and approved the final manuscript.

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Founder Management and Innovation: An Empirical Analysis Based on the Theory of Planned Behavior and Fuzzy-Set Qualitative Comparative Analysis

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Based on the expanded theory of planned behavior, this study first explores the configuration relationship between founder management and innovation by using the fuzzy-set qualitative comparative analysis (fsQCA). Based on the theory of planned behavior, this study divides the behavior intention of founders into three categories: Attitude, subjective norm, and perceived behavior control. Using fsQCA, we found that there are two ways to achieve high innovation input of enterprises. In combination with the two ways, the factors such as male and highly educated founder, and large firm size can effectively increase the innovation input of firms, which is consistent with the three aspects of the behavioral intention of the theory of planned behavior, and it proves that the theory of planned behavior can effectively explain the configuration relation between the founder and firm innovation. In addition, this study finds that the innovation output is different from the innovation input, is dependent on the innovation ability of the firm itself, and is less influenced by the external environment.

Keywords: founder management, innovation, theory of planned behavior (TPB), fuzzy-set qualitative comparative analysis (fsQCA), investment

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INTRODUCTION

The innovation literature suggests that unprecedented health emergencies, such as coronavirus disease 2019 (COVID-19), have the effect of stimulating firms to innovate (Ferrigno and Cucino, 2021). As a continuous power and inexhaustible source of organizational development, innovation is of great significance to the long-term development of the firm. However, due to its high risk and uncertainty regarding the outcome, innovation requires managers to have a sense of adventure and long-term vision. Managers tend to be shortsighted, reducing the level of innovation to avoid risk and improve short-term performance (Cho and Kim, 2017). Founders are often considered to be different from ordinary managers (Block, 2012). For example, Apple was criticized after the death of its founder, Steve Jobs, for failing to innovate in substance. Hence, it is of great significance for the development of firms to study the innovation behavior of founders.

In recent years, several research studies have examined the founder management on organizational innovation. For example, some scholars suggested that the founder-CEO-managed firm has a positive effect on innovation (Block, 2012; Lee et al., 2020). However,

Xu et al. (2019) found that non-founder management of firm innovation input significantly increased, and research conclusions have been inconsistent. Independent variables and dependent variables are not uniformly symmetric, potentially explaining some of the inconsistencies in the findings (Rihoux and Ragin, 2009). Previous studies on founder management and innovation have relied on traditional regression methods, focusing on the net effect of variables (Lee et al., 2020). But the influence of the founder management on the innovation is abundant and complex, which also depends on the interaction of founders with the external environment (Schein, 1995).

Despite these, we noted that extant research has been limited to the study of management attributes of each founder in isolation and has neglected to analyze the relationships and interactions between attributes themselves. Understanding this issue is important for two reasons. First, the importance of the interactions among attributes of founders has been recognized as crucial for the survival prospects of start-ups (Nelson, 2003; Fahlenbrach, 2009). In fact, many authors advocate that the exploration of interactions among management attributes of founders contributes to creating a unique asset that reinforces the competitive advantage of the start-up (Certo et al., 2001; Nelson, 2003). Second, the inherent information asymmetry and uncertainty surrounding the innovation of firms makes it even more likely to need that an analysis of synergistic interactions among the management attributes of founders. For instance, it might show whether the synergistic interactions of the management attributes of founders amplify the influence of executives on company innovation (Liu et al., 2021).

To address these research gaps, our study focuses on how the combination of characteristics of founder management firms influences their innovation. One of the most prominent methods is the fuzzy-set qualitative comparative analysis (fsQCA) that is used with increasing frequency particularly in entrepreneurship and innovation-related studies (e.g., Cho and Kim, 2017; Kraus et al., 2018). When causality in the research phenomenon is multiple, an outcome has more than one cause, and these causes work together to produce the outcome, fsQCA represents an appropriate method (Kraus et al., 2018). Based on the developed theory of planned behavior, we found founder management and firm innovation are synergistic interactions. Hence, we used the fsQCA method to provide an alternative but complementary explanation to related research.

In our analyses, based on the expanded theory of planned behavior, this study first explores the configuration relationship between founder management and innovation by using fsQCA. Based on the theory of planned behavior, this study divides the behavior intention of founders into three categories: Attitude, subjective norm, and perceived behavior control. Using fsQCA, we found that there is no single exclusive causal path leading to the outcome and there are two ways to achieve high innovation input of firms. In combination with the two ways, the conditions such as male and highly educated founders, and large firm size can effectively increase the innovation input of firms, which is consistent with the three aspects of the behavioral intention of the theory of planned behavior, and it proves that the theory of planned behavior can effectively explain the configuration relation between the founder and firm innovation. In addition, this study finds that the innovation output is different from the innovation input, is dependent on the innovation ability of the firm itself, and is less influenced by the external environment.

Our study makes several important contributions to the literature on founder CEOs, innovation, and corporate governance. First, we contributed to the entrepreneurship literature, in general, and to the founder CEO literature, in particular (Fahlenbrach, 2009; Lee et al., 2020), by linking founder CEOs with innovation.

Second, we added to the innovation literature by using a new method to explain the relationship between founder management and innovation. QCA is a more suitable methodology to capture the impact of the interactions among variables on an outcome (Ragin, 1987), which distinguishes it from traditional quantitative and qualitative methods. In our study, we argued that fsQCA is particularly adequate for examining the relationship between innovation and entrepreneurship.

Third, we developed the theory of planned behavior and find it is suited for explaining entrepreneurship and innovation-related studies. The theory of planned behavior explains individual behavior from the perspective of psychology (Jindal and McAlister, 2015). We developed the theory of planned behavior by considering the complex external environment, intention of founders, and so on. This insight contributed to the theory of planned behavior highlighting how the synergistic interaction of founder management influences innovation of start-ups.

THEORY DEVELOPMENT

Research has suggested that personal characteristics of CEOs and psychological attributes play important roles in determining the pursuit of innovation of a firm (Highfield and Smiley, 1987; Cho and Kim, 2017). The theory of planned behavior studies individual behavior from the perspective of psychology, and a central factor in the theory is the intention of an individual to perform a given behavior (Adams et al., 2009). The intention of an individual is assumed to capture the motivational factors that influence a behavior. Generally, the stronger the intention to engage in a behavior, the more likely should be its performance (Barker and Mueller, 2002; Bandiera et al., 2020). The theory of planned behavior has specified three determinants to explain how intentions engage in a specific behavior (Lee and Bae, 2020). The first determinant, attitude, describes the overall evaluation of the behavior of an individual. The second determinant, subjective norms, reflects the perceived social pressure regarding the performance of the behavior. Finally, the third predictor, perceived behavioral control, refers to the degree to which performing the behavior is perceived as easy or difficult. According to the theory of planned behavior, having a positive innovation-related attitude, strong innovation-related subjective norms, and high innovation-related perceived behavioral control

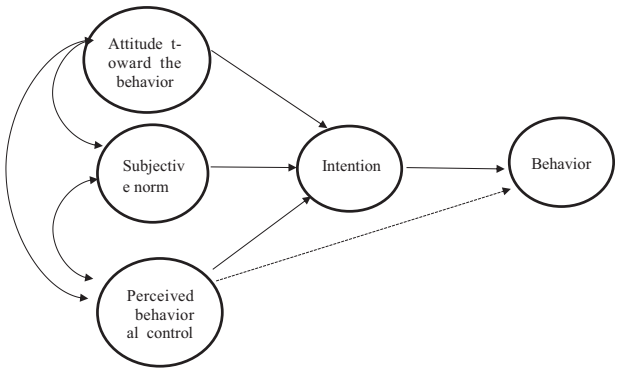

FIGURE 1 | Theory of planned behavior.

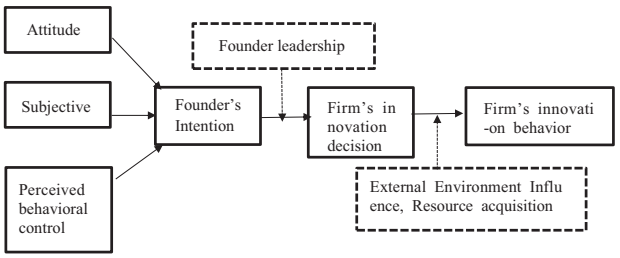

FIGURE 2 | The extension of the theory of planned behavior.

increase the intention of an individual to engage in innovation behaviors (Jindal and McAlister, 2015; Straatmann et al., 2018).

What is more, it should be clear, however, that a behavioral intention can find expression in behavior only if the behavior in question is under volitional control (Zahra et al., 2008), i.e., the performance of most depends at least to some degree on such non-motivational factors as availability of requisite opportunities and resources (e.g., time, money, skills, and cooperation of others). Collectively, these factors represent actual control of people over the behavior. To the extent that a person has the required opportunities and resources, and intends to perform the behavior, he or she should succeed in doing so, and **Figure 1** depicts the theory in the form of a structural diagram.

This study attempts to examine the complex relationship between founder management and firm innovation. As we studied how the individual behavior intention is transmitted to the specific firm innovation decision-making, the theory of planned behavior is quite appropriate (Jensen and Meckling, 1976; Haveman and Khaire, 2004; Kaplan et al., 2012; Ganter and Hecker, 2014). However, the theory of planned behavior needs to be expanded, and based on the research (Ma, 2009), the behavior intention of the individual founder can be transformed to the organizational decision-making of the firm, which depends on the dominant status of the founder in the firm, and this study extends Path 1, i.e., the behavior intention of the founder is adjusted by the status of the founder in the firm, which affects the organizational behavior of the firm.

In addition, whether the individual behavioral intention of the founder can ultimately influence the innovation-decision of the firm is also constrained by the complex external environment. To better understand the relationship of the role of founder to the firm, we require research and develop theory at three levels of analysis: individual, organizational, and environmental (Chandler and Hanks, 1994). According to the resource dependence theory, the survival of the organization needs to absorb resources from the surrounding environment, and it needs to interact with its environment to achieve its goal. Therefore, drawing on the research (Ma, 2009), this study extends Path 2. The influence of founders on innovation is also influenced by their ability to access resources, depending on the external environment. **Figure 2** depicts the extension of the theory of planned behavior.

According to the theory of planned behavior, this study examines the relationship between founder management and firm innovation from three perspectives. From the perspective of attitude, relevant studies (Lan et al., 2020) show that risk tolerance is an important subjective factor that influences innovation decision-making of founders. Meanwhile, scholars found more educated executives have greater cognitive complexity (Wally and Baum, 1994; Hitt et al., 1997), which could influence the overall evaluation of the individual of the innovation behavior and the tendency toward accepting innovation. Therefore, this study selects the risk tolerance of the founders and education degree to measure their attitude to innovation.

From the perspective of subjective norms, subjective norms influence intentions because of their compliance function (Kelman, 1974), motivating the individual to act in a manner that will gain approval from those important to the individual (Eagly and Chaiken, 1993). This study measures subjective norms by whether the CEO is also founder of firm and the gender of the founder. If the CEO is also the founder, his or her decisions are subjected to pressure from stakeholders inside or outside the company. In addition, CEO attributes matter for innovation, and their compliance function is amplified if the CEO is also a founder (Lee et al., 2020). Some studies have also pointed out (Cooper, 2012) that the external pressure and moral constraints, which male and female managers bear are different, will directly affect their decision-making behavior. These variables could better measure the perceived social pressure regarding the performance of the founder innovation behavior.

From the perspective of perceived behavioral control, we used the scale of firm and political relevance to measure. Perceived behavioral control refers to the degree to which performing the behavior is perceived as easy or difficult. The founder has served or is serving as a deputy in government which can send a positive signal to the outside world, helping companies to reduce financing constraints in innovative financing (Kim and Lu, 2011). At the same time, based on the resource-advantage view, large firms are assumed to be more resourceful and proactive (Russo and Fouts, 1997; Aragon-Correa et al., 2008), and small firms lack skills, capabilities, and financial and human resources (Biondi et al., 2000; Bowen, 2000). This theoretical

view implies that the size of firms also represents the ability of firms to access resources. Moreover, these two indicators can also reflect the external environment and resource constraints faced by firms, which will influence the innovation behavior perceived as easy or difficult.

RESEARCH METHOD

Data Analysis Methods

To answer our research question, the QCA method has been used. More specifically, four reasons led us to use this method. First, fsQCA bridges quantitative and qualitative approaches and allows us to analyze causal relationships between configurations (Ragin, 2008). As entrepreneurial innovation and founder management are asymmetric, management attributes of the founder of synergistic interactions may amplify the influence of executive on company innovation (Liu et al., 2021), and fsQCA can supplement regression analysis. Second, fsQCA is recently applied increasingly in entrepreneurship and innovation-related studies (e.g., Mas-Verdú et al., 2015; Kraus et al., 2018). Furthermore, fsQCA can account for equifinality, i.e., a situation in which an outcome may follow from different combinations of causal conditions, i.e., from different causal "recipes" (Ragin, 2008). Last, the aim of this method is not to reveal patterns that support the existence of the causal relationship but rather to identify whether some configurations are associated with an outcome of interest (Wasserman, 2003). Notably, fsQCA assumes cases as combinations of different values for the outcome of interest and the causal conditions. Accordingly, it was suitable to research the combination of different founder management "routes" that lead to firm innovation.

Sample

Founder management is more typical in private companies, so in the part of researching innovation input, the sample is derived from the 2019 IPO data of private company in the China A-share market. Since 2017 is the most recent year for which data are available to measure the patent output of firms in the CSMAR database, the measurement period of innovation output is 2017. Furthermore, we excluded firms with missing financial data, firms in the financial industry, ST and PT firms, and firms whose asset-liability ratio is greater than one, the final innovation input research got 328 samples of private listed companies, and innovation output research got 635 samples of private listed companies for study.

The data in this study are from the CSMAR database and WIND database. The data were analyzed using FSQCA3.0 software.

Outcome

Innovation

We followed prior literature and measured R&D productivity by the effect of R&D spending (Moshirian et al., 2020). Specifically, we used the logarithm of R&D cost plus one (Ln_R&D) to measure innovation input.

This study selects the patent output of firms as the main index to measure the innovation output. There are three kinds of patents in China: invention patent, utility model patent, and design patent. Since design patents do not involve innovation, this study uses the research by Tian and Meng (2018) for reference and chooses the sum of invention patents and utility model patents (Patents 1 and 2) to measure firm innovation output. The patent data in this study comes from the patent database of listed companies and subsidiaries of CSMAR, which can measure the innovation of firms more comprehensively.

Conditions

Founder Management (fc)

Drawing on the existing study (Xia et al., 2012), the founder management data in this study are collected manually. According to the description of "issuer status" in the prospectus of each sample company, we found out which person or group of people started the business in the first place. For a company founded by more than one person, the founder who plays the most important role (holding the most shares before the issue, or serving as chairman or general manager during the initial establishment of the company, etc.) is considered as the founder.

After identifying the founders, we obtained the names of the chairman and general manager (also known as president, CEO, etc.) of the company at the time of its listing from the CSMAR corporate governance database and checked with the name of the founder to determine if the CEO is also the founder of the company. "Founder management" is a virtual variable. If the CEO is also a founder, the value of founder management is 1; otherwise, it is 0.

We measured the gender of the founder (Gender) by creating a dummy variable coded as 1 if the founder is a man and 0 for a woman. Drawing on the research of Wang and Wang (2019), founder education was divided into a five-point scale: 0, junior high school and below; 1, senior high school; 2, junior college; 3, undergraduate degree; 4, master degree; and 5, Ph.D. degree. We also measured founder political affiliation (Gl) by creating a dummy variable coded as 1 if the founder has served or is serving as a deputy in government; otherwise, a variable coded as 0. Firm size is measured as natural logarithms of total assets. Based on the studies by Coles et al. (2006) and Lan et al. (2020), and upper echelons theory, this study uses short-term solvency (net working capital/total debt) to measure founder risk tolerance. **Table 1** presents variable design.

Calibration

In fsQCA, the outcome to be explained and the different causal conditions are assumed to range from no membership to full membership in a given set condition. Full membership is denoted by a value of 1 and no membership with a value of 0. Intermediate values, which denote partial membership in a set condition, are given values between 1 and 0. Membership scores greater than 0.5 indicate that a case is "more in than out" in the set condition, scores close to 1 indicate that a case is "mostly in" a set condition, scores close to 0 indicate that a case is "mostly out," and so on. It requires substantiation of the method of "calibration," i.e., the

TABLE 1 | Variable design.

Variable classification	Variable	Variable code	Definition
Innovation behavior	Innovation input	Ln_ R&D	Logarithm of R&D cost plus one
	Innovation output	Patent1&2	The sum of invention patents and utility model patents
Attitude	Risk tolerance	Fx	Net working capital/total debt
	Founder education	xl	Junior high school and below, set at 0; senior high school, set at 1; junior college, set at 2; undergraduate, set at 3; master, set at 4; and doctor, set at 5.
Subjective	Founder management	fc	If the CEO is founder, the value of founder management is 1, Otherwise 0.
	Founder gender	Gender	The founders are set to 1 for men and 0 for women.
Perceived behavioral control	Firm size	Size	Ln (Total assets)
	Founder political affiliation	gl	If the founder has served or is serving as a deputy in government, set it at 1; Otherwise, set it at 0.

transformation of original data to a scale over the interval (0, 1) (Ragin, 2008).

In this study, the upper quartile (75%), median (25%), and lower quartile (25%) of the descriptive statistics of the case samples are set up for 6 conditional variables and 2 outcome variables to calibrate. **Tables 2**, **3** present calibration anchors and descriptive statistics for each variable.

Fuzzy-Set Qualitative Comparative Analysis

The fsQCA involves three steps (Ragin, 2006). The first step consists of constructing a truth table, which reports all logically possible combinations of conditions and the outcomes associated with each configuration. Each row shows one of the logically possible combinations of conditions (Sui and Baum, 2014). The second step reduces the number of rows in the truth table considering two conditions, namely, a frequency threshold and a consistency threshold (Sui and Baum, 2014). Following Wasserman (2003), we applied a frequency threshold of 1 and a coherence threshold of 0.8, respectively. The third step uses an algorithm to simplify the truth table. In our study, we used the Quine McCluskey algorithm (used in the fsQCA 3.0 software package) to obtain a more parsimonious response.

EMPIRICAL RESULTS

Analysis of the Necessity Conditions

The necessity analyses evaluated whether a condition must be presented for an outcome to occur. Consistency is the degree to which a given solution is a subset of the outcome, and coverage is the degree to which the outcome can be interpreted by a given solution, like R^2 in regression analysis. The coverage is divided into raw coverage and unique coverage. We further reported raw and unique coverage measures. Raw coverage of a respective solution term is the coverage if only the respective solution term is assumed to be present. Unique coverage expresses the contribution of a solution term beyond what is explained already by other terms. This section presents the results of necessity analyses for the conditions gender, namely, gl, fc, fsxl, fsfx, and fsize. For the necessity analyses of conditions for innovation outcome Ln_ R&D and Patents 1 and 2, refer to **Table 4**.

The standard threshold of consistency value is 0.90 (Ragin, 2008). As **Table 4** shows, gender is a necessary condition and, in China, this may be due to men accounting for the clear majority parts in private firms. Furthermore, we considered the influence of configuration.

Analysis of the Sufficiency Conditions

The analysis of sufficiency identifies all the conditions that are sufficient for the result to occur. **Table 5** provides the main results of sufficiency analyses, which consider sets of conditions. These conditions lead to the outcome.

Sufficiency Analyses Results for High Innovation Input

According to previous literature (Schneider and Wagemann, 2012), we adopted a coherence threshold of 0.80 for

TABLE 2 | Innovation input calibration and descriptive statistics.

	Calibration			Descriptive statistics			
	Completely in	Point of maximum ambiguity	Completely out	Mean	*SD*	Minimum	Maximum
Gender				0.633	0.250	0	1
fc				0.479	0.500	0	1
gl				0.195	0.396	0	1
Size	20.721	21.119	21.611	21.234	0.746	19.665	25.342
xl	2	3	4	3.238	1.178	0	5
fx	0.453	1.085	2.509	1.941	2.339	–0.326	16.368
Ln_R&D	17.117	17.670	18.214	17.713	0.943	13.442	21.819

TABLE 3 | Innovation output calibration and descriptive statistics.

	Calibration			Descriptive statistics			
	Completely in	**Point of maximum ambiguity**	**Completely out**	**Mean**	***SD***	**Minimum**	**Maximum**
Gender				0.632	0.251	0	1
fc				0.510	0.500	0	1
gl				0.249	0.432	0	1
Size	20.543	20.960	21.555	21.094	0.748	19.647	24.616
xl	2	3	4	2.976	1.230	0	5
fx	0.775	1.630	3.226	2.432	2.613	–0.749	18.920
Patent1&2	1.609	2.485	3.238	2.365	1.337	0	7.517

judging a correspondence with necessity/sufficiency hypotheses as sufficient.

The fsQCA can produce three solutions: complex solution (not including logical remainder), intermediate solution (only including logical remainder), and parsimonious solution (including all logical remainders). According to the study by Ragin (2008), the intermediate solution is indicated as the most suitable since it achieves a balance between the complex solution and the parsimonious solution in terms of complexity. The intermediate solution is, therefore, a subset of the other possible solutions, namely the complex solution and the parsimonious solution (Wasserman, 2003). Therefore, in this study, the condition that exists in both the parsimonious solution and the intermediate solution is regarded as the core condition, and the condition that exists only in the intermediate solution is regarded as the peripheral condition.

Table 5 presents the results of the fsQCA. The solution table exhibits two solutions achieving high innovation input. As mentioned in **Table 5**, the overall consistency is 0.82, higher than the consistency standard of 0.8, and the consistency of each configuration is also higher than 0.8.

Solution 1 combines the presence of a highly educated founder and large firm size with the absence of risk tolerance of the founder, supplemented by the strong political connections of the founder and male gender of the founder. Core conditions are the presence of a highly educated founder, large firm size combined with the absence of risk tolerance. Thus, this configuration shows that when the risk tolerance of the founder is insufficient, the cognitive condition and perceived behavioral control condition are decisive in leading to high innovation input.

Solution 2 shows that the combination of large-sized firms with male, highly educated, highly risk-tolerant founder as CEO, supplemented by the fact that political connections is more conducive to the innovation input of the firm. Compared with solution 1, solution 2 increases the risk tolerance of the founder, the founder as CEO, and gender as core conditions.

Taken together, solutions 1 and 2 suggest that the factors such as the founder is highly educated and large firm size together can effectively enhance the innovation input of the firm. The founder is aware of the importance of innovation input to the long-term development of the firm. At the same time, since the founder usually owns a high share of the firm, this role has both motivation and power to increase the innovation input of the firm. Based on the theory of planned behavior, these conditions are subordinate to three factors: Attitude, subjective norm, and perceived behavior control, which further proves that the theory of planned behavior can effectively explain the innovative investment behavior of founders. A lot of psychological and behavioral economics research shows that women are more conservative when it comes to risk-taking, and

TABLE 4 | Necessity analyses for innovation input and output.

Condition	**High innovation input**		**High innovation output**	
	Cons	**Cov**	**Cons**	**Cov**
Gender	0.951	0.515	0.930	0.498
∼Gender	0.049	0.369	0.070	0.519
gl	0.174	0.451	0.251	0.503
∼gl	0.826	0.518	0.749	0.498
fc	0.498	0.525	0.542	0.531
∼fc	0.502	0.486	0.457	0.466
fsxl	0.457	0.615	0.513	0.559
∼fsxl	0.648	0.523	0.597	0.550
fsfx	0.510	0.503	0.492	0.480
∼fsfx	0.588	0.607	0.596	0.610
fsize	0.736	0.741	0.651	0.643
∼fsize	0.362	0.367	0.442	0.446

TABLE 5 | Sufficiency analyses results for high innovation input and output.

	High innovation input		**High innovation output**
Conditions	**Solution 1**	**Solution 2**	**Solution 1**
Gender	•	●	●
fc		●	●
gl	•	•	•
Size	●	●	•
xl	●	●	●
fx	⊗	●	●
Consistency	0.833514	0.836181	0.834215
Raw coverage	0.278207	0.150761	0.029842
Unique coverage	0.196484	0.069039	0.029842
Solution consistency	0.822107		0.834215
Solution coverage	0.347246		0.029842

● *Indicates the existence of a core condition,* ⊗ *indicates a lack of core conditions,* • *indicates the existence of a peripheral condition, while blank cells represent "don't care" conditions.*

innovation investment is a high risk and uncertain investment, male founders are more confident when it comes to making risky decisions. Moreover, highly educated founders obtain more innovation-relevant knowledge, which will reduce the information asymmetry problem in the process of investment in organizational innovation (Block, 2012). They have a long-term vision for the development of the organization, which will pay more attention to innovation investments. While the political affiliation of the founders and the large size of the firm could help organizations gain resources much easier, the firms may face relatively few obstacles when they carry out innovation financing. Besides, Manso (2011) found that risk tolerance of entrepreneurs is an important factor that affects the innovation of organizations. In addition, the fact that CEO is also the founder can increase the innovation input of the organization, which means the founder can directly manage the firm, because of his or her unique status, better supervise and manage the innovation investment of the firm, and reduce the agency cost; it also shows that the impact of the founder on the innovation investment of the company depends on his or her position in the company.

Sufficiency Analyses Results for High Innovation Output

Looking at the group of high innovation output, the fsQCA produces a group of solutions and the total consistency is 0.83, which is higher than the consistency standard of 0.8. As mentioned in **Table 5**, the combination of male, highly educated, highly risk-tolerant founder as CEO in the company leads to high innovation output of the firm, supplemented by the political connections of the founder and the large size of the firm. Different from innovation input, it is noted that in this group of innovation output, the attitude and the subjective norm perspective in the theory of planned behavior play a leading role, and the impact of the external environment and resource acquisition capacity may not be so important, which indicates that the innovation output depends more on the innovation capacity of firms themselves.

Robustness

To ensure the robustness of the results, we raised the consistency to 0.85 and then analyzed again, as shown in **Table 6**. We also made a robustness test on the adjustment of the frequency threshold and reported the results after the adjustment of the consistency.

As can be seen from **Table 6**, the solution is basically the same after raising the consistency, which proves that the conclusion of this study is reliable and robust.

TABLE 6 | Robustness.

	High innovation input		High innovation output
Conditions	**Solution 1**	**Conditions**	**Solution 1**
Gender	●	Gender	●
fc	●	fc	●
gl	•	gl	•
Size	●	Size	•
xl	●	xl	●
fx	●	fx	●
Consistency	0.891233	Consistency	0.834215
Raw coverage	0.0816623	Raw coverage	0.029842
Unique coverage	0.0816623	Unique coverage	0.029842
Solution consistency	0.891233	Solution consistency	0.834215
Solution coverage	0.0816623	Solution coverage	0.029842

● *Indicates the existence of a core condition,* • *indicates the existence of a peripheral condition, while blank cells represent "don't care" conditions.*

CONCLUSION: CONTRIBUTIONS, LIMITATIONS, AND FUTURE RESEARCH

How to improve the innovation input and innovation output of firms is the focus of this innovation research. In this study, the theory of planned behavior is extended, and the method of fsQCA is used for the first time to discuss the configuration effect of organizational innovation from the view of founder management. This study finds that three perspectives of the theory of planned behavior, namely, attitude, subjective norms, and perceived behavior control, can effectively explain the relationship between founder management and organizational innovation. Two different solutions can lead to high innovation input. First, the configuration takes the presence of highly educated founder, large firm size and the absence of risk tolerance as core conditions leads to high innovation input. Second, the combination of large firm size with having a male, highly educated, highly risk-tolerant founder, who coupled with being CEO and having strong political connections, are more conducive to increasing the innovation investment of the firm. Combining the theory of planned behavior, these two paths both contain three factors that influence the behavior intention of the founder, and the second path shows that the founder takes the role of CEO, which shows that the founder plays a leading role in the decision-making of the organization, and the behavior intention of the founder can effectively rise to the innovation decision-making of the firm and, finally, form the innovation input behavior of the firm under the influence of the two external environments of political connection and firm size. We determined that the male, highly educated, highly risk-tolerant founder as the CEO are core conditions for innovation output. This configuration shows that the innovation output is different from the innovation input and more dependent on the transformation of internal resources, but less affected by the external environment and resource acquisition capability.

This study provides an empirically validated framework to explore founder management and innovation. First, based on the expanded theory of planned behavior, this study explores the complex relationship between founder management and organizational innovation behavior. Earlier, most of the literature on the founder was simply set as a virtual variable (Kim and Lu, 2011; Markin et al., 2021), without considering the personal characteristics of the founder and how the personal intention of the founder rose to corporate behavior. This study expands the theory of planned behavior, which is mainly used in the fields of psychology and sociology, opens the black box between

the founder and the innovation behavior of firms, and describes the path that the behavior intention of the founder forms the innovation decision-making behavior of the firm.

Second, this study contributed to innovation and entrepreneurship studies (Fang et al., 2014; Falato et al., 2015; Cain and McKeon, 2016; Del Sarto et al., 2019; Ferrigno et al., 2021). The previous literature neglected the influence of the interaction between the personal characteristics of the founder and the external environment as well as the "chemical reaction" of their combination on the innovation behavior of a firm (Dell'Era et al., 2020). This study examines the relationship between founder and innovation from the perspective of configuration by using the method of fsQCA, and it provides a new way of thinking for the research of firm innovation field.

Third, we offered a methodological contribution. This study finds that the planned behavior theory and the fsQCA approach are highly matched in exploring the relationship between founders and firm innovation, and it is further proved that the combination of the theory in the field of psychology and the method in the field of management can effectively explain the problems of management practice and has positive significance to the research in the field of management.

The founders are vital to the long-term growth of the company. Most innovative companies we know are also under the control of their founders (Google, Facebook, etc.). But the role of founders in business innovation is not just through controlling the business. This study demonstrates that expanding the size of the business, increasing the education of the founders, and strengthening the political connections of the founders, in order to improve the risk tolerance of founders, are helpful to increase firm innovation input, while the founder with high educational background, high-risk tolerance, and to be CEO are effective ways to improve the innovation output.

The study also offers implications for both policy and practice. First, founder managers should constantly improve themselves to achieve professional governance. For firm innovation, managers need to have an independent judgment of technological development. The founder improves own knowledge quality, which is helpful for the firm to formulate suitable innovative decision-making.

Second, the founder should build a social resource network to reduce the dependence on the external environment. The founder strengthens the communication and cooperation with the government, is advantageous in grasping the market in time, and obtains more innovation financing, then promotes the firm innovation high-quality development.

Moreover, several limitations must be taken into account about this study. First, due to the limitation of the sample size of fsQCA, this study used only the data of the past 1 year, lacked the study of the dynamic change, and did not carry out the cross-time comparison, and the data were collected only from Chinese database and the manual collection; in the future, we can use the form of questionnaire from other countries for further analysis. In addition, firm innovation is an extremely complex firm behavior, which is affected by many factors. This study analyzes only some configurations with the theory of planned behavior, and future studies could investigate these configurations in different contexts.

DATA AVAILABILITY STATEMENT

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found below: China Stock Market and Accounting Research Database, https://www.gtarsc.com/.

AUTHOR CONTRIBUTIONS

C-AM: conceptualization, methodology, software, and writing—original draft preparation. RX: data curation, visualization, and investigation. H-YC: writing—reviewing and editing. G-RS: software and validation. All authors contributed to the article and approved the submitted version.

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How Does Long-Term Orientation Influence the Investments of Venture Capitals? Evidence From the Organizational Level

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Amid great uncertainty along with the possibility of huge returns, venture investment decisions are both technical and artistic. Past studies have paid much attention to the influences of objective factors on venture investment. However, subjective factors have been relatively ignored. As a salient psychological mechanism, temporal focus is of great importance for venture capitalists when making their investment decisions. This study performed content analysis to investigate how temporal focus at the organizational level affects investment decisions of venture capital (VC) firms. The results revealed that VCs with higher level of long-term orientation prefer to invest in less popular industries and ventures in the expansion period. Meanwhile, they are less likely to invest in very new start-ups. Moreover, long-term oriented VCs tend to re-invest in start-ups in their portfolios instead of just shooting once on numerous single start-ups. However, the author did not find any support on preferences of VCs for ventures with high level of human capital.

Keywords: long-term orientation, venture investment, content analysis, industrial popularity, reinvestment, venture stage

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INTRODUCTION

Venture investment has long been a hot topic in both the entrepreneurship and finance fields (Sahlman and Stevenson, 1985; Hallen and Eisenhardt, 2012; Chircop et al., 2020). With the recognition of unknowable and unpredictable extreme risks (Knight, 1921; De Bondt and Thaler, 1995) as well as possibility of gaining huge returns (Huang, 2018), past studies have differentiated venture investment from classic security investment from several angles. A stream of research has investigated processes and criteria used by venture capitalists (MacMillan et al., 1985; Carpentier and Suret, 2015; Monika and Sharma, 2015), highlighting different evaluation processes and focuses on new ventures. Other studies have separately determined factors influencing whether new ventures can receive investments from venture investors, such as geographic and status distance (Hallen, 2008; Wu, 2016), networks and networking abilities (Hallen, 2008; Hallen and Eisenhardt, 2012), signals or certifications from other organizations (Plummer et al., 2016; Bermiss et al., 2017), and framing and storytelling skills (Martens et al., 2007). Overall, existing knowledge of venture investment proves it to be a non-standardizable, difficult to quantify, challenging, and complicated task (Huang, 2018).

Related studies on entrepreneurs have pioneered the application of the psychological perspective in entrepreneurship academy (Brockhaus, 1980; Sexton and Bowman, 1985; Begley and Boyd, 1987). In early years, scholars investigated the impacts of the Big Five personalities and Hofstede cultural values on the decision of people to become entrepreneurs (Ardichvili and Gasparishvili, 2003; Zhao and Seibert, 2006). Later, some malleable factors, such as self-control, risk-taking, self-efficacy, overconfidence, and narcissism, were observed to have more direct influences on entrepreneurial entry and opportunity realization (Navis and Ozbek, 2016; Obschonka and Stuetzer, 2017). Effectuation, regulatory focus, optimism, and achievement motivation were suggested to be crucial to actions entrepreneurs and strategies of their start-ups (Brockner et al., 2004; Collins et al., 2004; Hmieleski and Baron, 2009; Reymen et al., 2017).

As a consequence, inspired by the opening blackbox of the mindset of entrepreneurs and the relationship between the uncertain decision context and the heuristic cognition process (Mousavi and Gigerenzer, 2014), recent studies on venture investment have turned the focus from objective factors to subjective features, exploring the influence of psychological characteristics and cognitive processes. For example, one of the most salient mechanisms is similarity bias, investors have the tendency to invest in entrepreneurs who have the same features with them, such as same education background, working experience (Franke et al., 2006), and cognitive mode (Murnieks et al., 2011). Moreover, motivational clues, such as passion, commitment (Cardon et al., 2017; Warnick et al., 2018), psychological capital (Anglin et al., 2018), developed identity (Wry et al., 2014), and narratives (Pan et al., 2020) of entrepreneurs are also among the psychologically related factors that affect the cognitive process of investors. Meanwhile, progress has also been achieved concerning subjective factors of venture capitalists, which impact the decision process. Scholars have found evidence that intuition and heuristics are widely used by capitalists and show effectiveness in this extreme uncertain context (Dane and Pratt, 2007; Huang and Pearce, 2015). The feeling of trust (Graebner, 2009) and perception of control (Drover et al., 2014), as well as dispositional affects (Chan and Park, 2013) of investors have also been studied. However, large gaps remain to be filled to unravel the mystery of psychological and cognitive mechanisms of capitalists.

Most studies on venture investment have only applied either the psychological perspective or the organizational perspective, whereas few of them have discussed both. However, as the investment decision process of venture capitals (VCs) usually starts from the individual investigation investors on related materials and ends with the collective consensus of an investment committee integrating all the intelligence of capitalists (Drover et al., 2017), investment decisions at the individual level are not completely consistent with those at the organizational level (Carpentier and Suret, 2015). Thus, psychological mechanisms at the organizational level must be explored.

Combining the psychological perspective and the organizational perspective, this study discusses the influence of the long-term orientation (LTO) of VC organizations on their exhibited investment characteristics. Deriving from temporal theories and the essence of venture investment, the author developed hypotheses positing that higher level of LTO of VC organizations entails larger motivation for them to invest in high-level-human capital, less popular industry, expansion stage ventures and ventures they have invested before. Benefitting from a recent quantitative method of content analysis (Martin, 2016), the author used the articles of VCs' WeChat official accounts as the source for generating LTO at the organizational level. This study contributes to the sporadic literature adapting the content analysis method and second-hand data source to psychological framework. The results support majority of the hypotheses of the author.

HYPOTHESIS: LONG-TERM ORIENTATION AND VENTURE INVESTMENT

Psychological Factors in Venture Investment

Scholars have observed psychological factors as significant influencers of venture investment decision-making at early times. Duxbury et al. (1996) described a personality profile of angel investors with an internal locus of control, high needs for achievement, dominance, and autonomy. In addition, Mason and Stark (2004) mentioned psychological differences of angel investors compared with other types of investors, angel investors have stronger motivation of involvement to acquire "satisfaction and enjoyment from playing a role in the entrepreneurial process," to be altruistic at times, and to give greater emphasis to subjective factors and gut instinct. Later studies on angel investors focused on their decision-making process, pointing out the use of heuristics, gut feel, and motivational clues as important machanisms (Maxwell et al., 2011; Harrison et al., 2015; Huang and Pearce, 2015; Cardon et al., 2017). In crowdfunding, herd effect and regulatory focuses were found to be influential (Ciuchta et al., 2016; Shen et al., 2020). Meanwhile, few studies have discussed the decision-making of an accelerator as a new organizational format in the entrepreneurial ecosystem. Yang et al. (2020) found that gender role congruity also exists in investment decisions in social impact accelerators. Meanwhile, congruity has been studied not only in terms of gender-role dyads but also in terms of cognitive modes (causation/effecuation) in entrepreneurial investment (Murnieks et al., 2011; Balachandra et al., 2017). Furthermore, studies have suggested that heuristics, gut feel, control motivation, and dispositional affect also matter in entrepreneurial investment decisions (Chan and Park, 2013, 2015; Drover et al., 2014; Huang, 2018). However, few studies have dealt with how a single psychological factor influences the preferences of investors for ventures with different features, especially at the organizational level.

Literature Review of Long-Term Orientation

Temporal orientation has been found to be an influential psychological mechanism, as "time is essentially in the eye of the

beholder (Hall, 1984) and varies across people" (Lin et al., 2019, 3115). Several temporal frameworks elaborate on how people perceive and regard time (Trompenaars and Hampden-Turner, 1998; Souitaris and Maestro, 2010), among which the lens of long-term and short-term orientation has attracted wide interest (Laverty, 1996). It offers an anchor for people to consider and balance the focus on the past, present, and future (Karniol and Ross, 1996; Bearden et al., 2006) to form a dominant temporal logic for decisions and actions (Lumpkin and Brigham, 2011).

Based on the achievements of past studies concerning LTO, it is not only a macro culture dimension at the national level (Hofstede, 2001) but also a multidimensional construct of personal psychology (Lumpkin and Brigham, 2011). In the latest literature, LTO is defined as the "tendency to prioritize the long-range implications and impact of decisions and actions that come to fruition after an extended time period" (Lumpkin et al., 2010). Concern for the future is intuitively and actually a key attribute of LTO (Brigham et al., 2013). However, a more accurate and complete understanding of LTO contains a holistic view of time with extended time horizon valuing both the past and the future instead of only caring for the effects of action in the here and now or the short term (Bearden et al., 2006; Lumpkin and Brigham, 2011). Futurity, continuity, and perseverance are the three components of LTO (Bearden, 2006; Lumpkin and Brigham, 2011).

Decision process is hardly possible to be entirely impartial. The orientations and perceptions of decision-makers are mirrored in their decisions while sifting through and reconciling incomplete ambiguous chaotic information (Hambrick et al., 1996). Thus, in intertemporal choices, LTO seems to be a significant force (Lumpkin and Brigham, 2011) widely discussed in strategic decision-making and family businesses literature. Long-term oriented top executives are willing to pursue interests in a farsighted and inclusive way (Miller and Le Breton-Miller, 2006), operate strategic control rather than financial control (Zahra et al., 2004), accelerate the development and deployment of new products (Yadav et al., 2007; Nadkarni and Chen, 2014), and maintain relationships with stakeholders (Flammer and Bansal, 2017). However, they take fewer strategic risks (Gentry et al., 2016). Meanwhile, LTO also improves the comprehensiveness, speed, and creativity of the strategic decision-making process (Lin et al., 2019) as well as innovative and entrepreneurial actions (Hofstede, 1991; Flammer and Bansal, 2017).

Long-Term Orientation in Venture Investment

Venture capitals invest in new ventures in order to exit through acquisitions or IPOs with considerable returns. However, outcomes vary in terms of whether they can achieve this goal, how long it takes, and how much they will be paid back. Majority of venture investments fail to generate positive returns, behind which stands the fact that new ventures are always accompanied by unpredictable uncertainties of varying types and temporal distributions (Kollmann and Kuckertz, 2010; Huang, 2018). VCs consider these attributes of ventures and balance different distributions of uncertainties, costs, and gains over time (Souder and Bromiley, 2012) to form their investment strategies. With limited amount of money to allocate in the duration of the funds, they reach an investment decision according to criteria under the implicit guidance of a temporal orientation ranging from short to long (Harrison et al., 2015). Thus, the author proposes that VCs with high level of LTO will demonstrate several features.

Human Capital

Prior literature has suggested that qualities of both entrepreneurs and economic attributes are essential in venture investment (Franke et al., 2008). We can distinguish investors according to their priorities of attention on either financial evaluation or qualities of entrepreneurial teams (Knockaert et al., 2010). Human capital acts as an intangible indirect long-term asset of firms (Bena et al., 2017) for ensuring sustainable competitive advantages (Hatch and Dyer, 2004). This notion is especially true in start-ups, as several investors have publicly expressed that entrepreneurs come first in their investment criteria. Ventures with high-level human capital founding teams may not exhibit their advantages at present but instead release strength continuously in the future, especially in the later period (Tzabbar and Margolis, 2017). VCs with high level of LTO are willing to provide more time for entrepreneurs with high potential to turn their human capital advantages into innovative products and economic returns (Symeonidou and Nicolaou, 2018). During this time, they also have the motivation to form long-term relationships and trust with entrepreneurial teams (Flammer and Bansal, 2017; Liu et al., 2019) and provide necessary and useful help. Thus, the author suggests that:

> H1: A VC with higher level of LTO keeps a larger percentage of new ventures with high-level human capital founding team in its investment portfolios.

Industrial Popularity

Investment trends fluctuate from industry to industry (Zhang et al., 2017). After a distinct improvement emerges in an industry, herd behaviors quickly take over it, with hundreds of imitators watching, learning, and following (Banerjee, 1992), and VCs scramble to pursue any opportunity (Valliere and Peterson, 2004). This pattern raises the uncertainties of the future to a very high level. Start-ups and VCs compete fiercely but have difficulty generating any benefit when the bubble bursts and the market cools down (Zhang et al., 2017, 1370). Therefore, chasing the investment trend does not match the benefits of long-term oriented VCs. The valuation of ventures simultaneously rises high along with rising industrial popularities (Valliere and Peterson, 2004), thus increasing the costs and exit thresholds of VCs in the long run. Conversely, investing in less popular industries can help a VC to establish proactive advantages as well as extend the benefit period (Lumpkin et al., 2010) with quite reasonable costs. This move will also contribute to the formation of reputation as a long-term asset (Wang and Bansal, 2012; Ortiz-de-Mandojana and Bansal, 2016) by differentiating VC from others and pioneering new trends. Moreover, the perseverance attribution of LTO facilitates VCs to concentrate on

clear directions and expected future, be patient, and impose self-control to eliminate outside disturbances (Le Breton-Miller and Miller, 2011; Brigham et al., 2013). Thus, the author hypothesizes that:

H2: A VC with higher level of LTO tends to invest in less popular industries.

Reinvestment

The author suggests that long-term oriented VCs will have higher tendencies to reinvest in same ventures. First, continuity is one of the dimensions of the LTO construct (Brigham et al., 2013). VCs with high level of LTO expect the future return to be continuous (Lin et al., 2019). Hence, they are less likely to pull out from profitable projects and tend to increase resource commitment (Keil et al., 2009; Souder and Bromiley, 2012). Second, interests in developing a long-term relationship also helps increase the affective commitment of investors to the ventures (Cohen, 2007; Brigham et al., 2013). Contrary to short-term oriented people who are more likely to be opportunists (Bakker and Knoben, 2015), long-term oriented investors tend to have more communication with their invested ventures, especially non-task communication (Lin et al., 2019), to form affective ties. This extra effort can help create a climate of trust between investors and start-ups (Adamson et al., 2003). The willingness and possibilities of reinvestment will then be reinforced by the mutual trust and commitment between high-level LTO investors and their portfolio ventures. Third, expecting the decisions to maintain long-lasting effects on the future, the long-term perspective drives decision-makers to search information broadly beyond the vicinity of the current horizon (Lin et al., 2019) before reaching the first investment decision, thus reducing the possibilities of regret and withdrawal. Lastly, for the pursuit of continuity, long-term oriented decision-makers are thought to be more risk averse (Lumpkin et al., 2010). They may keep requirements on certain levels of liquidity and slack (Gentry et al., 2016), which will help maintain their abilities to deal with uncertainty in the future and to save their portfolio ventures from dilemmas. A famous VC capitalist in China who is a great advocate of long-termism publicly said that "investors need to be more conservative toward risk . . . we do not have to support ventures by offering too much money at one time. Instead, we ought to offer 'smart' money to help start-ups at key points." One of his most successful investment cases is Meituan. He first invested Meituan in round A and reinvested it in rounds B, C, and E, helping the venture achieve multiple milestones. Thus, phasing the investment instead of completing it all at once may be an effective approach for high LTO VCs to control risks and ensure continuous utilization of the capital. Taking together, the author posits that:

H3: A VC with higher level of LTO keeps a larger percentage of new ventures in which it invested before in its investment portfolios.

New Venture Stage

As mentioned above, long-term oriented organizations and decision-makers tend to be proactive actors (Lumpkin et al., 2010). The literature on strategic decisions has also suggested that LTO is positively correlated with the speed of introduction of new products (Nadkarni and Chen, 2014) and long-term relationship with stakeholders (Lin et al., 2019). This suggestion may indicate that long-term oriented VCs will form investment ties with start-ups as early as possible. However, they may avoid investing too early for one reason: given the pursuit of continuity, long-term oriented organizations exhibit less willingness to take risk (Gentry et al., 2016), seeing that allowing other risks that amplify temporal risk is not a wise decision (Lin et al., 2019). Meanwhile, investing in ventures in a very early stage may expose VCs to high risks of venture failure and liquidity, as early-stage startups have higher level of ambiguities and uncertainties (Hopp and Lukas, 2014, 643) and lower possibilities of quick exits (Lahr and Mina, 2014). Hence, VCs with high level of LTO may need to balance proactiveness and uncertainties by selecting the appropriate stage to invest. Thus, the author supposes that:

H4: A VC with higher level of LTO keeps a larger percentage of new ventures in the expansion stage and a smaller percentage of ones in the early or mature stage in its investment portfolios.

MATERIALS AND METHODS

Sample and Data Source

As mentioned above, the author performed content analysis to measure the LTO of VCs, and first collected a list of VC organizations from IT Juzi (Su and Lichun, 2020), a website widely used by investors in China. Similar to VentureXpert, it aims to provide the most complete data on Chinese entrepreneurship and investments. It offers three streams of data: (1) founding information on new ventures, including founding dates, founding teams, and descriptions of business ventures; (2) VC profiles, including the amount of their managed money, employees, and other fundamental information; (3) funding information, including investor(s) and invested venture as well as investment date and amount of money. Specifically, the database contains founding and investing data for more than 200,000 ventures, 120,000 investment events, and 10,000 investment organizations, greatly exceeding data volume of other databases (e.g., another frequently used database named PE Daily records only approximately 23,000 investment events). The author matched these VCs with their WeChat official accounts if available. Nowadays, as digital technologies have reformed communication channels, organizations have been using these advancements to build their images and compete for the attention of the audience on the internet. WeChat has become the dominant communication tool and an important media in China. It has also become the most important platform for information dissemination. Organizations can create official accounts on WeChat. Their accounts serve as billboards for organizations to communicate with their audience, release latest news, and promote their ideas. For example, one VC posted an article to promote its investment logic:

"*. . . In terms of early-stage projects, our advantage is not the amount of capital but the fact that we can do a lot with a little.*

We look at projects with a keen eye. Early-stage projects are indeed risky, but the high growth of a particular project will cover the loss of other projects. . .Entrepreneurship and investment are subject to various risks and challenges. Challenges are good, and risks are not necessarily bad. I am partial to investing in higher-risk angel rounds, especially those with resources. . .”

The author collected articles published on the WeChat official account of VCs by year using frequencies of LTO keywords in these articles to indicate the level of LTO of VCs. The details are introduced in the latter part of this article.

The matched sample included 606 VCs with 1,473 VC-year observations of LTO from 2012 to 2019[1]. The author collected other data concerning general information and investment records of VCs from IT Juzi that were supplemented by other databases (such as PE daily and Tianyancha) and official websites of VCs.

Content Analysis and Measure of Long-Term Orientation

The majority of past studies used questionnaires to measure LTO, implying the same premise that the time orientation of top executives represents this aspect of the organization (Hambrick and Mason, 1984). However, the studies seem to evade the question of how to weigh the influence of each executive on organizations under varying levels of LTO (Lin et al., 2019). Thus, it is meaningful to search for direct measurement of such psychological constructs at the organizational level.

Prior research has used firm disclosures (such as annual reports and letters for shareholders) to indicate their visions and intentions (Gerstner et al., 2013; Flammer and Bansal, 2017). With the growing acceptance of cognitive-linguistic theory, content analysis has got wider use in entrepreneurship literature (Lee and Huang, 2018; Pan et al., 2020). According to the Whorf–Sapir hypothesis (Whorf, 1940; Sapir, 1944), thoughts of individuals and organizations (attention, cognitive categories, priorities, etc.) are reflected in the words and vocabularies they use. In this vein, the author attempted to use the method of content analysis to measure the LTO of VCs with frequencies of LTO words used.

Flammer and Bansal (2017) constructed a simple vocabulary of LTO with only four pairs of words: “long run,” “long-run,” “long term,” and “long-term.” Nonetheless, the other dimensions of LTO, except for futurity, were ignored. Then, the author followed the method of Pan et al. (2020) to create a dictionary (vocabulary) with a complete indication of LTO constructs and tested its validity.

Given that a Chinese sample was used, the author applied the simplified Chinese dictionary of LIWC as the basic dictionary, because it includes all commonly used words and is widely accepted in academic research (Parhankangas and Renko, 2017)[2]. First, a PhD student and the author, equipped with theoretical bases of LTO, independently selected keywords representing the construction of LTO from the basic dictionary using the scales from Bearden et al. (2006) as reference. These keywords constituted the original dictionary of LTO. In the second step, five PhD holders/PhD students independently voted on each keyword in the original dictionary, gauging whether the word reflected the meaning of LTO. They were also asked to make their judgments in accordance with the same scale. In the last step, the author calculated the content-validity ratio (CVR) for each keyword. The formula is:

$$\mathrm{CVR} = \frac{n - \mathrm{N}/2}{\mathrm{N}/2},$$

where n denotes the votes each word obtained from the judges ranging from 0 to 5, and N is the number of judges (5 in this study). The CVR ranges from −1 to 1.0, and the author only retained keywords with a CVR greater than or equal to 0.8 (which means it received at least four out of five votes from the judges). Finally, the author used 44 keywords to construct the final LTO dictionary.

To test the validity of the LTO dictionary, the author used a random subsample containing 149 articles from the full sample collected. The author and the PhD student who joined the first step to create the original dictionary rated these articles on a five-point Likert scale, with 1 indicating “shows no LTO of VC at all” and 5 indicating “heavily shows the LTO of VC.” Meanwhile, the author measured the LTO indexes of the articles using the LIWC dictionary approach, dividing the total number of LTO keywords by the total number of words of each article. The author calculated ICC = 0.83, which supported the good validity of the linguistic measure of LTO.

Measures

Long-Term Orientation

The author finally measured LTO at the VC-year level by calculating the means of the LTO index of each article the VC posted on its WeChat official account in every focal year. The formulas are as follows:

$$LTO\ index_k = \frac{the\ number\ of\ LTO\ keywords_k}{the\ total\ number\ of\ words_k} \times 100,$$

$$LTO_{vc,year} = \frac{\sum_1^n LTO\ index_k(vc, year)}{n},$$

where $LTO\ index_k$ represents the LTO index of each article, and n represents the number of articles the *VC* posted on its WeChat offical account in a focal year.

Human Capital

The author coded the experience of entrepreneurial team members to access the human capital of new ventures and recognized four types of experiences as sources of human capital, educational experience, industrial working experience, management experience, and entrepreneurial experience. The author first measured the human capital of each entrepreneurial team member by one count variable indicating educational experience and three dummies indicating the other three types of experience. For educational experience, the variable was 0 if the member had no degree or lower degree than a bachelor’s degree, 1 for bachelor’s degree, 2 for master’s degree, and 3 for

[1] WeChat launched the official account function in 2012.

[2] The simplified Chinese dictionary of LIWC is a translated version of the official English dictionary of LIWC and takes the nuances of the Chinese language into consideration. It is officially offered by LIWC.

doctoral degree. For industrial working experience, the dummy was equal to 1 if the member had worked in the same industry before he found the venture, otherwise it was 0. For management experience, the dummy was equal to 1 if the member had been a senior manager or a top executive of firms (leader of a department/division/branch instead of a team/group) before. For entrepreneurship experience, the dummy was equal to 1 if the member had founded a start-up or had been a founding partner of a start-up. After that, the author integrated these measures to team-level human capital by calculating the sum of the means of the four variables. Then, the author determined a venture with high-level of human capital if its entrepreneurial team human capital was higher than the average of all the ventures' received investment in the focal year. Lastly, the author derived the percentage of high-level human capital ventures in its investment portfolios by dividing the number of high-level human capital the VC invested in by the total number of ventures it invested in the focal year.

Industrial Popularity

The author followed Zhang et al. (2017) to derive the popularity of a focal industry as the total number of ventures receiving their first VC funding before or in D-round (namely the early and expansion stages) in this industry in the previous year. Then, the author calculated the average industrial popularity of the investment portfolios of VCs in the focal year.

Reinvestment

The author calculated the percentage of new ventures that a focal VC had invested in before this focal round in its investment portfolio by dividing the number of ventures that the focal VC had invested in before by the total number of ventures it invested in the focal year.

New Venture Stage

The author categorized the ventures according to their funding rounds when they received the investment. The "Seed," "Angel," "Pre-A/A/A+," and "Pre-B/B/B+" rounds represented the early stages, the C and D rounds represented the expansion stages, and the later rounds represented the mature stages. The author calculated the percentage of investments of the early/expansion/mature stage in VCs' investment portfolios separately by dividing the number of corresponding ventures the VC invested in by the total number of new ventures it invested in the focal year.

Controls

Following the prior venture investment literature, the author controlled the number of investors (invest analysts), age, amount of money managed with log transformation, and number of branches of each VC, which were indications of its experience and capability and might impact its investment behaviors. The author also controlled the number of foreign branches to control for more diverse information sources of the VC. Moreover, the author controlled the investment experience of the VC by the number of investments made in the 5 years before the focal year. The author controlled the investment accomplishments of the VC by the number of ventures it invested in the 5 years before the focal year by the VC that went to IPO later. The author controlled the number of industries in which the VC invested in the 5 years before the focal year to eliminate the possible influence of the industrial horizon of the VC. Lastly, as the network is supported as a strong force for investment decision (Zhelyazkov, 2018), the author controlled the effect of the network of the VC by the number of VCs that invested together with the focal VC in the 5 years before the focal year. The author used the log transformation of investment experience and network to adjust for skewness and to capture non-linear impacts. In addition, the author controlled the fixed effects of calendar years and cities where headquarters were located as well.

RESULTS

Data Description

Tables 1, **2** show the description and correlations of the variables. LTO did not exhibit any high correlations with the dependent variables and control variables, whereas some of the controls were

TABLE 1 | Statistics of variables.

Variable	Obs.	Mean	SD	Min	Max
LTO	1473	0.486	0.218	0	1.972
Percentage of high-level human capital new ventures	1473	0.488	0.347	0	1
Industrial popularity of portfolio	1473	0.035	0.021	0.002	0.126
Percentage of new ventures invested before	1473	0.105	0.197	0	1
Percentage of investments at early stage	1473	0.823	0.292	0	1
Percentage of investments at expansion stage	1473	0.08	0.188	0	1
Percentage of investments at mature stage	1473	0.096	0.228	0	1
Number of investors	1473	8.432	6.567	1	38
Investment experience	1473	2.502	1.189	0.693	5.756
Investment accomplishments	1473	1.197	2.767	0	23
Industrial horizon	1473	6.964	5.329	1	20
Network	1473	2.630	1.288	0	5.858
Number of branches	1473	1.666	1.426	1	11
Number of foreign branches	1473	0.058	0.315	0	4
Age	1473	4.924	4.229	0	31
Amount of money managed	1473	22.103	1.637	16.588	26.022

TABLE 2 | Correlations.

Variables	LTO	Percentage of high-level human capital new ventures	Industrial popularity of portfolio	Percentage of new ventures invested before	Percentage of investments at early stage	Percentage of investments at expansion stage	Percentage of new ventures at mature stage
Percentage of high-level human capital new ventures	0.053**						
Industrial popularity of portfolio	−0.060**	0.075***					
Percentage of new ventures invested before	0.116***	0.014	−0.026				
Percentage of investments at early stage	−0.082***	0.060**	−0.055**	0.015			
Percentage of investments at expansion stage	0.089***	0.007	0.044*	0.057**	−0.628***		
Percentage of investments at mature stage	0.031	−0.084***	0.032	−0.067**	−0.765***	−0.022	
Number of investors	0.055**	−0.010	0.022	0.111***	−0.029	0.027	0.014
Investment experience	0.100***	0.010	0.008	0.235***	0.044*	0.021	−0.075***
Investment accomplishments	0.061**	−0.028	−0.022	0.104***	−0.067**	0.076***	0.023
Industrial horizon	0.115***	−0.028	−0.068***	0.207***	0.065**	0.003	−0.086***
Network	0.144***	0.030	0.039	0.260***	−0.060**	0.119***	−0.023
Number of branches	0.012	−0.005	−0.001	0.069***	0.027	−0.017	−0.021
Number of foreign branches	0.032	0.004	0.007	0.027	0.024	−0.001	−0.030
Age	0.008	−0.025	0.100***	0.057**	−0.106***	0.055**	0.091***
Amount of money managed	0.077***	0.024	0.088***	0.019	−0.132***	0.088***	0.097***

Variables	Number of investors	Investment experience	Investment accomplishments	Industrial horizon	Network	Number of branches	Number of foreign branches	Age
Investment experience	0.573***							
Investment accomplishments	0.541***	0.549***						
Industrial horizon	0.568***	0.783***	0.523***					
Network	0.521***	0.884***	0.530***	0.727***				
Number of branches	0.251***	0.193***	0.186***	0.256***	0.162***			
Number of foreign branches	0.067***	0.017	0.116***	0.065**	0.067**	0.397***		
Age	0.439***	0.279***	0.331***	0.301***	0.318***	0.154***	0.098***	
Amount of money managed	0.269***	0.139***	0.225***	0.143***	0.169***	0.139***	0.120***	0.277***

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

correlated with one another. *Investment experience* was highly correlated with *Industrial horizon* and *Network* of VCs, which was understandable, as the more investments a VC made, the higher possibilities for it to invest in different industries and form ties with other VCs. *Network* also had a high correlation with *Industrial horizon*, as a larger network could offer more information and knowledge for the VC to explore opportunities in diverse industries. High correlations (above 0.5) appeared in other dyads among *Number of investors*, *Investment experience*, *Investment accomplishments*, *Industrial horizon*, and *Network* as well. The remaining controls, namely, *Number of branches*, *Number of foreign branches*, *Age*, and *Amount of money managed*, were not highly correlated with each other. The author applied OLS regression to test the hypotheses as expressed by Equation (1) below:

$$DV_{i,t} = \beta LTO_{i,t} + \delta Controls_{i,t} + p_i + y_t + \varepsilon_{i,t} \quad (1)$$

where *i* represents each VC in the sample, and *t* represents each calendar year. Thus, $DV_{i,t}$, $LTO_{i,t}$, and $Control_{i,t}$ represent the

TABLE 3 | Regression results of H1 and H2.

	H1		H2	
Variables	**Percentage of high-level human capital new ventures**		**Industrial popularity of portfolio**	
LTO		−0.0161		−0.00789**
		(0.0469)		(0.00290)
Number of investors	0.000959	0.000966	2.81e-05	3.13e-05
	(0.00206)	(0.00206)	(0.000124)	(0.000124)
Investment experience	0.00753	0.00732	0.0111***	0.0110***
	(0.0285)	(0.0286)	(0.00188)	(0.00187)
Investment accomplishments	−0.00504+	−0.00500+	−0.000162	−0.000141
	(0.00269)	(0.00269)	(0.000185)	(0.000183)
Industrial horizon	−0.00817+	−0.00814+	−0.00273***	−0.00272***
	(0.00466)	(0.00466)	(0.000394)	(0.000388)
Network	0.0393*	0.0397*	0.000272	0.000461
	(0.0173)	(0.0175)	(0.00106)	(0.00105)
Number of branches	−0.00196	−0.00190	−5.74e-05	−3.27e-05
	(0.00632)	(0.00632)	(0.000483)	(0.000494)
Number of foreign branches	0.00624	0.00642	0.000782	0.000871
	(0.0313)	(0.0314)	(0.00155)	(0.00151)
Age	−0.00253	−0.00260	0.000382*	0.000344*
	(0.00267)	(0.00268)	(0.000157)	(0.000155)
Amount of money managed	0.00571	0.00586	0.000865*	0.000939*
	(0.00608)	(0.00608)	(0.000388)	(0.000386)
Constant	0.467**	0.463**	0.0182*	0.0163+
	(0.177)	(0.177)	(0.00867)	(0.00866)
Observations	1,473	1,473	1,473	1,473
R-squared	0.057	0.057	0.181	0.187

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{+}p < 0.1$.

dependent variables, LTO value, and control variables of each observation, respectively. p_i and y_t are the fixed effects of places and calendar years. As the sample is of the VC-year level, the author clustered the errors to the VC level in the estimation.

Main Models

The results of the regression models are displayed in **Tables 3**, **4**. The results did not support hypothesis 1, as the LTO coefficient in the model of H1 was not significant [$\beta = -0.016$, $t = -0.34$, $p = 0.732$, and 95% CI = (−0.108, 0.076)]. As for the models of H2, the LTO showed significant negative effects on the industrial popularity of the portfolio [$\beta = -0.008$, $t = -2.72$, $p = 0.007$, and 95% CI = (−0.014, 0.002)]. Thus, hypothesis 2 was supported, that is, VCs with higher level of LTO tend to have less "popular" portfolio. Hypothesis 3 was also supported by a significantly positive coefficient of LTO [$\beta = 0.056$, $t = 2.54$, $p = 0.011$, and 95% CI = (0.013, 0.099)], which indicated that VCs with higher level of LTO tend to invest in the same venture continuously instead of shooting once at numerous single ventures. The models of hypothesis 4 containing three regressions demonstrated the expected significant effects of LTO on the percentage of investments in the early and expansion stages [early stage: $\beta = -0.068$, $t = -1.92$, $p = 0.056$, and 95% CI = (−0.137, 0.002); expansion stage: $\beta = 0.052$, $t = 2.22$, $p = 0.027$, and 95% CI = (0.006, 0.098)]. However, LTO showed no significant effect on the percentage of investments in the mature stage [$\beta = 0.015$, $t = 0.51$, $p = 0.608$, and 95% CI = (−0.044, 0.075)]. This result suggested that VCs with higher level of LTO are more interested in investing in ventures in the expansion stage but more conservative in ventures in the early stage. In addition, they maintain a neutral attitude toward mature ventures. Thus, hypothesis 4 was partially supported.

In addition to the main findings, the author also observed some significant coefficients of the control variables. The industrial horizon showed negative effects on all the dependent variables except for the new ventures in the early stage, possibly because VCs pursuing industrial diversity of their investment portfolios may reduce their attention on other attributions of ventures, such as human capital and popularity. Moreover, in order to invest in a larger industrial range, VCs may need to separate their money into pieces to invest more ventures in different industries. Thus, they may lack concentration on single ventures and attempt to catch opportunities from the early stage with fewer expenses. Conversely, a larger network of VCs results in more investments in high-level human capital new ventures as well as new ventures in the extension and mature stages. This outcome may be due to the information and knowledge spillover from the other members of the network.

TABLE 4 | Regression results of H3 and H4.

Variables	H3		H4					
	Percentage of new ventures invested before		Percentage of investments at early stage		Percentage of investments at expansion stage		Percentage of investments at mature stage	
LTO		0.0559*		−0.0678^{+}		0.0518*		0.0154
		(0.0220)		(0.0354)		(0.0233)		(0.0301)
Number of investors	−0.000102	−0.000125	−0.000743	−0.000715	−0.000681	−0.000702	0.00138	0.00138
	(0.00107)	(0.00106)	(0.00173)	(0.00173)	(0.00109)	(0.00109)	(0.00154)	(0.00154)
Investment experience	0.106***	0.107***	0.102***	0.101***	−0.0249	−0.0243	−0.0772***	−0.0770***
	(0.0172)	(0.0170)	(0.0281)	(0.0280)	(0.0176)	(0.0176)	(0.0227)	(0.0227)
Investment accomplishments	−3.70e-06	−0.000151	−0.0127**	−0.0125**	0.00648**	0.00635**	0.00620*	0.00616*
	(0.00212)	(0.00211)	(0.00424)	(0.00425)	(0.00219)	(0.00218)	(0.00300)	(0.00300)
Industrial horizon	−0.0160***	−0.0161***	0.00657^{+}	0.00669^{+}	−0.00639*	−0.00648*	−0.000134	−0.000159
	(0.00340)	(0.00334)	(0.00397)	(0.00396)	(0.00263)	(0.00263)	(0.00310)	(0.00310)
Network	0.00746	0.00612	−0.0943***	−0.0927***	0.0517***	0.0504***	0.0425**	0.0421**
	(0.0108)	(0.0108)	(0.0173)	(0.0171)	(0.0112)	(0.0110)	(0.0132)	(0.0132)
Number of branches	0.00757	0.00739	−0.00504	−0.00482	0.000712	0.000550	0.00436	0.00431
	(0.00480)	(0.00462)	(0.00514)	(0.00506)	(0.00311)	(0.00300)	(0.00440)	(0.00439)
Number of foreign branches	0.00739	0.00676	0.0572*	0.0579*	−0.0117	−0.0123	−0.0455*	−0.0456*
	(0.0159)	(0.0162)	(0.0272)	(0.0274)	(0.0155)	(0.0155)	(0.0179)	(0.0180)
Age	−0.00111	−0.000845	−0.00357^{+}	−0.00389^{+}	−3.71e-05	0.000211	0.00358^{+}	0.00365^{+}
	(0.00132)	(0.00133)	(0.00215)	(0.00214)	(0.00131)	(0.00128)	(0.00202)	(0.00203)
Amount of money managed	−0.000860	−0.00139	−0.0170**	−0.0163**	0.00731*	0.00683^{+}	0.00966^{+}	0.00951^{+}
	(0.00353)	(0.00348)	(0.00598)	(0.00599)	(0.00352)	(0.00354)	(0.00504)	(0.00505)
Constant	−0.204*	−0.190*	1.177***	1.160***	−0.0941	−0.0814	−0.0835	−0.0797
	(0.0801)	(0.0790)	(0.135)	(0.135)	(0.0846)	(0.0852)	(0.111)	(0.111)
Observations	1,473	1,473	1,473	1,473	1,473	1,473	1,473	1,473
R-squared	0.141	0.144	0.139	0.141	0.077	0.081	0.095	0.095

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{+}p < 0.1$.

Robustness Check

For robustness check, the author first ran the models with all variables to be standardized. The results turned out to be almost consistent. For H2, H3, and H4, which were supported in the main models, the author carried out extra models for robustness check.

For H2, which was about industrial popularity, the author applied a new measure to capture the industrial popularity level of the portfolios, which was similar to the measure of human capital explained in the Section "Materials and Methods." The author calculated the mean of the popularities of industries yearly and determined a venture as popular if it belonged to an industry with higher popularity than the mean. Then, the author accessed *the percentage of high-popularity new ventures* by dividing the number of *popular ventures* the VC invested in by the total number of ventures it invested in the focal year.

For reinvestment (H3), the author calculated the time a venture invested before the focal year by the focal VC (if a venture was first invested by the focal VC in the focal year, it was equal to 0). Then, the author integrated them to the portfolio level by calculating the means across portfolio ventures of a VC on each focal year as the measure of the focal VC's preference for reinvestment.

As for the hypothesis of preference on stages (H4), the author substituted the classified measures of stages with a continuous one. The author first coded the *round* by sequence: "Seeds" is equal to 0, "Angel" is equal to 1, "Pre-A/A/A+" is equals to 2, "Pre-B/B/B+" is equal to 3, "C/C+" is equal to 4, "D/D+" is equal to 5, "E" is equal to 6, "F to before-IPO" is equal to 7, and "after IPO" is equal to 8. Then, the author calculated *the average round of each VCs' portfolio ventures* yearly, the higher of which indicated the tendency of a VC to invest in more mature ventures.

The author reports the additional results of the robustness check in **Table 5**. For H2 (industrial popularity) and H3 (re-investment), the significant coefficients of LTO again supported the two hypotheses [H2: $\beta = -0.095$, $t = -2$, $p = 0.046$, and 95% CI = (−0.189, −0.002); H3: $\beta = 0.088$, $t = 2.95$, $p = 0.003$, and 95% CI = (0.030, 0.147)]. One percent rise in the VC's LTO may cause a 9.5 decline in the percentage of high-popularity ventures in its portfolio and a 0.088 increase in the frequency of investing in the same venture. For H4, which proposed that LTO is first positively related to preference in later stages and becomes negative after, the author tested the possible inverted "U"-shaped relationship between LTO and preference of the investment stage by introducing the squared term of LTO, as shown in Equation (2). Consequently, the inverted "U"-shaped relationship was

supported, as the coefficient of LTO was significantly positive while the coefficient of the squared term of LTO was significantly negative [LTO: β = 1.125, t = 3.85, p = 0, and 95% CI = (0.551, 1.699); LTO^2: θ = −0.554, t = −2.42 p = 0.016, and 95% CI = (−1.003, −0.105)]. The inverted "U" shape is clearly visible in **Figure 1**. This outcome confirmed our hypothesis that VCs with higher LTO prefer ventures in the expansion stage over those in the early and mature stages.

$$DV_{i,t} = \theta LTO^{\widehat{2}}_{i,t} + \beta LTO_{i,t} + \delta Controls_{i,t} + p_i + y_t + \varepsilon_{i,t}. \quad (2)$$

DISCUSSION

In this study, the author discussed the essence of LTO in venture investment. Concentration on the future, perseverance, and pursuit for continuity (Lumpkin and Brigham, 2011) influence venture investment at the organizational level. The empirical analysis strongly suggested that VCs with high level of LTO are more likely to put their money in less popular industries for the sake of forming longer-lasting proactive advantages. Instead of putting eggs in as many baskets as possible, VCs with high level of LTO have more patience in and dedication to their invested ventures with higher possibility of re-investing in a single venture. Lastly, the author proved the high LTO preference of VCs for ventures in the expansion stage. It may be intuitively suggested that the concentration on long-term benefits leads VCs to invest as early as possible. However, the impact of LTO on the timing of investment turned out to be a balanced result of the pursuit of long-term benefits and excessive risk aversion.

The author did not find support for any preference of high-level LTO VCs to high-level human capital of founding teams (H1). One possible speculation is that long-term oriented investors may be more interested in the role of a "coach" (Colombo and Grilli, 2010) who can contribute more to the development of ventures. They are willing to put their eyes on inconspicuous ventures or entrepreneurs at present yet with qualities and a high potential for future growth under their coaching. This notion coincides with the logic behind the industry popularity hypothesis in this study. Additionally, the different sources of human capital may be related to different

TABLE 5 | Robustness check for H2, H3, and H4.

	H2		H3		H4	
Variables	**Average popularity of the portfolio ventures**		**Average invested times by focal VC of the portfolio ventures**		**Average round of the portfolio ventures**	
LTO		−0.0952*		0.0884**		1.125***
		(0.0477)		(0.0300)		(0.292)
LTO^2						−0.554*
						(0.229)
Number of investors	0.000512	0.000551	−0.000122	−0.000158	0.00414	0.00391
	(0.00226)	(0.00226)	(0.00147)	(0.00144)	(0.00723)	(0.00721)
Investment experience	0.191***	0.190***	0.132***	0.133***	−0.502***	−0.494***
	(0.0325)	(0.0324)	(0.0223)	(0.0219)	(0.109)	(0.107)
Investment accomplishments	−0.00225	−0.00200	0.000354	0.000121	0.0487***	0.0473***
	(0.00333)	(0.00330)	(0.00301)	(0.00298)	(0.0142)	(0.0142)
Industrial horizon	−0.0464***	−0.0462***	−0.0195***	−0.0196***	−0.0523***	−0.0538***
	(0.00594)	(0.00586)	(0.00467)	(0.00456)	(0.0145)	(0.0144)
Network	−0.00192	0.000369	0.0138	0.0117	0.525***	0.509***
	(0.0204)	(0.0203)	(0.0121)	(0.0122)	(0.0647)	(0.0638)
Number of branches	−0.00177	−0.00147	0.00870	0.00843	0.0640**	0.0630**
	(0.00781)	(0.00799)	(0.00667)	(0.00641)	(0.0217)	(0.0218)
Number of foreign branches	0.0444	0.0455+	−0.000879	−0.00188	−0.193+	−0.196+
	(0.0276)	(0.0274)	(0.0178)	(0.0182)	(0.106)	(0.110)
Age	0.00737*	0.00692*	−0.00249	−0.00207	0.0220*	0.0246**
	(0.00296)	(0.00294)	(0.00160)	(0.00159)	(0.00952)	(0.00936)
Amount of money managed	0.0170*	0.0179*	−0.00167	−0.00250	0.0647**	0.0598**
	(0.00742)	(0.00735)	(0.00504)	(0.00497)	(0.0216)	(0.0214)
Constant	0.131	0.107	−0.250*	0.185	0.317	0.673+
	(0.164)	(0.162)	(0.115)	(0.479)	(0.476)	(0.400)
Observations	1,473	1,473	1,473	1,473	1,473	1,425
R-squared	0.157	0.160	0.161	0.203	0.212	0.272

*$p < 0.001$, **$p < 0.01$, *$p < 0.05$, +$p < 0.1$.

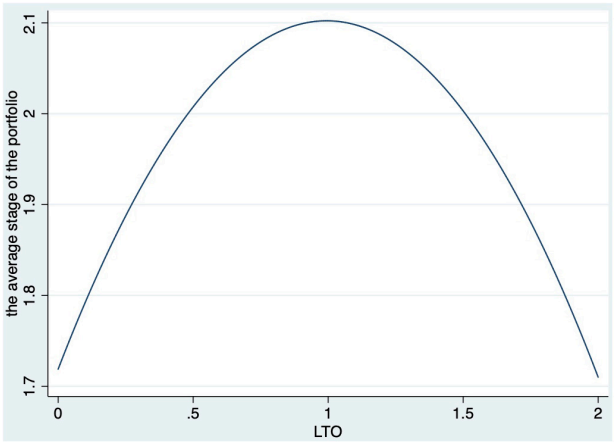

FIGURE 1 | Inverted "U"-shaped relationship between long-term orientation (LTO) and preference of investment stage.

levels of coachabilities, which may be valued by VCs differently. The author suggests that the relationship between characteristics of entrepreneurs and their coachabilities may be an interesting topic for future research.

One of the features of this study is performing content analysis for LTO measure. Content analysis has become a popular method for cognition-related research (Gerstner et al., 2013; Pan et al., 2020). By the analysis of officially released articles, the author generated the LTO measure directly at the VC organizational level, thus testing the psychological framework at the organizational level. This pioneered the psychological and cognitive empirical research to take advantage of second hand data of larger size.

Scholars have long called for cognitive exploration in the field of entrepreneurship (Shepherd and Patzelt, 2018). However, the mindset of investors is still covered by mist. Thus, this study has extended venture investment research by deepening the psychological view in this field. Along with the validation of LTO theory in the venture investment context, this study also serves as a reference for strategic decision-making research, as the context of venture investment decision is sometimes considered an extreme approximate of strategic decision-making (Maitland and Sammartino, 2015). Strategic decisions of firms are usually related to large long-term investments in projects, assets, or M&As where uncertainties and lack of information also stimulate the heuristic process (Loock and Hinnen, 2015). Moreover, VC firms have diverse strategies guiding the formation of their portfolios (Drover et al., 2017). Thus, the mechanism of venture investment may also be valid in strategic decision contexts.

The conclusion of this study provides a practical lens for VCs to examine their investment decisions from the angles of both process and result. Venture investors are suggested to understand their subjective decision process based on the understanding of their mindsets. Meanwhile, VCs need to consider the psychological characteristics of their employees to execute specific investment strategies. For entrepreneurs, this revealed mechanism should also be considered when selecting desired investors.

Limitations and Future Research

This study is limited in several ways. First, the author did not test the moderate effects of other related factors. Evidence shows that affects and cognitions are always intertwined in the decision making process (Elen et al., 2013). Future research can contribute by testing whether their interplay still exists at the organizational level. In addition, environmental factors can serve as important contingencies (Nadkarni et al., 2016; Lin et al., 2019) despite the challenge that venture investors may react to the environment much differently from top executives, as they have to look across industries and quickly catch the dynamics. Another deficiency is that the author did not have the opportunity to test the effect of LTO on investment performance. Our approach takes advantage of emerging online media resulting in limited length of the observation period. The author was only able to collect LTO data in the past few years; hence, the time window to observe investment performance is insufficient, as it takes years to see whether the investment can be paid back (Drover et al., 2017). Nevertheless, whether LTO can bring VCs with better investment performance is a research topic worthy of investigation. Another rising force is CVC with dual motivations for industrial and financial goals. Investigation on CVCs will reveal resonant effects of the psychological mechanism on both the strategic and financial decisions compared with independent VCs focusing more on financial goals. Meanwhile, the approach of this study can also be applied to similar frameworks about start-ups to investigate the impacts of LTO or other psychological factors on performance at the organizational level. Lastly, studies on venture investment always treat the formation of investment ties as a unilateral decision, made by either investors or entrepreneurs. The proven similarity bias exiting in a venture investment suggests more extensive "matching" effects between ventures and investors. Hence, future researchers are encouraged to explore "matching" effects under psychological frameworks.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

The author designed this study, conducted the empirical test and completed the writing.

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Does Top Management Team Media Exposure Affect Corporate Social Responsibility?

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This study examines the impact of top management team (TMT) media exposure on corporate social responsibility (CSR) and the moderating effect of TMT characteristics based on the upper echelons theory and stakeholder theory. Based on the observations of 5,352 firms between 2010 and 2019, multiple regression analysis is conducted to empirically test whether TMT media exposure can promote CSR. TMT media exposure is further divided into paper media and online media to reveal the impact of different types of TMT media exposure on CSR. Some robustness tests are also conducted to strengthen the regression results. The results found that a high level of TMT media exposure promotes social responsibility. In addition, the TMT power and political connections negatively moderate the relationship between TMT media exposure and CSR. The main contribution of this study is to develop a TMT media exposure model to assess the impact of TMT media exposure on CSR, providing a theoretical contribution to the existing literature and enriching the research in the CSR context from the perspective of the TMT characteristic moderating role.

Keywords: upper echelons theory, top management teams (TMTs), media exposure, corporate social responsibility (CSR), power, political connections

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INTRODUCTION

In recent years, corporate social responsibility (CSR) disclosure in China has attracted increasing attention (Yin and Quazi, 2018). According to the CSR rating report of Rankings Global (RKS) in 2019, the Chinese A-share companies listed in the CSR information disclosure report increased by 129% from 2009 to 2018, with an average of 48 new companies each year. By 2000, the number of Chinese A-share listed companies increased to 134%. The growth rate of CSR report information disclosure is slightly lower than the market scale growth rate. In view of the increasingly important position of social responsibility investment in corporate operation and management and the importance of CSR for corporate sustainable development, understanding the driving of CSR has become an important research field in corporate finance literature.

According to upper echelons theory (Hambrick and Mason, 1984), corporate strategic decision-making is influenced by the characteristics of top management teams (TMTs); therefore, CSR should be regarded as a type of strategic decision which can also be decided by TMTs. Scholars have studied demographic variables from the perspective of internal control, such as gender, age, and educational background (Sánchez et al., 2017). However, Tao et al. (2019) found that external

supervision encourages executives to generate better commitment in the decision-making process, while the internal characteristics of TMTs cannot effectively restrain the TMT power. Research on the external governance of executives mainly focused on government, law, and audit institutions (Allen et al., 2005). However, due to the rapid growth of China's economy, the laws have lagged behind the development of financial markets, and more external forces are needed to supervise the company's TMTs (Zheng, 2007). According to Atanassov and Kim (2009), extra-legal institutions, such as the media, played a critical role in influencing corporate decision-making. El Ghoul et al. (2016) also observed that media attention is an important driving force for CSR because it could influence the strength of CSR and encourage enterprises to voluntarily disclose their CSR information. Significant media attention to companies often means that companies perform in social responsibility.

Hambrick and Mason (1984) stated that the behavioural integration of TMTs comprises three main variables: the individual chief executive officer (CEO) level, the top management level, and the firm level. Previous research on media exposure and CSR has mostly focused on the firm level and has found that there is a positive correlation between media exposure and CSR (Garcia-Sanchez et al., 2014). However, most previous studies often ignore the media attention to the TMTs. Media is often the first to note the irresponsible behaviour of TMTs and protect investors by constraining managers (Zhang, 2011). It can affect corporate behaviour and promote the sustained growth of corporate value and capital markets. Media is perceived as the main source of legitimate information for investors, which helps to reduce information asymmetry for many stakeholders (Siegel and Vitaliano, 2007). Nevertheless, this process and its results are rarely examined from the perspective of the media exposure of TMTs in the CSR context. A few similar studies mainly focused on CEOs (Godos-Díez et al., 2020). Therefore, this study aims to fill this literature gap by examining a rarely considered exposure variable, namely, the media exposure of TMTs, which is determined by the frequency of their appearance in print and online.

As an important incentive mechanism, media attention is an effective substitute for the inadequacy of judicial protection and other systems in emerging markets. The media plays an intermediary role in the capital market through information communication. Even in developed western countries with relatively stringent legal and regulatory systems, the media still plays an important role in corporate governance. At the same time, with the separation of corporate ownership and control, how to introduce a more effective external governance mechanism to check and balance management teams' self-interest behaviour and reduce agency cost has become a topic of ongoing concern amongst Chinese academics. In the process of CSR decision-making, is the individual behaviour of TMT significantly affected by the attention of external media? Is this issue still relevant in different TMT characteristics? If so, what are the differences in the individual behaviour of TMTs?

This study makes an empirical analysis of Chinese listed companies from 2010 to 2019 and uses the newspaper and online media coverage of their TMTs as a proxy to test the impact of this media exposure on their CSR. With increased media exposure, executives' decision-making becomes more complex and diversified because they feel that their actions are being closely scrutinised and that they must consider the goals of the stakeholder groups in the decision-making process. The relationship between TMT media exposure and CSR is also expected to be affected by TMT characteristics. This article further discusses the moderating effects of TMT power and political connections.

The main contributions of this research are as follows. Firstly, as the world's second-largest economy and largest emerging capital market, it is an important supplement to study the impact of TMT media exposure on CSR in China. From the perspective of media attention to TMTs, this study finds that an increase in such attention may enhance the strength of TMT voices in their companies, improve the effectiveness of external supervision, and have a positive impact on CSR. It demonstrates that the media news exposure of TMTs in emerging economies can play a monitoring and governance role. Secondly, the existing literature on CSR tends to focus on the economic consequences of firm-level media coverage but has not examined the impact of TMT-level media coverage. This study examines CSR practices by investigating the media exposure to TMTs so as to provide a basis for the follow-up research of the relationship between TMT media coverage and other corporate behaviours. Finally, this study investigates the moderating effects of TMT power and political connections, and reveals their inhibition of TMT media exposure on CSR governance.

The remainder of this article is structured as follows. First, the literature review and hypotheses tested are presented, followed by the study's sample, methodology, and results. Finally, the discussions and proposals for possible areas of future research development are discussed.

LITERATURE REVIEW AND HYPOTHESES

Literature Review

The Consequences of Media Exposure

Most scholars hold that the media, as an informal governance mechanism, plays a positive role in corporate behaviour (Lim et al., 2017). This continuous overview can promote the function of informing stakeholders while alleviating the adverse effect of information asymmetry (Bushee et al., 2010) in addition to reducing the motivation for, and the possibility of, illegal management. Dyck et al. (2008) studied the media's governance function and found that it played a governance role through mechanisms of reputation and legal constraints. In light of China's underdeveloped manager market and imperfect reputation mechanism, Huang and Li (2015) pointed out that the Chinese media mainly achieves governance through administrative intervention. In terms of the tone of media reports, Bednar et al. (2013) suggested that negative news report of a firm is related to subsequent strategic changes. In contrast, positive reports on a CEO

can lead to overconfidence and increase corporate risk-taking (Chatterjee and Hambrick, 2011).

In addition to media exposure at the firm level, as the policymakers and executors of enterprises, media exposure of TMTs also influences corporate business behaviours (Górska and Mazurek, 2021). The CEO's image may indirectly affect the image of the enterprise products (Alghawi et al., 2014). Thus, the media coverage of a CEO can be regarded as a marketing tool. Such media coverage can also increase investors' understanding of the company, promote the reputation of the CEO and the company, and attract more investors to buy the company's shares (Carter, 2006). Kang and Han Kim (2017) found that CEOs can improve their compensation through media coverage, which, in turn, affects the company's performance. Some scholars also directly equated CEO exposure with CEO reputation (Weng and Chen, 2017). Media exposure of CEOs can enhance firm-specific information into stock prices, reducing stock price synchronicity (Li et al., 2019).

Influence of Corporate Social Responsibility

The existing analysis of the driving factors of CSR is mainly divided into the research on TMT characteristics, internal governance structure, and external public pressure. Firstly, the TMT characteristics can affect the fulfilment of CSR. Galbreath (2011) found that some characteristics of female executives, such as lack of self-confidence, kindness, and thoughtfulness, made it easier for them to adopt CSR policies. Wen and Song (2017) also believed that managers who received overseas cultural education could better fulfil CSR. Secondly, internal governance structure affects the participation of CSR. Wang et al. (2020) found that the ownership structure of multiple major shareholders is an effective internal governance mechanism. Specifically, the ownership structure of multiple large shareholders could restrict the controlling shareholders from infringing the interests of minority shareholders, thus promoting social responsibility. From the perspective of board structure, Liao et al. (2018) posited that the larger the board size and separation between the CEO and chairman positions and the female directors, the easier it is to promote the fulfilment of CSR. Thirdly, it is found that external public pressure can affect CSR. Gandullia and Piserà (2020) observed that effective average corporate tax reduced the level of CSR. However, effective tax policies encourage large and medium-sized enterprises to disclose information and assume social responsibility. Moreover, Zheng et al. (2014) found that under the supervision pressure of external governments, state-owned enterprises are more inclined to disclose CSR in detail.

Brown and Deegan (1998) made a preliminary contribution to the study of the impact of corporate media coverage on CSR. Specifically, based on the media agenda setting theory and the legitimacy theory, they explained the annual report disclosure of Australian companies in the first study, using media coverage as a proxy of social concern, and concluded that variations in media attention have a positive correlation with variations in management information disclosure. Thereafter, Lindgreen et al. (2009) found that the higher the levels of media attention given to listed companies, the more list companies pay attention to their external corporate image and the more they paid attention to environmental protection and other aspects of social responsibility investment. At the same time, more CSR information would be disclosed voluntarily. Subsequently, according to the legitimacy theory, Islam and Deegan (2010) conducted the first study on how developing country companies responded to media attention, emphasising that media supervision, as an external supervisory force, plays an important role in motivating companies to actively take responsibility for their stakeholders. Reverte (2009) demonstrated that as an informal system and independent supervisor of third parties, media attention is one of the important deciding factors in corporate decisions to voluntarily disclose CSR information, while also being an important driving force for them to fulfil their social responsibilities. In summary, media attention significantly improves the willingness and level of voluntary social responsibility information disclosure (Li et al., 2017).

To summarise, most scholars supported the idea that the media pays attention to the role of supervision and governance. However, most of the media exposure research focuses on the analysis of the firm level and seldom studies the role of media governance in TMTs. Up to now, there is little research on the supervisory role of media exposure of TMTs.

Hypothesis Development

According to the stakeholder theory, as an important external stakeholder of enterprises, the news media and their reports on executives have an important impact on managers' decision-making and behaviour (Delmas, 2001). When the media pays close attention to executives, this exposure can form a "spotlight effect," that is, the management reported upon becomes the focus of public opinion (Qi et al., 2014), thereby causing the public and investors to have higher expectations for enterprises to fulfil CSR expectations. At the same time, upper echelons theory posits that the effective implementation of TMT organisational strategies plays a key role, and the final organisational output is influenced by the strategic formulation and implementation. In addition, the behaviour of TMTs can directly affect CSR. Following Dyck and Zingales (2002) research, this section highlights three ways in which media coverage of TMTs affects their CSR performance.

Firstly, there is a reputation constraint mechanism (Dyck et al., 2008). Many researchers regard the level of CEOs' media exposure as an alternative variable of CEO reputation (Francis et al., 2008). TMTs realised that their appearances in the media had affected their image and reputation (Love et al., 2017). Extensive media attention to TMTs can also improve managers' transparency. Considering the company's long-term future interests, the possibility of TMTs seeking private interests becomes very low. Thus, they tend to actively disclose CSR information in order to obtain the support of investors and other stakeholders and maintain a positive image (Lindgreen et al., 2009).

The second way is the external market pressure, such as government agencies, the public, and the media or stakeholders. Xiong and Luo (2021) found that public pressure, such as media attention, may force TMTs to reduce opportunistic behaviour and corporate risk and improve corporate value. At the same time,

stakeholders are also concerned about media reports, which may bring greater environmental pressure to the company.

The final way is administrative intervention (Huang and Li, 2015). Media attention to TMTs can increase the pressure of potential government intervention, make them vulnerable to intervention by administrative bodies, and increase the likelihood to be punished by the administrative authorities. In order to meet the needs of sustainable development, TMTs are often more willing to voluntarily fulfil their social responsibility. Yang and Zhao (2012) documented that only when the government and administrative departments participate in media supervision can it play a role in governance. At the same time, TMTs are facing huge reputation loss and may also be subject to administrative punishment due to constant media exposure. Thus, the best countermeasure for TMTs receiving extensive media attention is to consciously fulfil their CSR requirements.

In short, companies whose TMTs are highly exposed by the media are faced with a more complicated stakeholder environment, greater expectations and pressure of stakeholders, and more social responsibilities to be fulfilled. As the disseminator of information, media exposure helps to reduce the information asymmetry of the market. The relatively transparent environment enables stakeholders to understand any potential "crisis" in TMT operations, which makes it difficult for these teams to take actions that harm the public interests (Chen et al., 2013). Based on the above analysis, the following hypothesis is proposed.

> H1: The level of TMT media exposure can promote the better fulfilment of CSR.

Haynes and Hillman (2010) believed that power plays an important role in strategic decision-making and strategic differences. TMT power (Finkelstein, 1992) refers to the power that TMTs have to continuously influence the key corporate decisions despite the potential opposition of other directors. Based on the upper echelons theory, when TMTs are powerful, their personal preferences will be well reflected in strategy making (Haynes and Hillman, 2010). Numerous studies have shown views that TMT power is negatively related to CSR (Rashid et al., 2020). Based on the managerial opportunism hypothesis, powerful executives are more confident in their business decisions to pursue the personal reputation and compensation increase brought about by the expansion of the company, which leads to blind over-investment and damage to the stakeholders. On the contrary, the weak TMTs in power are more worried about their own corporate decisions, considering taking on more social responsibilities, easing the relationship between the company and its stakeholders, and thus stabilising their careers.

The topic applied to Hypothesis 2 is that powerful executives are not interested in disclosing CSR. Instead, they prefer to invest in other profitable activities (Rashid et al., 2020). At the same time, when TMTs are with too much power, the media or shareholders' supervision of management is reduced (Jensen and Meckling, 1976), which leads to the weakening of supervision motivation and lack of supervision information. This, therefore, makes executives override corporate governance, have important control rights over the company, and formulate self-interest policies under the temptation of rent-seeking. In other words, powerful TMTs play a role of a "protective cover" for media exposure which reduces the sensitivity of enterprises to the environment. According to agency theory, with the increase of TMT power, under the lack of effective supervision, TMTs are more likely to ignore the corporate interests and seek benefit for themselves. In addition, in the process of strategy-making, powerful TMTs can significantly weaken the influence of industry standards on executive strategy-making, thus making it easier for enterprises to make strategic decisions deviating from industry standards (Tang et al., 2011). As a result, TMT power is too large or even above external supervision, and it is more likely to be "rent-seeking." In short, TMT media exposure enhances CSR, but when TMTs have too much power, the relationship between the two variables is weakened. Therefore, the positive correlation between TMT media exposure and CSR may be disturbed by TMT power.

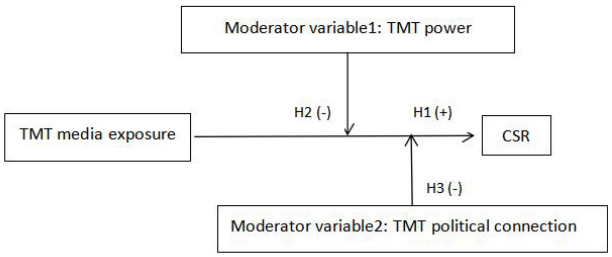
> H2: TMT power negatively moderates the impact of TMT media exposure on CSR.

Regarding political connections, as Allen et al. (2005) state in their article, political connections refer to the implicit political relationship between the company and individuals with political rights. In developing countries and regions, firms tend to get policy support and resource allocation through informal alternative mechanisms, and political connections can help firms eliminate the obstacles caused by institutional weaknesses.

Based on the upper echelons theory, when TMTs have political connections, they use these political resources to exert influence on the media and ensure that media reports produce "selective bias" or avoid important points so as to maintain their own reputation, thus weakening the media's governance role. TMTs with political connections play the role of "amulets." Due to the lack of effective supervision, politically connected companies are discouraged from improving the quality of their financial information disclosure (Chaney et al., 2011) to the company's violations, and the self-interest behaviours of its managers cannot be effectively reported by the media, significantly reducing the willingness of companies to fulfil their CSR. In this sense, political connections play a counter-role in improving capital market efficiency. Due to the lack of an invisible "shelter" for companies without political connections, the degree and content of company information disclosure are greater, allowing investors to better understand corporate performance. Wang et al. (2018) found that compared with politically affiliated enterprises, the media plays a greater role in monitoring the private interests of the controlling shareholders of non-politically affiliated enterprises. Therefore, media attention has a stronger driving force to CSR disclosure of listed companies without political connections. Consequently, we concluded that political ties tend to inhibit the supervision and governance of the media. This leads to the third hypothesis.

> H3: TMT politically connected firms negatively moderate the impact of TMT media exposure on CSR.

Based on Hypotheses 1, 2, and 3, the conceptual framework of this article is shown in the figure below.



STUDY DESIGN

Date and Samples

Listed companies that issued CSR reports in the Shanghai and Shenzhen Stock Exchanges from 2010 to 2019 are selected as the research sample. To ensure the quality of the data, we excluded financial, ST, ST*, and PT listed companies, companies with missing data and no CEO, and companies with less than 1 year of operation during the survey period. Therefore, we finally obtained 5,352 firm-year observations. The CSR data are derived from RKS's CSR Ratings[1], including the executive news data, TMT power data, political connections data, and other financial information that were extracted from the China research data service platform, CNRDS. Other control variable data are extracted from the CAMAR database. To avoid the influence of outliers on the regression results, all variables are winsorised at the tail of the upper and lower 1% distribution.

Measures

Dependent Variable

Based on the articles of Carroll (1999) and Dahlsrud (2008), and in combination with the development status of CSR, this current study defines CSR as a corporate social responsibility where an enterprise undertakes economic responsibility to shareholders (pursuing shareholders' interests), in which it also needs to pay attention to employees, creditors, customers, suppliers, government, and responsibilities of other stakeholders such as the community and the ecological environment.

The CSR reports rating results of listed companies released by RKS's CSR Ratings (Rezaee et al., 2020) are used to measure CSR in this article. As the CSR rating report of RKS has four characteristics of the macrocosm (M score), content (C score), technique (T score), and industry (I score), the score is comprehensive, fair, and reliable. The CSR score referred to in this study is the total comprehensive score of MCTI, which indicates the corporate CSR performance in the current year, with a full score of 100. The higher the social responsibility score, the more social responsibility the enterprise undertakes. Hence, a better CSR performance.

[1]http://www.rksratings.cn/

Independent Variable

There are many views on the definition of top management teams (TMTs) in academia (Carpenter et al., 2004), and different scholars have different understandings. Hambrick and Mason (1984) defined the TMTs as all senior managers while Finkelstein and Hambrick (1990) defined them as board members and senior managers. Referring to the definition in Hambrick and Mason (1984) and based on the actual situation in China and the availability of data, this article defines the TMTs as all the senior managers of the management level above the deputy general manager of the company, including the president, vice president, general manager, deputy general manager, general manager assistant, chief accountant chief engineer, and other senior managers of the management level disclosed in the annual report of the listed company.

Referring to Khan and Sukhotu (2020), this article defines media exposure as the number of times observations appear in both print and electric media. Since few people have studied the media exposure on TMTs, this article refers to the definition of CEO media exposure in Godos-Díez et al. (2020) and Wang et al. (2020) combined with the actual situation of China and the availability of data, TMTs are defined as the number of times TMTs appear on the print and internet media. The natural logarithm of "1++total TMT internet media coverage+total TMT press media coverage" is used to measure the overall media exposure of the TMTs (Media_total), while the natural logarithm of "1+total TMT internet media coverage" is used to measure the exposure of the TMTs in emerging online media (Media_net). The natural logarithm of "1+total TMT press media coverage" is used to measure the media exposure of the TMTs in traditional newspapers (Media_paper). The total media exposure included positive, neutral, and negative reports. Referring to Ning et al. (2020), all the media coverage of the TMTs is obtained from the China Executive News Database (CEND).

Moderating Variables

Many researchers have proposed that the CEO pay slice can be used to measure CEO power. The most authoritative representative is Bebchuk et al. (2011). According to this view, "the CEO Pay Slice is defined as the percentage of the total compensation to the top five executives that go to the CEO." Based on the actual situation in China and the availability of data (only the data of the top three executives' compensation can be obtained), this article uses the following way to measure TMT power. TMT power is measured by the top three executives' compensation divided by the total compensation of all executives.

The second moderating variable is TMT political connections. Referring to Fan et al. (2007) and Wang et al. (2017), the definition of TMT political connection in this article is that the TMT political connection of a company depends on whether any TMT is or has been a provincial, municipal, or local government official. We manually collect the annual report of the enterprise and check the resumes of the company's TMTs to determine whether any TMTs are or have been provincial, municipal, local government officials, deputies to the National People's Congress, and/or members of the National Committee of the Chinese people's Political Consultative Conference. This

TABLE 1 | Variable definitions and measurement.

Variable type	Variable name	Variable Symbol	Variable definition
Dependent variable	Corporate Social Responsibility	CSR	CSR Ratings score of listed companies on RKS.
Independent variable	TMTs media exposure	Media_total	The natural logarithm of "1+total internet media coverage+total press coverage"
		Media_net	The natural logarithm of "1+total internet media coverage"
		Media_paper	The natural logarithm of "1+total press media coverage"
Moderating variables	TMTs Power	Power	Total compensation of top three executives divided by total compensation of all executives
	TMTs Political	Political	TMTs political connection, measured by the proportion of TMTs with political relevance among TMT members.
Control variables	Proportion of female	Female_ratio	The proportion of female TMT
	Ave_age	Ave_age	The average age of TMT
	TMTs education level	Ave_edu	A categorical variable of TMTs education level
	Board size	Boardsize	Total number of directors
	TMTs shareholding ratio	Gm_holding	Measured by the ratio of total TMTs holdings to firm's total shares outstanding
	Duality	Dual	A dummy variable that takes 1 if the CEO is also the chairman of the board and 0 otherwise
	Firm Size	Size	Size of a firm, measured by the natural logarithm of total assets
	Financial leverage	Lev	Financial leverage of a firm
	Corporate performance	Roa	Return on the enterprise's total assets
	Product market competition	HHI	Indicator of the industry concentration, using the Herfindahl-Hirschman index (HHI)
	Ownership concentration	Top1	The concentration ratio of shares is expressed by the proportion held by the largest shareholder in the current year
	State	State	The property nature of state-owned enterprises (State) is 1, otherwise it is 0.
	Firm_age	Firm_age	The age of firm

article measures the degree of political relevance of a company's TMT by the proportion of TMTs with political relevance among TMT members.

To control the influence of other factors, this article selects the following two types of control variables with reference to Darmawan et al. (2019) research. The first category is the corporate level characteristic control variables. This article selects firm size (SIZE), asset-liability ratio (LEV) (Aharon and Yagil, 2019), return on assets (ROA) (Bollazzi and Risalvato, 2018), product market competition (HHI), shareholding ratio of the largest shareholder (Top1) (Peng and Yang, 2014), nature of property right (State), and firm age (Firm_age). The second category is the TMT level characteristic control variables. This article selects the proportion of females in TMTs (Female_ratio), TMT age (Ave_age), TMT educational level (Ave_edu), Board size (Boardsize), and duality (Duality). The specific definition and calculation methods of all variables are shown in **Table 1**.

Empirical Model

To test the impact of TMT media exposure on CSR, we constructed the following baseline empirical model. Based on the above analysis, if Hypothesis 1 is true, then α_1 would be significantly greater than 0.

$$CSR_{i,t} = \alpha_0 + \alpha_1 Media_{i,t} + \sum a_j Controls_{i,t} + Year + Ind + \varepsilon_{i,t} \quad (1)$$

In order to test Hypotheses 2 and 3, based on the model (1), this article adds TMT power (Power), TMT political (Political), and their interaction term with TMT media exposure (Media × Power and Media × Political) to test the moderating

TABLE 2 | Descriptive statistics.

Variables	Observations	Mean	SD	Minimum	Median	Maximum
CSR Score	5,352	40.13	12.36	17.24	37.57	84.13
Media_total	5,352	3.151	1.518	0.693	2.944	7.643
Media_online	5,352	2.927	1.565	0	2.773	7.560
Media_paper	5,352	1.515	1.380	0	1.386	5.700
Power	5,352	0.998	0.282	0.282	0.964	2.388
Political	5,352	0.048	0.057	0	0.040	0.278
Female_ratio	5,352	0.158	0.101	0	0.143	0.471
Ave_age	5,352	50.18	3.086	37.88	50.18	58.64
Ave_edu	5,352	3.478	0.477	2	3.522	5
Boardsize	5,352	9.210	1.961	5	9	15
Gm_holding	5,352	0.029	0.089	0	0	0.637
Dual	5,352	0.183	0.387	0	0	1
Size	5,352	23.27	1.477	19.58	23.13	27.42
Lev	5,352	0.495	0.202	0.038	0.510	0.973
Roa	5,352	0.076	0.131	−2.543	0.080	0.410
HHI	5,352	0.127	0.148	0.016	0.077	1
Top1	5,352	0.367	0.161	0.080	0.351	0.758
State	5,352	0.565	0.496	0	1	1
Firm_age	5,352	18.76	5.788	1	18	53

effect of TMT characteristics on the impact of TMT exposure and CSR, which is for model (2) and model (3) respectively.

$$CSR_{i,t} = \beta_0 + \beta_1 Media_{i,t} + \beta_2 Power_{i,t} + \beta_3 Media_{i,t^*} Power_{i,t} + \sum \beta_j Controls_{i,t} + Year + Ind + \varepsilon_{i,t} \quad (2)$$

$$CSR_{i,t} = \chi 0 + \chi 1 Media_{i,t} + \chi 2 Political_{i,t} + \chi 3 Media_{i,t^*} Political_{i,t} + \sum \chi_j Controls_{i,t} + Year + Ind + \varepsilon_{i,t} \quad (3)$$

RESULTS

Descriptive Statistics

This article makes descriptive statistics on 5,352 firm-year observations. **Table 2** shows the descriptive statistics of the variables. For the explained variable (CSR), the mean value of score is 40.13, the standard deviation is 12.36, the minimum score is 17.24, and the maximum score is 84.13, indicating that there are still big differences in CSR information disclosure between the listed companies in China. Overall, the CSR performance of China's listed companies remained low, and there exists much room for improvement. For explanatory variables (Media_total), the mean value of total coverage News is 3.151, the standard deviation is 1.518, the minimum value is 0.693, and the maximum value is 7.643, showing that there are great differences in the financial media exposure of different executives of Chinese listed companies. When comparing online news coverage and newspaper news coverage, it is found that the mean value, standard deviation, and maximum value of News_online are higher than those of News_paper, revealing that with the technological progress, the influence of the Internet as a medium of financial information dissemination which has surpassed that of traditional newspapers.

Table 3 shows the Pearson correlation coefficient matrix among the key variables. The correlation coefficients among Media_total, Media_online, Media_paper, and the Score are 0.230, 0.222, and 0.217, respectively, and all of them have passed the 1% significance level test. It is preliminary verification that more TMT media exposure is associated with better CSR performance. The correlation coefficients of the two moderating variables indicate that TMT power and TMT political connection hinder the relationship between TMT media exposure and CSR. Hypothesis 1 is initially supported. The correlation coefficient matrix can only be used as a very preliminary analysis, and multiple regression analysis and statistical analysis are required to gain insight into the real relationships between the variables.

Multiple Regression Analysis

Top Management Team Media Exposure and Corporate Social Responsibility

Table 4 shows the influence of TMT media exposure (Media_total) on the CSR Score of listed companies. There is a significant positive regression coefficient (α = 0.785, $p < 0.001$) which demonstrated that the more TMT media exposure (Media_total), the better CSR practice. That is, the strong pressure from public opinion and the public supervision of media exposure are beneficial to the improvement of CSR performance. This finding supports the theoretical expectations of Hypothesis 1. The results of online news and newspaper news also pass the significance test, and the regression coefficient is positive.

In terms of control variables, firm size has a significant positive regression coefficient which indicates that the larger the company size, the better its CSR performance, which is similar to the conclusions of Wickert et al. (2016). There is a significant negative correlation between financial leverage and CSR. Particularly, the significance level stands at 1%, suggesting that the better a company's financial situation is, the higher its CSR performance. At the same time, profitability has improved CSR performance at the 1% significance level. Finally, compared with non-state-owned enterprises, the CSR performance of state-owned enterprises is significantly higher.

The results of heterogeneity estimation are reported in **Table 4**. From column (1) to column (3), corporate-level characteristic control variables are added. The regression coefficients are 0.785, 0.728, and 0.857, respectively, and passed the significance level test of 1%. From columns (4) to columns (6), control variables at the TMT level characteristic variables are further added. The regression coefficients of A, B, and C are 0.729, 0.682, and 0.785, respectively, and all passed the significance level test of 1%.

In summary, as can be seen from the regression results in **Table 4**, regardless of the use of Media_total, Media_online, or

TABLE 3 | Correlation matrix.

	CSR Score	Media_total	Media_online	Media_paper	Power	Political
CSR Score	1					
Media_total	0.230***	1				
Media_online	0.222***	0.979***	1			
Media_paper	0.217***	0.835***	0.737***	1		
Power	−0.112***	−0.073***	−0.060***	−0.089***	1	
Political	−0.014*	0.144***	0.129***	0.180***	0.047***	1

** and *** Denote statistical significance at the 10 and 1% levels, respectively.*

TABLE 4 | Multiple regression analysis.

Variables	(1) CSR Score	(2) CSR Score	(3) CSR Score	(4) CSR Score	(5) CSR Score	(6) CSR Score
Media_total	0.785***			0.729***		
	(7.11)			(6.71)		
Media_online		0.728***			0.682***	
		(6.87)			(6.52)	
Media_paper			0.857***			0.785***
			(6.76)			(6.27)
Size	3.664***	3.703***	3.667***	3.269***	3.298***	3.288***
	(23.42)	(23.81)	(23.21)	(20.33)	(20.56)	(20.40)
Lev	−5.373***	−5.391***	−5.491***	−4.948***	−4.963***	−5.051***
	(−5.63)	(−5.65)	(−5.75)	(−5.29)	(−5.31)	(−5.40)
Roa	1.689*	1.775*	1.373	2.016**	2.095**	1.740*
	(1.72)	(1.81)	(1.39)	(2.11)	(2.20)	(1.82)
HHI	6.710***	6.715***	6.470***	6.285***	6.289***	6.065***
	(2.97)	(2.97)	(2.86)	(2.82)	(2.82)	(2.72)
Top1	2.829***	2.788***	2.687**	2.891***	2.860***	2.746***
	(2.70)	(2.66)	(2.57)	(2.81)	(2.77)	(2.67)
State	0.971***	0.962***	0.870***	0.112	0.096	0.050
	(2.93)	(2.90)	(2.64)	(0.31)	(0.27)	(0.14)
Firm_age	0.080***	0.079***	0.080***	0.071***	0.070**	0.072***
	(2.94)	(2.87)	(2.93)	(2.59)	(2.52)	(2.61)
Female_ratio				2.805*	2.772*	2.810*
				(1.81)	(1.79)	(1.82)
Ave_age				0.226***	0.230***	0.210***
				(4.02)	(4.10)	(3.72)
Ave_edu				2.445***	2.429***	2.527***
				(8.06)	(7.99)	(8.36)
Boardsize				0.498***	0.504***	0.483***
				(5.81)	(5.87)	(5.66)
Gm_holding				6.195***	6.135***	6.587***
				(4.16)	(4.12)	(4.41)
Dual				−1.563***	−1.568***	−1.552***
				(−4.31)	(−4.32)	(−4.28)
_cons	−55.302***	−55.622***	−54.536***	−70.107***	−70.486***	−69.081***
	(−15.38)	(−15.45)	(−15.04)	(−16.82)	(−16.92)	(−16.35)
Industry/Year	Yes	Yes	Yes	Yes	Yes	Yes
N	5,352	5,352	5,352	5,352	5,352	5,352
adj. R^2	0.362	0.361	0.361	0.378	0.378	0.377

, **, and * Denote statistical significance at the 10, 5, and 1% levels, respectively. The t values are in parentheses.*

Media_paper as an explanatory variable and no matter what control variables are considered, there is a significant positive correlation between TMT media exposure and CSR. Hence, Hypothesis 1 of this article cannot be rejected. We, therefore, find that TMT power negatively moderates the impact of TMT media exposure on CSR according to our results.

Moderating Variable Regression Results

The moderating variable TMT power and its interaction term (Media_total × Power, Media_online × Power, and Media_paper × Power) are further introduced into the observations to investigate the moderating effect of TMT power. The regression results are shown in **Table 5**. To observe whether the impact of TMT media exposure on CSR differs due to the heterogeneity of executive team characteristics, TMT power is added as the first moderating variable in this article.

In **Table 5**, we can find that the regression coefficient between the interaction term (Media_total × Power) and CSR (Score) is −0.688, which is significantly negative at the level of 10%. It shows that the positive correlation between TMT media exposure and CSR may be interfered by TMT power. When the independent variables are Media_net and Media_paper, the results are basically the same. The regression results thereby support research Hypothesis 2.

We further examine the influence of TMT political connections (another important TMT characteristic) on

TABLE 5 | Top management team (TMT) media exposure and corporate social responsibility (CSR): the impact of TMT power.

Variables	(1) Score	(2) Score	(3) Score
Media_total	1.408***		
	(4.22)		
Power	0.053	0.138	−1.322***
	(0.05)	(0.14)	(−1.89)
Media_total × Power	−0.688*		
	(−2.18)		
Media_net		1.451***	
		(4.46)	
Media_net × Power		−0.766**	
		(−2.50)	
Media_paper			1.272***
			(3.37)
Media_paper × Power			−0.512
			(−1.42)
Controls	Yes	Yes	Yes
Industry/Year	Yes	Yes	Yes
N	5,352	5,352	5,352
adj. R^2	0.391	0.391	0.390

, **, and * Denote statistical significance at the 10, 5, and 1% levels, respectively. The t values are in parentheses.*

TABLE 6 | TMT media exposure and CSR: the impact of TMT political connection.

Variables	(1) Score	(2) Score	(3) Score
Media_total	0.040		
	(0.43)		
Political	12.086**	10.920**	6.212
	(2.46)	(2.40)	(1.62)
Media_total × Political	−3.116***		
	(−2.74)		
Media_online		0.079	
		(0.89)	
Media_online × Political		−3.001***	
		(−2.79)	
Media_paper			−0.074
			(−0.65)
Media_paper × Political			−2.499*
			(−1.95)
Controls	Yes	Yes	Yes
Industry/Year	Yes	Yes	Yes
N	5,352	5,352	5,352
adj. R^2	0.342	0.342	0.342

, **, and * Denote statistical significance at the 10, 5, and 1% levels, respectively. The t values are in parentheses.*

TMT media exposure and CSR. In **Table 6**, we can find that the regression coefficients between interactive items (Media_total × Political, Media_online × Political, and Media_paper × Political) and CSR (Score) are −3.116, −3.001, and −2.499, respectively, all of which are significantly negative at least at the level of 10%, which shows that when the degree of TMT political connection is relatively low, the positive impact of TMT media exposure on CSR is stronger. The regression results support the research of Hypothesis 3.

Robustness Tests

We explore the impact of possible reverse causality on the research conclusions. The topic discussed in this article is that more TMT media exposure promotes CSR performance. At the same time, those companies with better CSR performance will receive more media exposure. Therefore, the research result of this article may be affected by reverse causality. Therefore, in order to solve this problem, this article refers to Zuo et al. (2020) in using the per capita postal and telecommunications traffic (Ave_traffic) to represent the information level and using it as Instrumental Variable for generalised moment estimation (GMM). GMM is measured by the sum of the total postal services plus the total telecommunications services and then divided by the total population in the region. Generally speaking, the higher the informatisation level of the region where the listed companies are located, the more information the media will expose on the listed company under the market competition. Consequently, the development level of regional postal and telecommunications services will not directly affect the CSR decision-making of the listed company. Therefore, the selected tool variables meet the requirements of "correlation" and "exogenous." The first and second columns of GMM in **Table 7** report the respective regression results of instrumental variables. The first column is the regression results of the first stage, which shows that the significance of Ave_traffic and Media_total is positive at the level of 5%. The second column in GMM is the second stage regression result, which shows that the significance of Media_total and CSR Score is positive at the level of 1%. This further shows that the empirical results of this article are not disturbed by reverse causality.

Next, we use the fixed-effects model regression analysis to examine the effect of TMT media exposure on CSR and confirmed that our results do not qualitatively differ from the findings reported in **Table 7**'s fixed-effect model column. We again ran fixed-effects regressions and control for unobservable characteristics that are time-invariant. The fixed-effects model regression results were consistent, suggesting that our conclusion is not vulnerable to the omitted-variable bias.

Finally, we refined the CSR measurement method to strengthen the research conclusions. The measures of the explanatory variables are replaced and the empirical results are retested. Referring to Noronha et al. (2018), the social contribution value per share (SCVPS) is used to measure CSR. SCVPS was brought up by the Shanghai Stock Exchange in 2008. The regression results are reported in **Table 7**, Redefining CSR column. It can be seen that the regression coefficient between TMT media exposure and SCVPS is 0.065 and is significantly positively correlated at the 1% level. The regression coefficients of the interaction terms of the moderating variables (Media_total × Power and Media_total × Political) and SCVPS are −0.005 and −0.376, respectively, showing a significant

TABLE 7 | Robustness tests.

Variables	GMM		Fixed effect model			Redefining CSR		
	Media_total	Score	Score	Score	Score	Scvps	Scvps	Scvps
Media_total		6.461***	2.216***	0.279	0.813***	0.065***	0.063*	0.086***
		(11.08)	(7.43)	(1.20)	(5.74)	(4.60)	(1.79)	
Power				0.085			−0.143	
				(0.10)			(−0.52)	
Media_total × Power				−0.397*			−0.005**	
				(−1.82)			(−2.05)	
Political					11.659**			0.666
					(1.97)			(1.02)
Media_total × Political					−1.921**			−0.376*
					(−2.20)			(−1.89)
Ave_traffic	0.001**							
	(2.36)							
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry/Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	5,352	5,352	5,352	5,352	5,352	5,352	5,352	5,352
adj. R^2	0.342	0.301	0.314	0.318	0.389	0.441	0.441	0.442

, **, and * Denote statistical significance at the 10, 5, and 1% levels, respectively. The t values are in parentheses.*

negative correlation at least at the 10% level. It can be seen that the findings of this article remain unchanged.

Further Tests

Different Corporate Social Responsibility Dimensions

We test the impact of TMT media exposure on different CSR dimensions. The rating results, combined with the reality of the Chinese context, are used to classify CSR into four dimensions, namely, Macrocosm (M), Content (C), Technique (T), and Industry (I), and to evaluate the quality of CSR. Macrocosm focused on the strategic management of CSR, with a weight of 30%; Content focused on the actual performance of CSR, with a weight of 45%; Technique mainly focused on CSR information disclosure, with a weight of 15%; and Industry evaluated the industry characteristics of the enterprise, with a weight of 10%. The influence of the TMT media exposure on different CSR dimensions is tested, and the results show that the regression coefficients of executive media reports on the four dimensions of CSR are all significantly positive (**Table 8**). This indicates that the impact of the TMT media exposure on enhancing CSR is mainly achieved by strengthening CSR strategy formulation, promoting CSR strategy implementation, and improving CSR information disclosure.

Distinguish Media Exposure Tone

Given that negative media reports generally criticise some problems or improper behaviours of executives of listed companies, the supervision and dissemination of negative reports are more obvious than positive and neutral reports. Therefore, this study further distinguishes the tone of media reports into positive and negative. On the one hand, when negative events occur, the TMT with political connection and power may use political authority to influence the tendency of the media so as to reduce the governance role of the media. On the other hand, due to the lack of invisible shelter, the media can give full play to the role of supervision and governance. Therefore, the attention of the media is more binding on the earnings management behaviour of non-political and less powerful TMTs and related listed companies. Therefore, compared with the measurement of the number of media exposure, negative media reports can induce administrative intervention, hence, the impact on the TMT is more obvious.

Therefore, this article further tests and distinguishes the tone of media reports. **Table 9** shows that the regression coefficient is 0.776 when the independent variable is negative media coverage, which is greater than 0.446 when the independent variable is positive media coverage. In addition, the test of the interaction term shows that it is significant only when the independent variable is negative media coverage. This result confirms the research of Islam and Deegan (2010) which stated that when TMTs have negative media reports because they are worried about the intervention of the regulatory authorities, TMTs focus on the implementation of CSR.

TABLE 8 | TMT media exposure and CSR: Different CSR Dimensions.

Variables	(1) M	(2) C	(3) T	(4) I
Media_total	0.205***	0.323***	0.104***	0.092***
	(5.36)	(5.96)	(6.41)	(6.61)
Controls	Yes	Yes	Yes	Yes
Year/Industry	Yes	Yes	Yes	Yes
N	5,352	5,352	5,352	5,352
adj. R^2	0.416	0.336	0.426	0.469

**** Denotes statistical significance at the 1% level. The t values are in parentheses.*

TABLE 9 | Distinguish media exposure tone.

Variables	Negative News(3)			Positive News		
	(1) Score	(2) Score	(3) Score	(4) Score	(5) Score	(6) Score
Media_total	0.776***	1.173***	0.522***	0.446***	1.197***	0.868***
	(7.20)	(3.71)	(4.22)	(4.77)	(3.76)	(6.19)
Power		−0.863			−1.151	
		(−1.19)			(−1.54)	
Media_total × Power		−0.703**			−0.437	
		(−2.41)			(−1.48)	
Political			9.139**			9.829**
			(2.37)			(2.25)
Media_total × Political			−1.563**			−2.204
			(−2.10)			(−1.40)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry/Year	Yes	Yes	Yes	Yes	Yes	Yes
N	5,352	5,352	5,352	5,352	5,352	5,352
adj. R^2	0.375	0.389	0.376	0.389	0.392	0.390

*** and **** Denote statistical significance at the 5 and 1% levels, respectively. The t values are in parentheses.*

CONCLUSION

Concluding Remarks

This study takes the listed companies in Shanghai and Shenzhen Stock Exchanges from 2010 to 2019 as its research object to examine the relationship between the level of media attention paid to their TMTs and CSR in Chinese markets. The study investigates the influence of executives' characteristics on the media's role of supervision and governance and information transmission, paying special attention to the differences of TMT power and political connection. The empirical results show that TMT media exposure can promote CSR. Powerful TMT and political connection inhibit the relationship between TMT media exposure and CSR.

Theoretical Contributions and Practical Implications

Theoretical Contributions

Firstly, based on the upper echelons theory and stakeholder theory, combined with the characteristics of Chinese enterprises, this study focuses on how TMT media exposure affects corporate social responsibility. Since the upper echelons theory was put forward, scholars have continuously combined new concepts with the upper echelons theory. At the same time, they have responded to the call of Hambrick and Mason (1984) to "Introduce new variables into the upper echelons theory."

However, most of the researchers base their discussions on the personality traits of TMTs on the upper echelons theory, ignoring the pressure of external stakeholders on TMTs and the strategic adjustment of executives. In this study, the new variable of TMT media exposure is introduced into the research of the upper echelons theory. By studying its influence on CSR strategic decision-making, the study of external stakeholders' pressure on TMTs is promoted along with further development of the upper echelons theory and the stakeholder theory. At the same time, the external stakeholders in the research field, such as media exposure (Ramadhini et al., 2020), are expanded.

Secondly, TMT power and TMT political connection are introduced into the research of TMT media exposure and CSR as moderating variables from the perspective of TMT characteristics (upper echelons theory). We find that TMT power and TMT political connection play a negative role in regulating the relationship between TMT media exposure and CSR, which is contrary to most previous views, and supplements the rare literature on the negative influence of TMT power (Jiraporn and Chintrakarn, 2013; Velte, 2019) and TMT political association (Huang and Zhao, 2016).

Thirdly, it broadens the research perspective of CSR. CSR plays an important role in promoting the progress of enterprises, which has been generally recognised by society and academia. Many achievements can be referenced by academia for the influencing factors of corporate social responsibility, but these achievements are basically at the company level, such as corporate governance. As for the influencing factors of CSR, many academic achievements can be referred to, but these achievements are basically at the firm level, such as corporate governance. There is little research on internal managers, such as senior management and CEO.

Since Hambrick and Mason (1984) put forward the concept of the upper echelons theory, the combination of TMT characteristics and CSR has gradually become a research hotspot in academic circles. A large number of relevant research results and literature have sprung up, and relevant conclusions have been drawn. At the same time, the proponent of the upper echelons theory has been calling on management scholars to learn from the research results of psychology, sociology, and communication and introduce new variables into the research of TMT characteristics. Media attention is an important research variable in the field of communication. However, this important characteristic has not been paid attention to by the field of management, especially the field of strategic management. In this study, the important variable of TMT media exposure is

introduced into the research of CSR, and it is found that TMT media exposure exerts pressure on TMTs (Wallack and Dorfman, 1996), increasing administrative intervention, and influences corporate strategic decisions. In a word, the introduction of TMT media exposure, a new research variable, has greatly enriched and expanded the research on CSR.

Practical Implications

This research also has important practical implications. Firstly, it gives full play to the media's function of supervising TMTs, which compensates for that which cannot be covered by the existing legal system. TMT media attention emphasis on CSR supervision cannot be separated from the timely and objective exposure of media. The government should strengthen legal guarantees and economic support for the media, improve the enthusiasm, impartiality, and credibility of news media exposure, exert pressure on enterprises through the non-legal system of the media, and promote CSR practices. At the same time, media attention to executives is a double-edged sword, bringing public opinion pressure not only to TMTs but also to companies as a whole. If TMTs handle this attention properly, it is easier to arouse investors' confidence in the capital market and safeguard the public's interests and vice versa.

Secondly, powerful TMTs reduce TMT media attention on CSR fulfilment, which shows that the agency problem caused by powerful TMTs is still the primary problem in the process of corporate governance in China. Under the background that the public and investors are paying more and more attention to the corporate sustainable development level, media exposure can effectively promote the managers of listed companies to pay attention to social responsibilities. Corporate controllers should balance the self-interest managerial behaviours in the decision-making process through reasonable incentive mechanisms. At the same time, they should constantly improve the corporate internal control level and form effective supervision and restraint for strong managers to avoid abuse of power.

Thirdly, the present article supplements the sparse literature on the benefits of a lack of political connections. "Rule No. 18," issued by the Communist Party of China on October 19, 2013 mandates that no government or party officials, including both incumbent officials and those who have resigned or retired within the past 3 years, should serve on boards of directors or receive payments from private firms (Wei et al., 2020). This study provides further elaboration of this policy. It shows that building a healthy relationship between government and business and allowing listed companies to fully compete in the marketplace facilitates them to actively fulfil their CSR through stakeholder pressure.

Limitations and Future Research Directions

This study has some limitations. Its predecessors only used print media as a source of data on media exposure, while the present study adds network media as a source of media reports. However, with the popularity of Weibo, Tiktok, WeChat, Twitter, and other internet-based media communication platforms, whether TMT exposure affects CSR information disclosure still requires further study. Secondly, the research in media reports is often cross-sectional and focuses on a certain level of analysis. Thus, it is hoped that in the future research literature, the institutional, organisational (Garcia-Sanchez et al., 2014), and individual levels can be combined in multi-level and longitudinal studies. Finally, this article does not discuss whether external media governance mechanisms and internal corporate governance mechanisms are complementary or substitutes for each other in the fulfilment of CSR nor does it discuss the role of executive media coverage in the governance of CSR in different external contexts. Further investigation may be needed in the future.

We acknowledge the invaluable input by one of our reviewers who directed our attention to the following challenges. (1) The relationship between the media outlets and corporate financing and advertising expenses. (2) Because the journalists are afraid of being sued by the company, there is a certain deviation in the reported content which cannot better reveal the internal corporate governance information. (3) Media could be used in political conflicts or debates (manipulation of the media by political competitors of the TMT). The reports of political conflicts by mass media often have a strong ideology and certain national tendency so as to affect the influence of the audience and strive for the initiative of public opinion. Therefore, political conflict has always been the focus of social mass media. As the embodiment of justice, the guiding function of mass media directly affects the choice and orientation of the public. (4) There is a necessary difference between advertising in the media and critical objective analysis. In short, the Chinese media also pay strong attention to the material conflict between the group and the government, which means that the coal body no longer regards the conflict between the officials and the people as a restricted area. It blindly maintains a high degree of consistency with the ideology of the party and the government, but objectively reflects the problems existing in the social reality and criticises and supervises the government power, which is great progress in the supervision of public opinion by the Chinese media.

DATA AVAILABILITY STATEMENT

Publicly available datasets were analysed in this study. This data can be found here: http://www.rksratings.cn.

AUTHOR CONTRIBUTIONS

YJ conducted the statistical analysis. LZ and YJ conducted the data analysis. LZ contributed to all the phases of the study from conception and design of the study, results interpretation, and writing manuscript and also mainly responsible for replying to the comments of reviewers. HT was responsible for the proofreading of the manuscript. All the authors agreed to all aspects of the work, and approved the version to be published.

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frontiers in Psychology

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Affect and Cognition in Managerial Decision Making: A Systematic Literature Review of Neuroscience Evidence

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How do affect and cognition interact in managerial decision making? Over the last decades, scholars have investigated how managers make decisions. However, what remains largely unknown is the interplay of affective states and cognition during the decision-making process. We offer a systematization of the contributions produced on the role of affect and cognition in managerial decision making by considering the recent cross-fertilization of management studies with the neuroscience domain. We implement a Systematic Literature Review of 23 selected contributions dealing with the role of affect and cognition in managerial decisions that adopted neuroscience techniques/points of view. Collected papers have been analyzed by considering the so-called reflexive (X-) and reflective (C-) systems in social cognitive neuroscience and the type of decisions investigated in the literature. Results obtained help to support an emerging "unified" mind processing theory for which the two systems of our mind are not in conflict and for which affective states have a driving role toward cognition. A research agenda for future studies is provided to scholars who are interested in advancing the investigation of affect and cognition in managerial decision making, also through neuroscience techniques – with the consideration that these works should be at the service of the behavioral strategy field.

Keywords: affect, cognition, decision making, neuroscience, Systematic Literature Review (SLR), behavioral strategy

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INTRODUCTION

Since Simon's (1947) *administrative man* – featured by bounded rationality – and the conceptualization of a firm's performance as the result of the decision makers' collective choice (Cyert and March, 1963) – a series of studies in management studies advanced the debate of how organizational actors (individually or collectively) make decisions (Kahneman, 2011; Lovallo and Sibony, 2018; Cristofaro, 2021a). Over the years, managerial decision making – concerning the decisional activities made at the low-, middle-, and top-management levels (Koontz et al., 1980) – attracted the interest of scholars in various areas, mainly due to its cross-disciplinary

nature (Cristofaro, 2017; Adinolfi, 2021). A great advancement has been made by the *Behavioral Decision Theory* (BDT), that originated in the '60s for the study of the *real* behavior of people when making decisions (Edwards, 1961), and then increasingly adopted/developed in managerial decision-making research stimulating reflections on bounded rationality (e.g., Edwards, 1961; March, 1978; Kahneman, 2011; Powell et al., 2011; Sibony et al., 2017; Abatecola et al., 2021; Cristofaro and Giannetti, 2021).

From the progress made, the role of affective states has continuously and increasingly gained momentum within managerial decision-making research (e.g., Cristofaro, 2017, 2019, 2021a,b). This happened mainly because affective states are considered the first biological reaction to stimuli in a decisional environment, condensing all other irrational impulses (Weick, 1979). Emotional response, however, may not only directly influence the initiation and/or the output of a decision path, but they can also influence the content and depth of thought within decision-making processes at the individual and collective levels (e.g., Damasio, 1994; Lerner et al., 2013; Cristofaro, 2019).

However, as reported by the Call for Papers on the research topic "Affect and Cognition in Upper Echelons' Strategic Decision Making: Empirical and Theoretical Studies for Advancing Corporate Governance" to which this article contributes, what remains largely unknown in managerial decision-making research is "the interplay of affective states and cognition; considered by some scholars to be two parallel competitive systems of the human mind". From that, we want to answer the following research question: *how do affect and cognition interact in managerial decision making?* Concerning the definition of affect, we can recall the contribution brought by Forgas (1995), who asserted that this word depicts a broad array of various affective states (the main term we will use hereafter), among which the preeminent ones are "moods" and "emotions". Specifically, moods are related to low intensive and lasting affective circumstances (e.g., feeling down) that cannot be identified as a reaction to a precedent situation, while emotions, on the contrary, group all those affective reactions into a specific event. With regard to the definition of cognition, Neisser (1967) has defined it as the mental procedure through which inputs, such as information, are transformed, reduced, elaborated, and gathered, and then put into practice when needed.

To answer this study's research question in a solid and "new" way, we offer a first systematization of contributions on managerial decision making that implement neuroscience techniques/points of view; thus allowing this review to robustly inform the affect-cognition debate. In this regard, a series of position papers/reviews/commentaries have been published about the impact of neuroscience approach and techniques in management studies (e.g., Becker et al., 2011; Powell, 2011; Ashkanasy et al., 2014; Ward et al., 2015; Jack et al., 2019; Massaro et al., 2020; Cucino et al., 2021), but only a few looked at the decision-making processes of managers within organizations. The sole contribution that tried to look at the influence of neuroscience studies in managerial decision making was Butler et al. (2016); however, for their results categorized under the "organizational behavior cluster" heading, some of the 12 contributions in that sample did not deal with managerial decision-making processes (e.g., Peterson et al., 2008), as well as it was not focused on shedding light on the affect-cognitive debate.

The collected 23 papers have been thematically analyzed by considering the type of managerial decisions, and under the reflexive (X-) and reflective (C-) systems of our brain, which seem to be devoted differently in describing consciousness, awareness, and mental processes (Lieberman et al., 2002; Lieberman, 2007; Lieberman-Aiden et al., 2009). From the analysis, affect and cognition work in a meaningful interplay that directs decision-making processes of managers, with affective states having an initial (but not exclusively) driving role. This result shed light on the possibility of a "unified" mind processing theory (Sadler-Smith, 2016; Cristofaro, 2020a; Cristofaro and Giannetti, 2021) for which the two Systems of our mind – System 1, devoted to operating mental processes that are fast and automatic, and System 2, devoted to operating mental processes that are consciously monitored (Kahneman, 2003) – are not in conflict, but they operate dialectically. These are the main theoretical implications of this paper. Yet, the main implications for research coming from this paper are related to the need for: *(i)* continuing the deconstruction of the distinction between irrational/automatic vs. rational/deliberate; *(ii)* articulating the ecological dimension of decision-making; and *(iii)* trying distinguishing the brain default activity by the task-evoked one, occurring while performing decision tasks.

THEORETICAL BACKGROUND

Affect and Cognition in Decision Making

Since the birth of the bounded rationality concept by Simon (1947), scholars have been increasingly involved in identifying how management decisions are made. This endeavor has found fertile ground in *Behavioral Decision Theory* (BDT).

Behavioral Decision Theory was born to understand *real* human behavior in decision making by studying, for example, models for static risky decision making, utility function, subjective probability, variance preferences, and personality variables, mainly through experimentations and computational models (Edwards, 1961). In particular, BDT tries to explain why decision makers go beyond normative assumptions, such as violating expected utility axioms (Einhorn and Hogarth, 1981). In this regard, initial progress of BDT studies (e.g., Good, 1962) lead to depict rationality being shaped by unconscious psychological events and external forces that determine human decisions and their consistency. This updated conceptualization of rationality in organizations, rooted in Simon (1947), stimulated other new theories within BDT. The main contribution in this direction was the *Behavioral Theory of the Firm* by Cyert and March (1963), which stated that decisions in organizations are always made in the presence of scarce information and negotiated within coalitions composed of managers and other stakeholders with different preferences and interests. Another relevant advancement in BDT was made by Tversky and Kahneman (1974) who proposed and verified one hypothesis that threatened normative decisional approaches: decision makers act according

to unstable and ambiguous preferences (Slovic et al., 1977). This conceptualization was based on the idea that people have multiple selves with conflicting assumptions, causing them to act inconsistently with regard to their previous choices.

Developments in BDT reinforced the need to enlarge the debate on human rationality to also include unconscious "irrational forces"; in this regard, Simon later added that "to have anything like a complete theory of human rationality, we have to understand what role emotion plays in it" (Simon, 1983; p. 29). Stemming from this last assumption, over the past decades, many scholars (Barsade and Gibson, 2007) have attempted to analyze the impact that both affective and cognitive variables play in the decision-making process. As an example, one recent contribution toward this last direction is the one by Treffers et al. (2020), who demonstrated that managers in a positive affective state and under high time constraints elaborate fewer original and fewer feasible strategic ideas and make their original strategic choices worse when compared with managers in a negative affective state and under high time constraints, who generated better original strategic choices.

However, despite the growth of research on the affect-cognition debate in managerial decision making, there has been a profound division among scholars concerning whether affective states influence cognition or *vice versa*. This can be seen in the debate on the roles of System 1 and System 2 in our mind. Indeed, within dual mind processing theories (Kahneman, 2003), there are two main schools of thought that flourished over time (see Evans, 2021 for a discussion): *(i) default-interventionist*, whereby, as a default setting, individuals make decisions recurring to intuition/emotions and reflective thinking may intervene dependent on the task at hand (e.g., Stanovich and West, 2000); and *(ii) parallel-competitive*, whereby, intuitive/emotional and reflective processes operate in parallel, such that "in the event of conflicts between them, they literally compete for the control of thinking and behavior" (Hodgkinson and Sadler-Smith, 2018; p. 483).

Stimulated by these different visions within dual mind processing theories and strongly anchored in BDT, many contributions have tried to shed light on the relationship between affect and cognition in decision making. For example, Blanchette and Richards (2010) reviewed a series of articles to identify if and how affective states have repercussions on cognitive mechanisms. In particular, these scholars concluded that cognitive biases are mainly linked with anxiety and that (high/low) risk perception is also influenced by (negative/positive) affective states. However, according to them, sometimes affective states hinder normatively correct thinking, while in other cases, they promote it. In the same vein, Lochner and Eid (2016) proved that both negative and positive affective states drastically impact individuals' reasoning performances.

On the other hand, another group of scholars claimed the supremacy of cognition over affective states. In this regard, Grecucci et al. (2020) recently hypothesized, tested, and verified that cognitive strategies are powerful enough to alter emotional states. Nevertheless, between these two opposite points of view, there is a third group of scholars who assumed that emotions and cognition could not be analyzed separately; indeed, they claimed that the affect-cognition debate should be studied by adopting lenses of mutual interplay since cognitive and affective domains should be perceived as two faces of the same coin (Gosling et al., 2020).

In this last vein, Cristofaro's (2019; 2020a,b; 2021a,b; Cristofaro and Giannetti, 2021) recent and in-depth contributions rooted in BDT enriched the debate by discussing the role of affect in management decisions, also proposing an *Affect Cognitive Theory* to explain how decision-making processes occur by considering the interplay between affective states and cognition. Hence, this new theory proposes that the crucial circumstances in which emotional states influence/are influenced by cognition and its biases identify that decision makers are affected by multi-level variation of both physical and social scenarios. Under these circumstances, decision makers are perceived as "emotional cognizers", overwhelming the thinking-feeling dichotomy often promoted in the precedent studies of management decisions.

Neuroscience in Management and Organization Studies

The first seminal contribution that tried implementing neuroscience techniques/points of view in management studies was by Taggart et al. (1985). In particular, by analyzing the link between decision style and cerebral dominance in 71 subjects by the use of an Electroencephalogram (EEG), these scholars concluded that psychological measurement captures very little actual cerebral processing. In practice, a boost of neuroscience adoption was encouraged to arrive at more solid managerial implications when concerning decision making.

After that stroke of genius, a period of stagnation followed and contributions aimed at connecting the management and neuroscience disciplines started appearing again – but not in a continuous way – only around the 2010s. This raised interest gave light to the field of "organizational neuroscience", aiming at using neuroscience knowledge and approaches at different levels in organizations, as well as promoting linkages to management practice[1]. However, due to the strong epistemological and ontological differences of these two disciplines, there have been many "positioning" contributions oriented to provide a solid direction for this cross-fertilization.

With regard to the above, the work by Laureiro-Martínez et al. (2015a), which discusses the possible merge of cognitive neuroscience and strategic management starting from the value in their complementarities (see also Ascher et al., 2018), is noteworthy. In particular, they suggested three pillars – task selection, sampling, and ethical issues – for a successful mutual implementation of neurosciences and strategic management and provided a research agenda about the several circumstances of synergy between management and neuroscience researchers. Yet, the authors underline the advantage of neuroscience for management research laying in the possibility to scrupulously analyze the decisions made by managers at the brain level, a locus

[1]This definition is taken from the Organizational Neuroscience interest group born within the Academy of Management (https://neu.aom.org/home).

of psychological formation that cannot be intentionally biased by the participant.

In a similar vein, Murray and Antonakis (2018) and Jack et al. (2019) also provided updated suggestions about how to advance this new area of research. Under a methodological point of view, Jack et al. (2019) have envisioned that neuroimaging procedures, particularly functional Magnetic Resonance Imaging (fMRI) and Electroencephalogram (EEG)[2], are expected to provide a lot of support to organizational neuroscience over the following decades. However, in line with Powell (2011); Jack et al. (2019) highlighted that reverse inference, i.e., inferring the presence of a specific cognitive process from observed brain activation, is mandatory for neuroscience to inform scholars involved in the organizational field consciously. However, as advanced by Murray and Antonakis (2018), the hype and the unfamiliarity with the methods made scholars cautious about adopting neuroscientific methodologies in social sciences. Notwithstanding, in terms of benefits, Murray and Antonakis (2018) have pointed out that neuroscience data are exempt from the "cheap talk" and social desirability that can bias self-reports and surveys (Podsakoff and Organ, 1986). In fact, data coming from neuroscience have several advantages such as their immediate observability, impartiality, and require relatively low-cost measurement tools.

Affect and Cognition in Neuroscience

Within the last decades, due to the emergence of powerful new tools for assaying the brain, researchers in cognitive psychology and neuroscience have been able to identify and validate the foundations of the decision model (e.g., Fellows, 2004) while looking at affect and cognitive mechanisms.

In particular, neuroimaging studies have identified two main brain regions involved in the "cognitive" system: the Anterior Cingulate Cortex (ACC) and the dorsolateral Prefrontal Cortex (dlPFC). The ACC's dorsal part is linked with the Prefrontal Cortex (PFC), the Parietal Cortex (PC), the motor system, and the Orbitofrontal Cortex (OFC). In terms of functions executed, the ACC processes top-down and bottom-up stimuli and assigns specific control to other areas of the brain. Regulation of norm enforcement and self-interest, and adaptive response to a changing condition, are juxtaposed with the emotions in this structure (Knoch et al., 2006). The dlPFC is part of the PFC. Yet, the dlPFC has been associated with functions executed as switching attention, working memory, abstract rules, and inappropriate response inhibition (Fehr and Krajbich, 2014).

Regarding the "affect" system, this has been found to include three independent areas known to serve as broad functions in emotional processing, including mind-body integration of affective information and fundamental for experience and expression of emotions: insula, amygdala, and ventromedial Prefrontal Cortex (vmPFC). The insula is a portion of the cerebral cortex folded deep within the fissure, separating the temporal lobe from the parietal and frontal lobes. The amygdala is an almond-shaped set of neurons located deep in the brain's medial temporal lobe, which has been shown to play a critical role in processing emotions, necessary for triggering aversive emotional states from primary inducers (Haruno and Frith, 2010). The vmPFC is situated in the medial portion of the PFC and has been implicated in various social, cognitive, and affective functions; for example, it is critical for generating and regulating negative emotions and the representation of reward and value-based decision making. This is why a vmPFC study is essential in encoding subjective values of perceived offers and emotion regulation (Gilam et al., 2015).

The described brain areas (see **Appendix 1** for a graphical illustration) can also be re-interpreted according to the largely adopted brain categorization of the X- and C-systems (Lieberman et al., 2002). This view includes, in contrast to the dual-process theories, the social cognitive neuroscience perspective, which implies a social interaction to drive behavior. Indeed, the dual system, represented for example by the Kahneman systems 1 and 2, is a more individualistic view, which highlights only the personal perception of the context. Although, the managerial decision making includes the individual along with external data processing from the social context, which reinforces our statement that Lieberman's framework is adapting to provide a more complete and complex view in which managers need to operate. Environmental, social, and cultural conditions that should not be included in the decision-making process are, instead, part of it due to the inner characteristics of individuals finding they have to choose in the event of uncertainty.

In particular, the X-system is associated with non-conscious environmental analysis, which some scholars have described as automatic processing, implicit learning, and even intuition. In practice, the X-system conducts perhaps a vast majority of everyday processing (Reynolds, 2006). The X-system has many components: the ventromedial PFC (vmPFC), basal ganglia (BG), amygdala (A), lateral temporal cortex (LTC), posterior superior temporal sulcus (pSTS), temporal pole (TP), and dorsal anterior cingulate (dACC) are the most relevant to automatic cognition. On the contrary, the C-system is the mechanism by which complicated reasoning is accomplished (see Lieberman et al., 2002). Specifically, the C-system is capable of rule-based analysis and can be interpreted as a complex analytical tool able to take the facts of a situation and apply an abstract decision rule to determine an outcome (Reynolds, 2006). Yet, when activated, the C-system performs a regulatory role over the X-system. In terms of composition, the C-system is formed by lateral PFC (LPFC), ventrolateral PFC (VLPFC), medial temporal lobe (MTL), medial parietal cortex (MPAC), lateral parietal cortex (LPAC), rostral ACC (rACC), medial PFC (MPFC), and dorsomedial PFC (DMPFC).

However, for the sake of clarity, it is noteworthy to say that despite the apparent clarity and distinctions of brain areas, neuroscience studies also advanced some different positions about the functioning of affective and cognitive mechanisms. For example, Adolphs and Damasio (2001), by reconsidering

[2] fMRI and EEG are two popular non-invasive techniques used in medical sciences to analyze brain responses to specific stimuli evoked by sensory, motor or cognitive tasks in controlled environments. Specifically, EEG uses electrodes to quantify the dynamics of the global neuronal activation with sub-millisecond resolution, while fMRI, by the means of a magnetic resonance machine, produces images of local changes in cerebral blood oxygenation, which are indirect consequences of neural activity. Therefore, given this complementarity – direct vs. indirect analysis of neuronal activation – fMRI and EEG techniques are often used simultaneously.

previous laboratory findings of cognitive neuroscience, highlighted that affect and cognition are inseparable and that the former drives the latter. Specifically, they reaffirmed that the arousal of affective states is the first reaction external stimuli, and that in this process it is the amygdala that rapidly triggers physiological changes in response to emotionally salient stimuli. Thus, through the vmPFC, the influence of affective states on cognition happens through changes in the visceral state (e.g., heart rate, blood pressure, gut motility – somatic markers in general) that then affect cognitive processes (e.g., learning through failures and being aware of the future consequences of decisions). This conceptualization is at the basis of the *somatic marker hypothesis* (Bechara, 2011).

At the center of the somatic marker theory, there is the assumption that decision makers encode the consequences of choices effectively (e.g., Pessoa, 2008). In particular, according to Reimann and Bechara (2010), when making a decision, "the immediate prospects of an option may be driven by more subcortical mechanisms (e.g., via the amygdala) that do not require a PFC. However, weighing the future consequences requires the PFC for triggering somatic responses about possible future consequences. Specifically, when pondering the decision, the immediacy and prospects of an option may trigger numerous somatic responses that conflict with each other (that is, positive and negative somatic responses). The end result, though, is that an overall positive or negative signal emerges (a "go" or "stop" signal)" (p. 770). Therefore, from that theory – that is not an excerpt of criticism (see Dunn et al., 2006) – it emerges that complex cognitive-emotional behaviors are grounded in dynamic coalitions of brain areas' networks.

In this vein, Pessoa (2008) has deeply highlighted that behavior should be perceived as the result of the mutual interaction of different brain areas, proposing, at the same time, the idea that emotion and cognition not only strongly interact in the brain but that they also jointly contribute to shaping human actions. In particular, Pessoa (2008) has remarked that the amygdala plays an essential role in forming individuals' emotional aspects, while the PFC is responsible for the cognitive one. However, as recalled by this scholar, several brain regions are loci where both the affect and cognitive mechanisms interact vigorously, such as in the lPFC and the dlPFC. This hypothesis is also supported by evidence on brain structure in highly clustered synapses. Hence, brain areas cannot be considered as watertight compartments. From that, it can be said that Pessoa (2008) was one of the first who advanced that cognitive and affective mechanisms are mutually influenced.

METHODOLOGY

In order to answer the research question: "*How do affect and cognition interact in managerial decision making?*", we implemented a Systematic Literature Review (SLR) of contributions dealing with the role of affect and cognition in managerial decisions that adopted neuroscience techniques/points of view. In this regard, we identified the SLR methodology as the suitable research design to consolidate and synthesize academic research. In particular, this method differs from the traditional narrative reviews in: *(a)* assisting in linking future research to the questions and concerns that have been posed by past research, and *(b)* being more explicit in the selection process by employing rigorous and reproducible evaluation methods. In this work, the established SLR procedure by Tranfield et al. (2003) has been followed; see also **Figure 1**.

(1) The databases for the identification of the studies were: *(a)* Business Source Premier (EBSCO); *(b)* ProQuest's ABI/Inform; *(c)* ISI Web of Science; *(d)* Scopus; *(e)* PsycINFO; and *(f)* PubMed (including MedLine);

(2) Only peer-reviewed journal articles published in English have been included to enhance quality control. Furthermore, the research was not restricted to a given starting period (end period December, 31th 2021) and type of paper (qualitative or quantitative). These two criteria enhanced the value-added of this work compared to the one by Butler et al. (2016), who just considered empirical papers published between 2007 and 2014.

(3) Only articles adopting a neuroscientific methodology/point of view have been considered by using the keywords: "neuro*" or "brain*" or "Functional Magnetic Resonance Imag*" or "FMRI" or "Electroencephalograph*" or "EEG" or "Magneto Encephalograph*" or "MEG" or "Transcranial Magnetic Stimulation*" or "TMS" or "Transcranial Electric Stimulation" or "tES" or "Positron Emission Tomograph*" or "Functional Near Infrared Spectroscop*" or "fNIRS" or "skin conductance" or "Galvanic Skin Response" or "GSR" or "GRV" or "skin conduct*" or "electrodermal activ*" or "eye track*" or "gaze track*" or "pupillometr*" or "pupil diamet*" or "heart rate*" or "HRV" or "facial expression recognition" or "emotion recognition" or "non-invasive brain stimulation" or "NIBS" or "cortisol" or "testosterone." These keywords have been derived – and enlarged – following Butler et al. (2016) and Ascher et al. (2018) and aim to identify works related to cognitive neuroscience. 28,705 results were produced.

(4) The substantive relevance of contributions to the managerial decision-making theme has been ensured by requiring that the selected abstracts contained at least one of the following words: "decision*" or "choic*" or "preference*" or "judg*." These keywords have been derived from the SLR by Cristofaro (2019) on affecting management decisions. 3,070 results were produced.

(5) Only articles regarding business issues have been considered by using the keyword "organization*" and its synonyms: "compan*" or "manag*" or "corporat*," or "firm*" or "business*" or "enterprise*" or "venture*" or "start-up*" (these keywords have been derived following De Vita et al., 2013). 633 results were produced.

(6) Duplicates from databases were eliminated at this stage thanks to the integration operated through reference-manager software. 401 hits were produced;

(7) The resulting articles were scanned by reading all the abstracts to ensure their substantive context, mainly according to their coherence with the review's aim. When there was doubt about the content regarding the inclusion/exclusion of an article, the full text was examined. 77 results were produced;

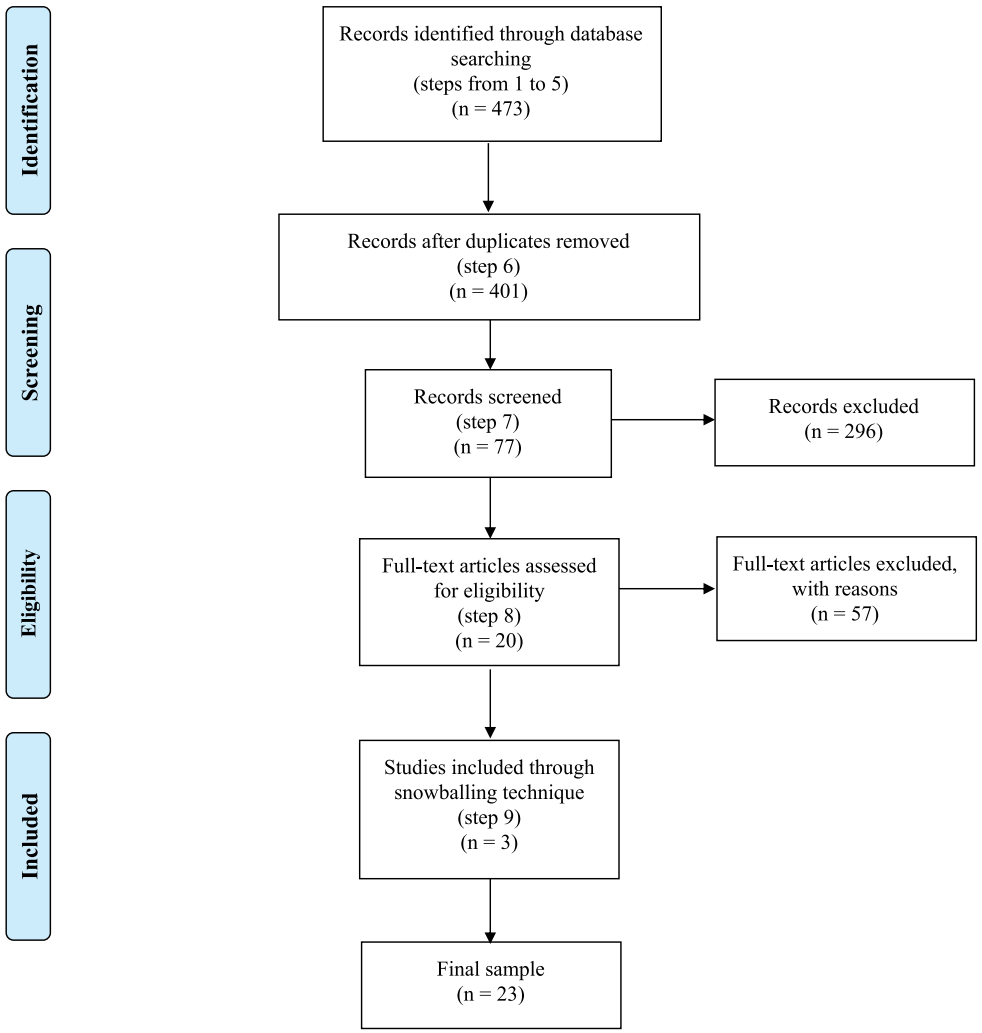

FIGURE 1 | PRISMA representation of papers' collection strategy.

(8) The remaining papers were fully read to ensure their alignment with the research objective. Thus, we included in the sample *only* scientific contributions dealing with managerial decision-making processes that implement neuroscience techniques/points of view; 20 results were produced. In this regard, we implemented the same exclusion criteria as Butler et al. (2016) – see their online S-2 Appendix. Initially, the authors individually read the articles and then compared their evaluations; when disagreeing, the authors assessed the papers together and decided whether or not to include those papers within the sample. Cronbach's alpha for inter-rater reliability was 0.95.

(9) Snowballing techniques have been applied to the reference lists of the resultant 20 articles. This ensured that important works in the field were included that might have been missed. Three were added arriving a final sample of 23 articles (almost double that of Butler et al., 2016; $N = 12$; yet, these two samples are very different too in terms of selected papers; see **Table 1**).

The selection at points 7 and 8 followed criteria used by Sandberg and Tsoukas (2015); in particular, studies have been included that explicitly: *(i)* aim to contribute to the development of managerial decision making, and *(ii)* apply neuroscience in their research. So, similarly to Butler et al. (2016), we excluded articles "that only briefly highlighted cognitive neuroscience in a cursory way, for example, in a one-line reference to the topic" (p. 546) and that did not use the terms at point (5) in relation to organizational contexts (e.g., waste-water management).

Following Butler et al. (2016), the 23 contributions related to the role of affect and cognition in managerial decisions that implemented neuroscience techniques/points of view have been structured into three clusters. The literature itself (Braun and Clarke, 2006) defined these inductive emergent clusters and reflected the type of decision made by managers. Sample articles categorized into these three clusters have been read by looking at the assumed relationship of decisions with the reflexive (X-) and reflective (C-) systems (Lieberman et al., 2002;

TABLE 1 | The study sample's papers.

	Author(s)	Year	Type of article	Setting	Methods	Dependent Variable(s)	Independent Variable(s)	Analysis methods	Main findings
1	Srinivasan and Balasubramanian, 2003	2003	Conceptual paper	Neuronal architectural framework	–	–	–	–	As leadership in the emerging millenium achieves new dimensions, sustaining precognition would be most critical. This circumstance would not be fulfilled unless: (1) managers stay anchored to a deeper region of consciousness and make sure all decisions or cognitions emanate from there; (2) there is an effort to acquire complex and new inputs or experiences constantly, so that the brain is primed for incessant change as it ensues. Both these conditions would guarantee that the world economic order in the next millenium stays both robust and customer centric.
2	Wenstøp, 2005	2005	Conceptual paper	Emotion in Multi-criteria Decision Analysis	–	–	–	–	Rationality requires that both beliefs and values be well founded, and values cannot be well founded without emotion. Thus, rational decision making (or emotional rationality) requires elicitation of emotions. However, Multi Criteria Decision Analysis cannot handle virtues well, although questions involving virtues are usually very emotional. Therefore, proper MCDA requires a careful separation of virtues and ends, and then focus on the ends in the subsequent analysis.
3	Reynolds, 2006	2006	Conceptual paper	Neurocognitive model of ethical decision making	–	–	–	–	Explaining, predicting, and motivating ethical behavior are goals worth pursuing. Accomplishing these goals, however, requires models that adequately disclose ethical decision making in a way that sparks research and fosters application. This neurocognitive model is such a model, and the extent to which the authors can expand and apply such a perspective to these uncommonly complex issues gives the authors a greater chance of achieving those goals.
4	White et al., 2007	2007	Empirical paper	166 MBA students	Testosterone measurement	Entrepreneurial experience; family business background	Testosterone level	Logistic regression	This study presents theory and evidence linking the combination of both sociological and biological factors with new venture creation: a biosocial model of entrepreneurship. Empirical results indicate new venture creation is more likely among those individuals having a higher testosterone level in combination with a family business background.
5	Hodgkinson et al., 2009	2009	Conceptual paper	Intuitive and analytical approaches to decision making	–	–	–	–	The rapidly expanding developments in social cognitive neuroscience investigated in this article look set to further corroborate and enhance current understanding of intuition, bringing vital scientific foundations for its increasing role in organizational life as well as a framework of lessons for managers.
*6	*Krueger et al., 2009	2009	Empirical paper	67 United States combat veterans	Computed tomography (CT) scans	Emotional Intelligence	Perception and integration of emotional information	Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT); ANOVA; Wechsler Adult Intelligence Scale (WAIS) III; Gaussian distribution (Kolmogorov–Smirnov test); variance homogeneity (Bartlett's test); non-parametric tests (Kruskal-Wallis test)	This study shows that competencies underlying emotional intelligence (EI) have clear neural foundations and can be impaired despite otherwise normal basic intellectual functioning. Prior findings have indicated that the behavioral and emotional dysfunction associated with vmPFC damage cannot be explained by impaired cognitive intelligence measured by standard intelligence tests. Moreover, although the dlPFC has been correlated with cognitive intelligence, recent lesion evidence failed to endorse the hypothesis that dlPFC damage would disproportionately impair general measures of cognitive intelligence. On the other hand, EI complements cognitive intelligence and permits the assessment of individual discrepancies in emotional and social processes – such processes are key factors in making the right vs. wrong decisions in one's personal life and in influencing people's choice about optimal situation-specific social and economic exchange strategies.
*7	*Boyatzis et al., 2012	2012	Empirical paper	7 people, enrolled as senior-level managers, business owners, or second career faculty members	fMRI	Activation of neural areas	Recalling experiences	Least-squares regression	The results showed compelling activation or negative activation of 31 different brain regions for all subjects with 23 of these remaining significant with the exclusion of the single female subject. The findings seemed to cluster in a manner that was puzzling. Because this was an exploratory study, scholars could only define the possible connotations of these findings in light of past research; future studies will be needed to test these interpretations and determine which regions are critical to effective leadership and the role of gender.
8	Linkov et al., 2012	2012	Conceptual paper	Neuroscience and decision making	–	–	–	–	How the brain makes decisions adopting imperfect information is a pivotal question of modern cognitive neuroscience. First, despite its irrationalities and inefficiencies, the brain remains by far the most flexible and complex decision-making tool available and, therefore, may be an appropriate model for structuring decision-making mechanisms, similar to other biologically inspired solutions to real-world problems in computation, optics, immunology, and other fields. Second, policy decisions must basically depend on human judgment and, thus, will be best served by methods and tools that complement human abilities.

(Continued)

TABLE 1 | (Continued)

	Author(s)	Year	Type of article	Setting	Methods	Dependent Variable(s)	Independent Variable(s)	Analysis methods	Main findings
*9	*Hannah et al., 2013	2013	Empirical paper	103 military executives	EEG (qEEG)	Psychometric- and Neurologically based measures	Adaptive decision making	Standardized self-complexity measure	The authors have derived psychometric- and neurologically based measures demonstrating that both of them are calibrated for unique variance in external ratings of adaptive decision making. Furthermore, the authors have argued about how these findings can provide a deeper understanding of the latent and dynamic mechanisms that underpin leaders' self-complexity and their adaptability.
10	Hodgkinson and Healey, 2014	2014	Conceptual paper	Discuss the conditions for a framework that enables firms to harness the cognitive and emotional capacities of individuals and groups	–	–	–	–	As scholars have determined, emotion is pivotal to enabling radical innovation. However, ongoing organizational practices are predicated on a (bounded) rationality façade, rooted in the cold cognition era. This has unintended consequences for organizations, both in respect of formulation and implementation attempts to foster radical innovation.
11	Leger et al., 2014	2014	Empirical paper	21 MBA students	Electrodermal activity (EDA)	IS_ERP; IS_HUM	Non-specific amplitude of electrodermal response (AMP.NS.EDR); Non-specific electrodermal response (SD.NS.EDR)	Descriptive statistics and correlations of the variables	Results show that both expert and beginner users exhibit considerable EDA activity during their interaction with the ERP system, indicating that ERP use is an emotional mechanism for both groups. However, the findings also indicate that experts' emotional responses led to their sourcing information from the ERP, while novices' emotional responses led to their sourcing information from other people.
12	Dedeke, 2015	2015	Conceptual paper	A cognitive–intuitionist model of moral judgment	–	–	–	–	Emotions always guided a worker's cognitive moral decisions. These emotions could make it more or less likely for the employe to comply with the moral rules. Hence, it is in the interest of the organizations to know the emotions that their employes have when they comply or ignore the company's moral codes.
13	Laureiro-Martínez et al., 2015b	2015	Empirical paper	63 participants with at least 4 years' experience of making managerial decisions	fMRI	Activation of the brain circuits related to attentional control	Decision-making performance	ROI analysis	This article could contribute to theories at the intersection of control and attention through a focus on attentional control, as the cognitive systems that experienced decision makers use to shift to alternative options. Attention control guides cognition, particularly when there is no predetermined means to achieve goals. Authors have found a positive correlation between the strength of attentional control and decision-making performance.
14	Butler et al., 2016	2016	Review	14 empirical papers on neuroscience and managerial decision making	Systematic Literature Review	–	–	–	The authors have classified three organizational neuroscience clusters that have already made substantial theoretical improvements to management and organizations. Neuroimaging has the capacity to co-locate the cortical substrates that mediate decision-making processes within the brain, and to relate the processes to time. All three clusters are already providing insights into the specific boundaries surrounding the human freedom to act. Clarifying the more precise function of emotions and their regulation in forming a judgment in managerial decision making in different contexts has been a recurring theme. The organizational behavior batch, probably because of the multiple methods that have been adopted, has also been able to analyze how team members function synchronously, and the links between physical traits and leadership.
15	Chen et al., 2016	2016	Empirical paper	60 accountants with at least 5 years of working experience	Eye-tracking	Time spent focused on the financial and non-financial indicators	Strategic Business Unit information; linked or non-linked performance indicators	ANOVA	Authors have found that respondents who look more at strategically linked performance measures are more likely to make decisions consistent with the achievement of their subordinates' strategic objectives; and, especially, when respondents were aware of the corporate strategy, they have focused more on strategically linked performance measures than on non-linked measures.
16	Cropanzano et al., 2017	2017	Conceptual	A theoretical model combines the use of justice rules to assess events, cognitive empathy, and affective empathy	–	–	–	–	Authors have claimed that deontic justice is an important moral factor for individuals, even when it does not directly serve their self-interest. In this vein, the authors have hypothesized that deontic justice is the result of the intertwined interaction between the neural systems associated with cognitive empathy, affective empathy, and individuals' ability to evaluate and apply and apply moral rules. This suggests also that organizations should promote the presence of deontic justice as a part of their overall culture, since it enables the generation of ethical behaviors and, thus, pleasant working environments.
17	Ascher et al., 2018	2018	Review	50 scientific studies on neurostrategy	Systematic Literature Review	–	–	–	Authors have pointed out that tools of neuroscience are promising in strategic management, but there is still much misinterpretation about what would be neuroscientific research and behavioral research, and the contribution to these new fields of studies on strategic management lies on a proposition for a better classification of them.

(Continued)

TABLE 1 | (Continued)

	Author(s)	Year	Type of article	Setting	Methods	Dependent Variable(s)	Independent Variable(s)	Analysis methods	Main findings
18	McDonald, 2018	2018	Conceptual paper	Intertwined insights from social cognitive neuroscience sustainability management	–	–	–	–	The central thesis of the paper is about the insights from the arising field of social cognitive neuroscience that have academic and practical consequences for challenges facing sustainability management.
19	Lee and Yun, 2019	2019	Empirical paper	178 business students; 43 business managers	fNIRS	Oxyhemoglobin values on DLPFC	Time constraint	Custom-written MATLAB codes; ANOVA	The authors have found that under high time constraints, individuals can have heightened oxygenation and gamma-range EEG activities. The emotional stress that an agent can experience when he or she chooses a moral option is significant and, thus, there is a need for more future research into the emotional well-being of business agents who have to make hard choices.
20	Rybnicek et al., 2019	2019	Empirical paper	44 MBA students	fMRI	BOLD signal	High income vs. low income	ANOVA; ROI analysis	The findings of this study help to validate *need theory* on a neuroscientific level. In fact, results confirm theoretical assumptions upon which that theory is constructed. First, it is shown if and how far different management rewards are perceived as rewarding and may contribute to work motivation. Second, based on these results, the authors have shown that rewards that closely match a person's needs are seen as more rewarding than rewards that match those needs to a lesser extent. Moreover, the results extend neuroscientific literature by studying management-relevant rewards that have not been studied before.
21	Boone et al., 2020	2020	Conceptual paper	Neuroscience and CEO social values in investments for Corporate Social Responsibility	–	–	–	–	Authors have brought a corollary illustration based on the results of neuroeconomic experiments to suggest that CEOs' social values, through association with different sequences of neural processing, affect how responsive they are to compensation arrangements and institutional pressures.
22	Massaro et al., 2020	2020	Conceptual paper	Functional neuroimaging as a tool to advance entrepreneurial cognition	–	–	–	–	Scholars present a cross-disciplinary effort to take a step toward bridging entrepreneurship research and functional neuroimaging, arguing that the time is ripe for the progression of a neuroscience-based standard for studying entrepreneurial cognitive processes and linkages to action. The opportunity to objectively assess mental processes unfolding in the brain, associate such processes with behavior, and ultimately generate physiologically informed theories of entrepreneurial cognition are the pillars supporting why and how neuroimaging can complement, challenge, and ultimately, extend current knowledge in entrepreneurship.
23	Fennimore and McCue, 2021	2021	Conceptual paper	A risk-taking model based on the neurobiology of four motivational states (hope, fear, frustration, and relief)	–	–	–	–	Authors claim that financial managers should be able to manage both their reflexive valuations (i.e., Pavlovian learning) and risk preferences (i.e., instrumental learning) in order to learn the new organizational culture and set of risk preferences. Additionally, the authors suggest that it is viable to follow neurobiological patterns of behavior for those who habitually express risk-aversion, punishment sensitivity, and stronger loss valuations for outcomes, since these motivational states may affect how and why decisions are made and, therefore, help to have a greater understanding of the mechanisms behind such short-, medium- and long-term choices.

The asterisk (*) identifies papers that are also present in the sample by Butler et al. (2016).

Lieberman-Aiden et al., 2009). This course of action helps build a solid neuroscientific basis for the assumed connections between neuroscience and the affect and cognition of managers proposed in the discussion section below.

RESULTS

Among the 23 papers in the sample, only three contributions (i.e., Krueger et al., 2009; Boyatzis et al., 2012; Hannah et al., 2013) are present also in the "organizational behavior cluster" of Butler et al. (2016), substantiating originality and novelty in the systematization we propose. The majority of the 23 papers in our sample are conceptual (12; 52%), then 9 empirical articles (39%) and 2 review works (9%) complete the sample. Among these, authors who have published empirical contributions have used many techniques to test their assumptions; the main ones used have been fMRI (40%), EEG or qEEG (20%), and electrodermal activity (13%). Other techniques used for the data analysis have been: Computed Tomography scans (5%), Facial Expression Recognition (5%), Eye-tracking (5%), fNIRS (5%), and Testosterone (5%). With regard to authors, Gerard P. Hodgkinson is the only one present with two contributions (both conceptual).

The 23 selected papers cover a period of 18 years, with the distribution shown in **Figure 2**. There is an average of two publications per year. Furthermore, the selected contributions were published in many different journals; among them, 4 (15%) appeared in *The Leadership Quarterly*.

An inductive thematic analysis of the 23 selected papers' manuscripts has been implemented, aimed at identifying the type of decisions treated. In particular, thematic analysis is principally employed to acquire a nuanced comprehension of spontaneous and sophisticated processes (Mills et al., 2009), such as decision making. Within inductive thematic analysis, there is no presence of an initial codebook and themes are free to emerge. In line with Strauss and Corbin (1998), the coding has relied on the research question to determine themes associated with the main aspects of the analysis based on the theoretical background. The resulting themes/decision types emerging from the manuscripts dealing with managerial decision making are: *(a)* ethical decisions, *(b)* innovation decisions, and *(c)* data-enabled decisions.

Ethical Decisions

Our systematic review includes many publications on ethical decision-making processes (i.e., consistently evaluating and choosing ethical principles), emphasizing moral aspects. In this vein, Reynolds (2006) was the first to report the interaction of the C- and X-systems in the ethical decision-making process. In particular, according to Reynolds (2006) model, ethical decisions come from the accuracy of the neural pattern of the stimulus, i.e., prototype, which are activated in the brain of the decision maker, such that: "an effective and thorough search can facilitate ethical behavior by gathering enough accurate information either to match a prototype correctly or to apply the moral rules available effectively" (Reynolds, 2006; p. 743). Prototypes are evoked according to the information *reflexively* collected and categorized into ethical patterns by the decision maker. The ability to structure information to match multiple prototypes will be positively associated with ethical behavior. Then, the ethical judgment is made, and it would be highly positively correlated to ethical behavior if performed by the C-system rather than by the X-system. This last avenue allows restructuring prototypes

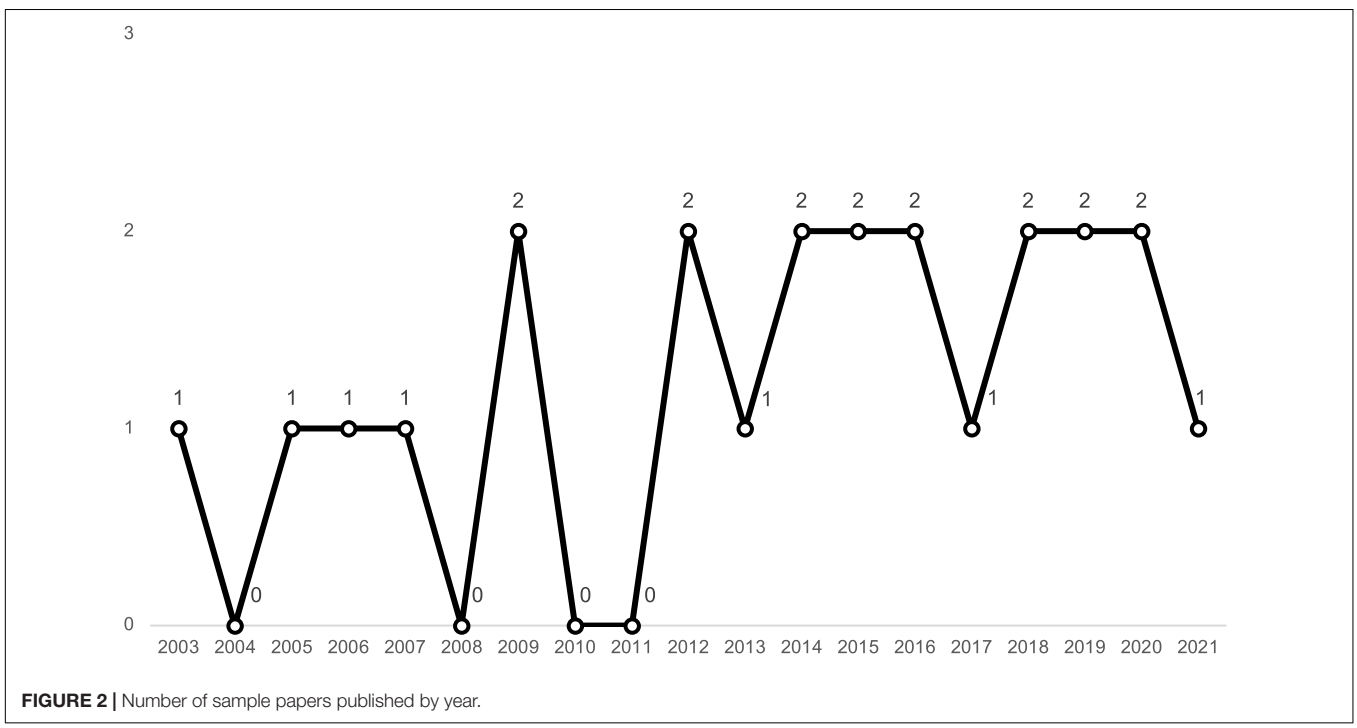

FIGURE 2 | Number of sample papers published by year.

in the light of a rationalization process of moral rules and, in sum, substantiates that the C-system would exert control over the X-system to ethically manage organizations.

However, research has reported that not only the pre-frontal cortex, but also the amygdala (involved in memorizing emotional reactions) are important for a person's moral development (Greene, 2015), suggesting that "the discussion of ethics should not rest solely on a rational decision-making model" (Robertson et al., 2017; p. 691). This adheres to the conceptualization of moral development by Kohlberg and Hersh (1977) that does not consider moral judgment as a necessary condition for moral action, because of the fact that also emotions, and a general of sense of will, come into play. Therefore, moral reasoning does not always lead to moral behavior. In this vein, Dedeke (2015), in his theoretical model, suggests that ethical decision making includes five interdependent yet functionally distinct steps and proposes an intuitive view of ethical judgment, as it describes how emotion regulation, perceived moral intensity, and perceived ethical climate constructs impact the formation of moral intent (Dedeke, 2015). In particular, Dedeke (2015) proposes that emotions always influence employes' cognitive moral decisions. He assumes that automatic cognition (i.e., intuition) and automatic emotions interact within the pre-processing stage of an ethical decision. This would happen as follows: *(i)* the situation faced by the decision maker elicits some memories (as knowledge structures, schematic mental structures) that recall actions that have been implemented in the past and that can also have a role in ethical decisions; and *(ii)* concurrently, emotions provide a frame of reference for cognition; emphasizing some elements of the context over others. Moreover, the emotional reaction is used as an information point in decision making and works as a driver for cognition (i.e., somehow, the X-system drives the C-system).

In the same vein, McDonald (2018) underpins the importance of social cognitive neuroscience in sustainable management and related ethical decisions. The author reports several research insights from the literature, underscoring the essential role of social cognitive neuroscience in corporate sustainability management research. In particular, McDonald (2018) focused his attention on managers and their responsibilities on creating value in an integrated manner across ecological, economic, and social spheres. In doing that, he highlighted the importance of the amygdala, which was found to be assisting emotional learning in ethical decision-making processes. According to this author, the amygdala allows bypassing the cortex providing an automatic and unconscious reaction (X-system over C-system) in unforeseen situations and humans respond immediately to an input, such as fear. To improve ethical decisions in sustainability management, this latter needs to be communicated so that emotional tags are created within the memory to evoke a future state that will facilitate creative solutions. In this regard, the X-system of decision makers, in which the amygdala operates, should prepare the field for an oriented cognition operated by the C-system. This is aligned with the results by Lee and Yun (2019) who identified, using fNIRS, an increase in the hemodynamic responses in the dlPFC that can be linked to moral stress, caused by time constraint and that causes shifting to a proself-condition (i.e., adopting a selfish behavior). Accordingly, it could be hypothesized that activated dlPFC correlates with the capacity to handle moral stress, and can easily affect the C-system favoring the X-system in ethical decision-making processes.

Fennimore and McCue (2021) also deepen the role of stress and other motivational drivers in ethical decision making. From their model, decision makers are neurobiologically inclined to be engaged in risk-averse behaviors once they are persuaded by the fear of disrupting the *status quo* and seek relief by preventing punishment. Yet, other decision makers have neurobiological preferences toward risk-seeking behaviors, galvanized by the hope of reward prospects. In brief, from this study, the X-system seems to orient the risk orientation behavior (similarly to Cropanzano et al., 2017), who studied the neurobiological origins of deontic justice; the moral obligation to uphold norms of justice. In particular, Cropanzano et al. (2017) pointed out that the presence, or absence, of business ethics within the organizational environment are likely to affect positively, or negatively, the behaviors of those involved, since "the pernicious effects of injustice are likely to be spread rapidly through an organization, as some employes become displeased with the treatment and experiences of their coworkers" (Cropanzano et al., 2017; p. 746). Consequently, in deontic justice contexts, the emotional state (X-system) seems to prevail over the rational one (C-system) for the formation of ethical choices.

Innovation Decisions

With regard of innovation decisions, i.e., the choice to adopt or not adopt an innovation, Hodgkinson et al. (2009) identified intuition as crucial for those organizations seeking innovation, such as new business opportunities (i.e., exploration). Hodgkinson and Healey (2014), demonstrated that reflexive processes (associated with the X-system) are not relegated to a mere source of error or bias to be overcome with effort; rather, they are integral to reflective (C-system) processes of human cognition and critical for skilled processes such as intuition. In particular, they added that, to achieve a successful level of innovation and shifting strategic choices, managers must be offered the opportunity to regulate their feelings (the so-called emotional reframing); adaptive regulation stimulates the PFC.

Such adaptability may be contingent upon managers having the requisite complexity to facilitate effectiveness across various roles with different grades of intuition and expertise. Hannah et al. (2013) specifically examine managers' self-complexity, which is based on the self's central role in managing the interface between a manager's internal processes (closer to the C-system) and his or her interactions with the social environment (closer to the X-system). More effective managers possess a requisite level of complexity that allows them to perceive and assess complex and changing dynamics accurately and, in turn, adapt their decision making and behaviors to enact effective responses. This was confirmed by these scholars through the measurement of the executive and cognitive-associated frontal lobe by quantitative EEG. In addition, Hannah et al. (2013) have recommended that practitioners assess managers' self-complexity (LSC) to measure their ability to handle internal processes – i.e., goal system, self-regulation, and identity – and their synergies with the external

environment. Specifically, Hannah et al. (2013) have highlighted that LSC is a reliable precursor of managers' adaptive behavior; thus, according to these scholars, LSC can be spotted in managers that can lead them to achieve goals characterized by a higher degree of complexity.

To confirm what was proposed by Hannah et al. (2013); Laureiro-Martínez et al. (2015b) have used the fMRI technique in a sample of expert decision makers that exploitation – deepening the existing business – relies on brain regions (i.e., the mPFC and the hippocampus bilaterally) mainly associated with anticipation of rewards, while exploration – looking for new business opportunities – depends on regions primarily associated with attentional control (bilateral parietal and frontal regions, e.g., dACC). From that, exploitation and exploration are separate behaviors involving different mind processes. Moreover, Laureiro-Martínez et al. (2015b) found that the locus coeruleus-norepinephrine (LC-NE) system and the PFC are activated by the cognitive processes that enable decision makers to switch between exploitation and exploration processes. In particular, these brain regions can be traced back to the C-system and, thus, the LC-NE, which controls the degree of attention, affects this particular system rather than the X-system. In practice, brain circuits related to attentional control allows individuals to achieve better decision-making. Nonetheless, the rational and attentive management of exploration-exploitation processes usually leads, as for March (1991), to selecting more reliable business actions, such as exploitation, rather than those leading to uncertain outcomes – thus, degrading, however, organizational learning in a mutual learning situation and compromising the competitive position in the long term. In brief, even if the more attentive brain processes are put into action, they cannot ensure that the produced equilibrium between exploration and exploitation is the best for successfully adapting to the changing environment.

Data-Enabled Decisions

Some neuroscience contributions (Damasio, 1994; Bechara and Damasio, 2005) intensely stressed the idea that decision-making processes are not exempted from being affected by emotions and, in recent times, scholars started investigating the emotional responses of decision makers in data-enabled decisions (i.e., decisions facilitated by information technology (IT) systems and related produced data). In this regard, pioneers such as Dimoka et al. (2011) asserted that, in different social contexts in an office environment, exploring the potential of cognitive neuroscience and information systems (neuro-IS) research offers examples of a fertile intersection in which there is a considerable potential to optimize management activities.

Following this line of research, Leger et al. (2014) measured emotional responses, based on electrodermal activity, in two samples of managers with different expertise during the use of an enterprise resource planning system in a decision-making context led to different sourcing information. These scholars found confirmation that the more people become proficient in doing a specific task, the higher the decreasing activity in the prefrontal brain regions. Moreover, as the prefrontal brain regions are correlated with the cognitive side, it can be hypothesized that the more a person becomes confident with a task, the more intuitive his/her behavior will be and the X-system will prevail over the C-system. Hence, remarking on the contribution brought by Krueger et al. (2009) concerning the role covered by emotional intelligence (i.e., the ability of reasoning about emotions, and, in turn, to use emotions to intensify reasoning) in driving individuals' reasoning and behavioral skills, Leger et al. (2014) shed light on the function played by emotions in IT systems' frameworks – marking the distinction between proficient and neophyte users.

Similarly to Leger et al. (2014), through the means of the Locarna eye tracker, Chen et al. (2016) investigated how decision quality is affected by the amount of time managers spend looking at the Balanced Scorecard (BSC)'s performance metrics, and whether understanding of a firm's strategy and how the presentation format affect individuals' focus. In this context Chen et al. (2016) found that: *(i)* managers who look more at strategic performance measures (e.g., sales margin, brand recognition rating, and employes' satisfaction) are more likely to make decisions consistent with the achievement of their subordinates' strategic objectives, and *(ii)* when managers are informed about the strategy put in place by their organizations, they are more concentrated on strategic performance measures than others. Therefore, it could be possible to conjecture that the C-system overrides the X-system in shaping managers' approach to the results depicted in the BSC.

DISCUSSION

Generally speaking, the distinction between the X- and C-systems, building upon the lateralization of the brain, although valid, is a coarse classification of many distinct human faculties that pertain to one of two broad domains and their interaction. This general distinction oversimplifies brain lateralization and assumes absolute functional differences in management studies. Our literature review consistently shows that the distinction between reflexive and reflective systems dominates the debate with marginal articulations within each of the systems (Laureiro-Martínez et al., 2015a,b; Boone et al., 2020). In this regard, we recognize from our SLR that three different schools of thought emerged: *(i)* the C-system has a predominant role over the X-system; *(ii)* the X-system has a predominant role over the C-system; *(iii)* the C- and X-systems interact, and neither of the two has a primacy.

For the first cluster, Reynolds (2006) study is among the few important works. Indeed, he was the first to report the interaction of the C- and X-systems in the ethical decision-making process. Ethical judgment would be highly positively correlated to ethical behavior if performed by the C-system rather than by the reflexive one. Hence, according to Reynolds (2006), the C-system exerts control over the X-system for the management of organizations. Recently, Boone et al. (2020) conducted a study to assess the pivotal importance of the controlled C-system over the automatic X-system for pushing Top Management Teams (TMTs) to invest in corporate social responsibility.

With reference to the second cluster, many other scholars, instead, have devoted their efforts to analyzing the influence that

the X-system has on the C-system. Among them, it is noteworthy to recall the contribution brought by Leger et al. (2014), who, using electrodermal activity to measure psychophysiological responses elicited by arousal, have confirmed what was previously proposed by Krueger et al. (2009), thus that the more a person becomes confident with a task, the more intuitive his/her behavior will be and, therefore the X-system will prevail over the C-system. This latter idea also has found fertile support from Antonakis and Dietz (2010), who have asserted that the decision makers' emotional intelligence, combined with other elements such as the working memory and the intelligence quotient, plays a pivotal role in shaping leaders' answers in critical situations, such as when they face constraints in their own cognitive resources. Particularly, leaders' ability to handle emotional intelligence allows them to be engaged in higher quality decision-making processes since, due to the aforementioned skill, they are more competent in the creation of proactive environments where a contamination of ideas is widely supported and positively perceived (Antonakis et al., 2009).

A third cluster supports the idea that there is a mutual influence between the C- and X-systems. Among them, we recall the important works by Hodgkinson et al. (2009) and Hodgkinson and Healey (2014), proposing a theoretical framework in which the two systems of human mind have close interaction and mutual influence. According to this third cluster, lateralization of the brain appears to be more complex than how it is popularly investigated (Toga and Thompson, 2003). As suggested by Hodgkinson et al. (2009): "old models based on a simplistic left brain/right brain dichotomy are giving way to more sophisticated conceptions, in which intuitive and analytical approaches to decision making are underpinned by complex neuropsychological systems" (p. 277).

From the above, we should be aware that the traditional distinction between reflexive (X-) and reflective (C-) systems, considered alone, cannot be framed as a complete theoretical framework as the nature of the interplay defines specific paradigms. Indeed, many theories assume dual processing of information, but they radically differ in their articulation. A fundamental distinction, mainly discussed in literature with reference to System 1 and System 2, is between a *parallel-competitive* and a *default-interventionist* approach (Evans, 2021). In this last regard, from the analysis of the sample contributions described above, it can be derived that the managerial decisions result as the product of an emotional-driven dialectic of affect and cognition (e.g., Damasio, 1994; Sadler-Smith, 2016; Abatecola et al., 2018; Cristofaro, 2020a,b, 2021a,b), redirecting the discussion on information processing from dual-mind processing theories (e.g., Stanovich and West, 2000; Hodgkinson and Sadler-Smith, 2018) to a "unified" mind processing theory (Sadler-Smith, 2016) for which the two systems of our mind are not in conflict and for which affective states have an initial (but not exclusive) primary driving role. As a consequence, the recent affect-cognitive interplay emerges, under a neuroscientific point of view, as supported, and may be considered as the fertile ground from which a renewed understanding of managerial decision making can move forward – also because its explanations are intertwined with other relevant streams of research such as the Upper Echelons Theory (Hambrick and Mason, 1984; Abatecola and Cristofaro, 2020) and Behavioral Strategy (Powell et al., 2011; Sibony et al., 2017; Abatecola et al., 2021; Cristofaro and Giannetti, 2021). In particular, it seems to be that the provided understanding supports the recent Affect-Cognitive Theory of management decisions by Cristofaro (2021a); in fact, assumptions of this theory clearly identifies an interplay of affect and cognition, with affective states having an initial (but not exclusive) primary driving role, for the formation of choices supporting the cited "unified" mind processing theory.

LIMITATIONS OF THE RESEARCH FIELD AND FUTURE RESEARCH

Neuroscience can help to deconstruct and reformulate from scratch some traditional problems – i.e., the roots of behavioral strategy (Powell et al., 2011) – that connote the agenda of management studies. Notwithstanding such premises, the contributions present in our literature review seem not to follow this trend. Indeed, they are characterized more by a mere integration of neuroscientific methods than a radical reformulation of research questions based on neuroscientific evidence.

The main limits of the papers in our sample are that: *(a)* neuroscientific studies are often conducted on non-representative populations, because studies on practitioners are limited, and nothing can grant that the evidence found on non-representative populations (e.g., students) can be generalized; *(b)* when practitioners are present, samples are often limited or biased, as there is difficulty in balancing the different profiles of participating organizations and teams; and *(c)* studies are often based on laboratory experiments.

The above limitations are commonly connected with the intrinsic difficulty of implementing several neuroscientific tools in ecological conditions (e.g., fMRI outside a medical hospital center) and ethical problems in adopting them. In this regard, as expressed by other scholars (e.g., Tivadar and Murray, 2019; Zwaan et al., 2019), since managerial decision-making processes are filled with strong interplay between affective and cognitive contents, the use of either laboratory experiments or non-representative populations will unquestionably lead to results affected by a lower ecological validity and, in turn, to a lesser practical utility of these results to help scholars in the study and explanation of peculiar situations (e.g., by controlling, in real-time, the neurobehavioral mechanisms affecting executives' decisions while they have to counteract sudden organizational/financial crises).

Furthermore, the neuroscientific contributions examined in this study often present limitations concerning the statistical analysis techniques. More specifically, the number of significance tests carried out in neuroimaging analyses (e.g., fMRI, EEG, and qEEG) are extremely likely to inflate the risk of Type I error (false positiveness) – in line with Jack et al. (2019). A clear example of limitations regarding the statistical methods has been explicitly declared by Balthazard et al. (2012) who have not correctly applied multiple comparisons in their analyses, because this "would impose an overly conservative and impractical limit for exploratory studies like

our own" (p. 255). To overcome this limit, Balthazard et al. (2012) have wisely improved the likelihood of any "spurious results" by the means of a second population to replicate their results. Therefore, despite having cross-validated their findings to overcome statistical limitations, this represents a common and evident barrier that many other contributions have had to face.

An Agenda for Future Research

Articulating the Reflexive System

The general distinction between reflexive/X-system and reflective/C-system dimensions seems to substitute the further distinctions among specific cognitive phenomena within the reflexive realm. Affect, intuition, insight, instinct, are quite different types of cognitive phenomena – pertaining to the reflexive system – each markedly connoted by distinctive features and neurophysiological systems. What seems to emerge from our literature review is that such a fine-grained distinction is never by scholars. With a few exceptions (such as Hodgkinson et al., 2009), the selected contributions rely on a coarse-grain distinction between reflexive and reflective systems, avoiding further articulations within each one of them. This theoretical choice seems to discharge the many advancements made in cognitive neuroscience in the last two decades, which tend to articulate on a neurophysiological level of the specific sub-systems involved.

Generally speaking, this review easily indicates that many reflexive processes do not necessarily present an affective dimension. For instance, numerical cognition involved in the well-known "bat and ball" like problems (e.g., Branas-Garza et al., 2019) relies on automatisms but does not consider any affective dimension. What seems to be relevant here is not that distinctive cognitive phenomena are all ascribed to the reflexive system, but they are quite different types whose specificities are underexplored by management scholars.

Assuming a strict functional specialization and rigid modularity between reflexive and reflective systems could be misleading, as it hides several alternative views of the human brain that have emerged in the last decade. System 1 is quite flexible and content-sensitive, as different specialized brain regions are able to contingently interact to form coalitions of brain areas to perform new tasks, instantiating *neural reuse* (Gallese et al., 2021; Mastrogiorgio et al., 2022). Such considerations about the nature of the X-system are quite absent from the contributions that emerged in our literature review and should be explored further in future studies. In particular, and contrary to the idea that the reflexive system is biased, the automatic response can be a source of satisficing decisions in specific task environments (Gigerenzer, 2007). For instance, the recognition heuristic is based on the idea that if one of two objects is recognized, we can infer that the recognized object has a higher value than the criterion to infer it. Generally speaking, organizations that incorporate the affective dimension in decision making are more successful than those organizations that rely solely on analytic approaches (Hodgkinson and Healey, 2011).

The contribution of our literature review seems to acratically assume (with a few exceptions like Hodgkinson et al., 2009) a Manichean duality to overlook the idea that automatic response can generate rational outcomes, which is another avenue for future research. The reflexive system can be a significant source of correct judgments; Hodgkinson et al. (2009) discuss the distinction between insight and intuition, both characterized by the automatic response, where the anterior superior temporal gyrus region of the right hemisphere is related to insight and the orbitofrontal cortex and the amygdala are activated in intuitive judgments (Volz and von Cramon, 2006). If we admit that the reflexive system is a source of rational judgments, we should be tempted to criticize most of the arguments presented in the contributions that tend to unwittingly adopt a sharp distinction between the sources of rational or irrational judgment. We think that continuing the deconstruction of the distinction between irrational/automatic vs. rational/deliberate is a fundamental domain of future research.

Articulating the Ecological Dimension

The traditional perspective of *cognitive biases* (Kahneman et al., 1982; Stanovich and West, 2000) has been, in the last decades, complemented by an alternative program emphasizing that decision makers are able to deal with complex environments through the use of fast and frugal heuristics that are adapted to the structure of the environment (Gigerenzer and Selten, 2002). Kahneman's (2003) framework has been criticized for a poor specification of the role of the environment when formulating judgment, as Kahnemanian heuristics are assessed using non-ecological benchmarks (such as logic and probability calculus) (e.g., Gigerenzer and Murray, 1987; Gigerenzer, 1991). Within the framework of bounded and ecological rationality, it is impossible to assess human rationality only by looking at the cognitive phenomenon, limited-to-the-brain, as the structure of the environment specifies which cognitive process is successful (Gigerenzer and Selten, 2002). Interestingly, the contributions in the sample, despite they have been selected with specific reference to Simon's (1947) tradition, neglect the role of ecological dimension and, in particular, the fit between cognitive resources and environmental structure (also known as the scissors' argument, Newell and Simon, 1972). The so-called naturalistic decision making – which analyzes how experts make decisions in ill-structured, complex environments under conditions of time pressure (Zsambok and Klein, 2014) – introduces an alternative perspective on reflexivity and represents a promising, but somehow underexplored, program of research. Organizational neuroscience represents a "natural" articulation of the ecological dimension, where the workplace represents the "real-world" in which specific neuro-cognitive mechanisms can be studied.

Views of the Brain and Affective-Cognitive Interaction

Traditionally, experimental research favors a reactive view of the brain, as brain functions are studied by means task-evoked responses. The experimental perspective, though successful, leaves aside the factual consideration that brain activity is mainly intrinsic and involves functions for interpreting and predicting

TABLE 2 | A potential typology of future research.

		Type	
		Affective	**Cognitive**
View of the brain	**Reactive brain**	Articulating the reflexive system *Biased or "gut feelings"?*	Articulating the ecological dimension *Which cognitive process for which task-environment?*
	"Intrinsic" brain	Understanding the role of persistent traits *How do personality traits enter into the process?*	Understanding the "baseline" of expertise *How does intrinsic activity affect expert decision-making?*

environmental instances, and not just reacting to them. Generally speaking, what makes the study of the *intrinsic brain activity* relevant is that the brain's enormous energy consumption is not related to specific tasks, but to its default activity mainly related to the ongoing, perceptual information processing of large amounts of sensory data (Raichle and Snyder, 2007; Raichle, 2010).

Although the idea that the brain is not primarily reactive – a default activity occurs prescinding from the responses of contingent tasks – is not new, the investigation of intrinsic brain activity (i.e., "baseline") represents a relatively under-investigated domain of neuroscientific research, also considering its related methodological problems. Indeed, while experiments are rigorously designed (stimuli and responses can be measured with great precision), the measurement of the default activity of the brain can be elusive, as there is no specific theoretical focus. We think that the role of the intrinsic brain represents a future domain of investigation for decision-making research, which is able to shed new light on the affective-cognitive interplay. As shown in **Table 2**, while in the reactive brain perspective, articulating the reflexive system and the ecological dimension (discussed in the previous section) represents the two domains respectively related to the affective and cognitive dimension, in the intrinsic brain, the focus is on the long-term default mode of brain functioning. In particular, with reference to the affective dimension, personality is reflected in the brain's intrinsic functional architecture, where the resting-state functional connectivity is predicted by specific personality traits (Adelstein et al., 2011). With reference to the cognitive dimension, when humans have ample time at their disposal to make a decision – and this is expected in upper echelons contexts – spontaneous brain activity constrains the selection of solution strategy (Barnes et al., 2014), as intrinsic activity may reflect a memory system represented by an internal statistical structure of the outside world (Sadaghiani and Kleinschmidt, 2013).

The role of the default mode in the affective-cognitive framework helps us to uncover the long-term, stable, not contingent, boundary conditions of decision making. Emerging domain of investigation could be central in organizational neuroscience which, by definition, focuses on the stable "default-experience" of individuals in structured organizational contexts. Notice, incidentally, that this focus on stable default-mode experience can be also useful to investigate the cultural issue (as we expect that specific organizations' practices enter into the "baseline" in order to affect the way in which decisions are made).

IMPLICATIONS AND CONCLUSION

How do affect and cognition interact in managerial decision making? This is the research question that we tried to answer through the SLR of contributions produced on managerial decision making, which consider neuroscience techniques/points of view. In terms of originality, this is the first contribution filling this gap, stemming from the fact that the only other SLR produced (Butler et al., 2016) did not deeply focus on managerial decision making.

Results of the sample papers show alternative views about the X- and C-systems that seem differently devoted to non-conscious and complicated reasoning. Selected works are not unanimous, but, from their systematic analysis, it can be advanced that the relationship between affective states and cognition is dialectical, with affective states having a driving role toward cognition: the X-system initially drives the C-system. This is aligned with brain studies that point toward a driving role of affective states, since they come from the biochemical response of individuals to their context. In this regard, seeing the relationship between System 1 and System 2 in managerial decision making as parallel, reorients the discussion on information processing from the tradition of sequential dual-mind processing to a "unified" mind processing theory for which the two Systems are not in contrast and for which affective states have an initial (but not exclusive) primary driving role (e.g., Damasio, 1994; Cristofaro, 2020a,b).

From this work, the relationship between BDT – including its developments – and neuroscience emerges as stronger, because one modifies/reinforces the other in a virtuous scientific debate. However, as advanced by Powell (2011), management scholars must not forget that neuroscience can add significant value to the current state of the art in management research only if the former is "at the service" of the latter. Otherwise, neuroscience results could be not perceived as relevant for practitioners and for management scholars themselves, reducing the communication power of the neuroscience-management duality in decision-making research. To avoid that, traditional managerial problems must be re-articulated through a neuroscience lens. Brain imaging techniques can reveal the specific brain area involved in specific decision-making domains. But, there is more. The investigation of intrinsic brain activity could represent a future domain of organizational neuroscience research in which the default-mode of brain functioning can be considered as a "boundary condition" for decision making. This trend is also favored by the increasing use of dedicated devices (such as a stress bracelets, EEG, etc.) in organizational settings. Measuring

the default-mode parameters of brain activity can inform a next-generation of practitioners on how to improve decision making.

Our study also shows that real novelty in hypothesis generation, informed by cognitive neuroscience, is somehow missing. While neuroscience allows deconstructing consolidated categories – to reformulate old management problems in a fresh manner – this is not what our literature review shows; instead of generating radically novel hypotheses, it seems that management scholars are more prone to use novel neuroscientific tools to investigate old management problems. For example, with reference to innovation decisions, the dynamics that lead to innovation are framed within the traditional paradigms such as organizational myopia (Laureiro-Martínez et al., 2015b) or managers' adaptability (Hannah et al., 2013). Interestingly several neuroscientific accounts of innovation-related problems – such as technical reasoning and technological culture (e.g., Osiurak and Reynaud, 2020) – are not explored. This type of consideration also applies to the data-enabled decision, where neuroscientific tools are used in an ecological setting that involves data manipulation (e.g., Leger et al., 2014 measured electrodermal activity during the use of an enterprise resource planning ERP system). Interestingly, despite their neuroscientific claims, such contributions seem to ignore a relevant tradition of neuroscientific evidence dealing with related problems (such as manipulating numerical magnitudes and formats, e.g., Kadosh and Walsh, 2009). Generally speaking, management scholars are more and more prone to neuroscientific investigations. Still, their hypotheses do not seem to be well-informed by the art of cognitive neuroscience and its related debates.

However, if we think that moving from consolidated neuroscientific evidence and debates can be the solution to a solid generation of hypotheses in management studies, we are wrong. Cognitive neuroscience is a dynamic domain characterized by different theories and views of the brain that are often incommensurable. This is particularly true for affect and cognition that, far from being distinct domains, have been shown entangled as cognition is affectively modulated (Damasio, 1994; Adolphs and Damasio, 2001). What should guide future research is the awareness, informed by neuroscientific evidence, that the interplay between affect and cognition could be radically different from what a folk approach could suggest.

In terms of practical implications, managers should take into consideration that their decisions are the concurring product of affective and cognitive influences, with the former having an initial (but not exclusive) role. In this regard, decision makers' course of action can be regulated acting on the perceived affective state; e.g., decision makers interested in enhancing accurate analyses for a choice should consider planning them after recognizing the dramatic impact that a wrong decision may have – this can be done by referring to the "pre-mortem" technique of Klein (2007) aimed at discovering why a project may fail – so as to insert a negative mood. From what has been said, it also suggested investigating the emotional side (by using, for example, the Positive and Negative Affect Schedule questionnaire) of potential collaborators – at all levels – for a complete evaluation of their decision-making processes. Yet, as advanced many times in this study, one of the biggest limitations of the empirical studies in this field lays in the scarce possibility to accomplish ecological testing of the neurobehavioral processes that shape managers' decision-making choices. Consequently, this has prompted scholars to rely mainly on laboratory experiments or non-representative populations reducing the validity – given the absence of important stressors (e.g., the awareness that their choices, being taken in the laboratory, will not affect the safety or stability of their organization) – and, in turn, the practical utility of the resulting insights. Therefore, in addition to having a higher confidence toward neuroscience, as well as an improved availability of the instruments belonging to this scientific field, it is desirable to reach greater synergy between scholars and practitioners in order to produce more complete, trustworthy, and meaningful understandings of the real neurobehavioral processes that affect managerial decision-making outcomes, thus resulting in a mutual win. Doing that ensures following the recommendations by Powell (2011) in using neuroscience as the mean to explore behavioral assumptions of managerial decision making, reinforcing, in turn, behavioral strategy research (Powell et al., 2011).

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

MC and APM equally contributed to section introduction. APM contributed to the sections: neuroscience in management and organization studies, and ethical decisions. MC contributed to the sections: affect and cognition in decision making, methodology, data-enabled decisions, and discussion. PG contributed to sections: affect and cognition in neuroscience, results, innovation decisions, and limitations of the research field and future research. AM contributed to the section: an agenda for future research. MC and AM equally contributed to the section implications and conclusion. All authors approved the submitted version.

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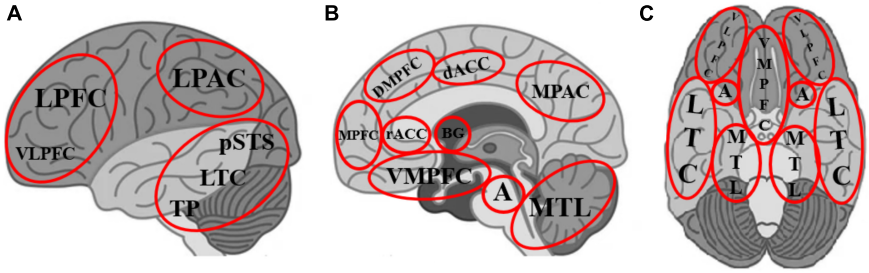
Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

APPENDIX 1



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Leader's Implicit Followership and Employees' Innovative Behavior: Chain Mediation Effect of Leader–Member Exchange and Psychological Empowerment

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In the Chinese society, where power distance is high, leaders' attitudes and behavior toward employees determine their career development as well as affect the entire team's performance. Therefore, exploring the kind of employees that leaders expect in China is essential. Based on implicit followership theory perspective, this study considers leaders' positive implicit followership (LPIF) as the main research variable and examines its influence on employees' innovative behavior (EIB). Moreover, it explores the multiple mediation effect of the leader–member exchange (LMX) relationship and psychological empowerment (PE) in this influence mechanism. The study sample comprised 389 leaders and their direct employees at 45 large- and medium-sized enterprises in Shandong, Beijing, Hebei, Shanghai, Shanxi, Zhejiang, and other regions of China. We used the leader–employee 1:1 matching questionnaire, and the longitudinal research design was adopted to avoid homology variance, making the study results more realistic and reliable. This study used the SPSS 26.0 and AMOS 26.0 statistical software to verify the hypotheses. Our findings show that LPIF has a significant positive effect on EIB, and LMX and PE have multiple mediation effects on the relationship between LPIF and EIB. When the level of LPIF is high, LMX and PE are also enhanced, which in turn promotes the increase in EIB. This study provides a new perspective for subsequent research on the psychological mechanism of employees and suggests an important method for understanding leadership and following processes in an organization. It plays a guiding role for the management practice of an enterprise, selection of leaders, and training of employees.

Keywords: leader's implicit followership, employees' innovative behavior, leader–member exchange, psychological empowerment, chain mediation effect

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INTRODUCTION

As per Hofstede's (2001) cultural dimension theory, the power distance index in Chinese society is much higher compared to Western countries. In China, people's acceptance of power inequality is also higher. Power distance refers to the degree to which members of an organization accept the uneven distribution of power. In Chinese society, where power distance is high, leaders'

attitudes and behavior toward employees determines their career development as well as affects the entire team's performance (Ni et al., 2019). Therefore, it is essential to explore the kind of employees that leaders expect in China. Leaders' implicit followership refer to their perceptions of employees' qualities and behaviors (Sy, 2010). Furthermore, it is a leader's cognitive schema for employees, representing employees' characteristics in leaders' minds (Sy, 2010). Leaders' implicit followership includes positive implicit followership (prototype, LPIF) and negative implicit followership (anti-prototype, LNIF; Van Gils et al., 2010). LPIF is a leader's positive assumption about the characteristics and behaviors that employees should have (Whiteley et al., 2012; Epitropaki et al., 2013). In China, the measurement of implicit followership focuses on LPIF research. This is because with the continuous development of enterprises, employees who conform to LNIF will be eliminated by the enterprise (Zhu et al., 2017). Simultaneously, research on LPIF is also consistent with the mainstream direction of research (Kong et al., 2018) and can play a positive role in management practice (Duong, 2011). Therefore, this study also focuses on leaders who have positive expectations from their employees.

According to implicit followership theories (IFTs), leaders have preconceived notions of employees and make judgments based on this perception to influence others (Fiske and Taylor, 1991). Leaders internalize and endorse a certain implicit followership and gradually use this fixed standard to select, evaluate, and treat employees (Shondrick and Lord, 2010), while employees tend to act according to their leaders' expectations (Eden, 1992). Leaders' expectations or perceptions affect their attitudes or behaviors toward employees and ultimately influence their behavior (Lord and Maher, 1990; Rosenthal, 1993). Eventually, different levels of LPIF bring about differences in employee behavior (Carsten et al., 2010).

Scholars have investigated the relationship between LPIF and leaders' perception and behavior as well as employees' work attitude and behavior from multiple perspectives. For example, studies have found that LPIF can promote leaders' trust and liking for employees (Sy, 2010) and can improve the level of leader–member exchange (LMX; Uhl-Bien and Pillai, 2007). Moreover, LPIF has a positive relationship with employees' trust and liking for leaders, employees' job performance, and team creativity (Sy, 2010; Whiteley et al., 2012; Kong and Qian, 2015; Zhu et al., 2017, 2019).

Employees' innovative behavior (EIB) is vital to ensure the survival and success of enterprises and is an important capital of individuals and enterprises (Kanter, 1983; West and Farr, 1990). EIB is the premise and foundation of enterprise innovation (Woodman et al., 1993; Shalley et al., 2004); it can also improve organizational performance (Dedahanov et al., 2017). However, the existing research on the improvement of employee creativity has mostly focused on antecedent variables, such as external conditions of the enterprise (Dul and Ceylan, 2011) and explicit leadership theory (Jaiswal and Dhar, 2016), and research on EIB from an implicit perspective is scant. Shalley et al. (2004) and Zhang and Bartol (2010) believe that one responsibility of a leader is promoting the formation of EIB and ultimately obtaining sustainable competitive advantage and achieve organizational success. To grasp the mechanism of EIB, it is important to identify the subjective and objective factors that affect EIB within the organization and introduce new concepts or theories. Studying EIB from the LPIF perspective is conducive for maintaining the consistency and coherence of innovative ideas and innovation activities between senior managers and employees so that enterprises have sustainable competitive advantages.

This study attempts to verify how LPIF affects EIB and explores the chain mediation role of LMX and psychological empowerment (PE) in this influencing mechanism.

THEORETICAL BACKGROUND AND RESEARCH HYPOTHESES

Leaders' Positive Implicit Followership and Employees' Innovative Behavior

Sy (2010) defines positive implicit followership as employees' expectations or assumptions about positive characteristics or behaviors. Essentially, it is a positive expectation of employees (Whiteley et al., 2012). Thus far, the subvariable of positive implicit followership adopted by most scholars is Sy's (2010) three-dimensional classification method, that is, "Industry, Enthusiasm, and Good Citizen." Specifically, in terms of working ability, an employee is hard-working, honest, and outstanding. Emotionally, they work with enthusiasm, positivity, and fun. In terms of interpersonal relationships, employees get along well, exhibit good teamwork, and share a sense of trust (Sy, 2010; Peng et al., 2016). In this study, the aforementioned three-dimensional classification methods are described as "ability," "emotion," and "interpersonal relationship." In "ability," individuals can enhance their ability to achieve high-performance expectations. Amabile (2012) indicated that the stronger the individual's ability in associated fields, the more innovative thinking and actions can be triggered. In "emotion," leaders' expectation of employees' positive emotion encourages them to express themselves actively in the organization (Kruse and Sy, 2011) or evoke high self-efficacy (Wang and Wang, 2015). Therefore, these positive and affirmative emotions can promote employees' forward-thinking when individuals face the pressure of failure brought about by innovation, which positively impacts innovation behavior (Frijda, 1986). In "interpersonal relationship," the positive expectation of the employee's "interpersonal relationship" can enable them to manage interpersonal relationships more carefully in the organization, thereby reducing conflict and improving the quality of the interpersonal relationship. Good interpersonal relationships can form an excellent psychological atmosphere for employees (Scott and Bruce, 1994), help information sharing between individuals and groups, and accelerate the construction of personal knowledge systems (Hakanen et al., 2008). Furthermore, such relationships can promote innovative behavior and improve learning ability (Andrews and Delahaye, 2000).

Sy's (2010) empirical study points out that leaders with positive views on employees have positive role expectations. A leader's role expectation and innovation support are essential factors for

employees to implement innovation behavior (Scott and Bruce, 1994). When employees have low role expectations, they tend to complete tasks and not show exploratory behaviors, such as thinking about new ideas. Conversely, employees with positive role expectations are more likely to show exploratory behaviors, such as thinking about new ideas (Derler and Weibler, 2014). Employees' out-of-character behavior is consistent with leaders' expectations of employees' roles, which triggers and activates positive concepts, such as being referred to as a "good employees" and an "insiders" (Bargh et al., 1996). Chinese scholars Wang and Li (2017) and Zhu et al. (2017) have verified the influencing relationship between LPIF and EIB. Based on this, the following hypothesis is proposed:

H1: Leaders' positive implicit followership has a significantly positive effect on EIB.

The Mediation Effect of Leader–Member Exchange

Specifically, social exchange theory (Blau, 1964) describes the social exchange of tangibles (i.e., money) and intangibles (i.e., social support) as a social exchange process. This theory has been applied to illuminate numerous circumstances and behaviors. For example, it is used to explain employees' job performance (Kuruzovich et al., 2021), interorganizational exchanges and trust (Lioukas and Reuer, 2015), and the relationship between leader and peers (Miao et al., 2014). Moreover, social exchange theory provides a basis for understanding the relationship between leaders and employees and explains the influence of LMX on employees' attitudes and behaviors. With limited time and energy, leaders can communicate with each employee at different levels at work. Some employees gain the leader's trust to become insiders, while others become outsiders (Graen and Uhl-Bien, 1995). Additionally, leaders who have positive assumptions about their employees (LPIF) can give them more trust, support, and encouragement (Sy, 2010). The deeper the trust, the higher the LMX level (Kong and Qian, 2015). Thus, the leader will regard the employees consistent with LPIF as insiders (Duong, 2011; Whiteley et al., 2012). For employees consistent with LPIF, leaders will recognize their out-of-role behaviors, thus enabling leaders and employees to develop closer relationships and trust each other more. Leaders can provide more information and resources to "insiders" (Scandura and Schriesheim, 1994), which are not only crucial for the inception of creativity (Lin et al., 2018) but also positively impact EIB (Scott and Bruce, 1994; Basu and Green, 1997; Tierney et al., 1999). In high-quality exchange relationships, the leader shares more constructive and comprehensive ideas with the employees (He et al., 2021). Meanwhile, employees who experience high-quality exchange relationships with their leader are more motivated and more likely to enjoy autonomy while dealing with challenging tasks (Lin et al., 2018; Kirrane et al., 2019). Risk-taking in new procedures and experimenting with novel ideas lead to superior creativity for employees. A high-level LMX can stimulate employees' positive work response and improve enthusiasm for EIB (Atwater and Carmeli, 2009), thus helping employees to innovate (Graen and Wakabayashi, 1994). Based on this, the following hypothesis is proposed.

H2: Leader–member exchange plays a mediation role in the relationship between LPIF and EIB.

The Mediation Effect of Psychological Empowerment

Psychological empowerment is a process that can increase intrinsic motivation and enable employees to control their lives (Spreitzer, 1995); it is an individual's perception regarding job meaning, self-efficacy, self-determination, and job impact (Thomas and Velthouse, 1990). Individuals are motivated only if the task itself brings a sense of self-determination and competence to the individual (Deci, 1975). PE theory states that employees' perceptions concerning work will affect their behavior (Spreitzer, 1995). Leaders with LPIF exhibit more positive attitudes and behaviors and give their employees more trust, attention, and empowerment (Junker and van Dick, 2014; Peng and Wang, 2015; Yang and Peng, 2015). This makes employees feel greater self-confidence and work meaning; consequently, as employees have the ability and belief of self-determination, they trust themselves to determine the process and results of own work behavior (Kong and Qian, 2015). Employees with high levels of PE have greater autonomy and influence over their work, feel less restricted than other employees, and tend to be more proactive and innovative (Amabile, 1988). PE can trigger EIB by improving self-efficacy, strengthening intrinsic motivation, and increasing autonomy (Laschinger and Shamian, 1994). Therefore, from the self-determination perspective, employees' basic autonomy needs in terms of autonomy, competence, and relatedness are satisfied; therefore, psychologically empowered employees obtain a higher level of intrinsic motivation (Ryan and Deci, 2000) and thus are more likely to propose new ideas and implement incremental innovation (Singh and Sarkar, 2012). Additionally, evidence shows that self-determined and impactful employees are more likely to test new ideas (Schermuly et al., 2013). Moreover, employees who believe in their competence are more creative (Zhou, 1998) and those with meaningful commitment to their tasks exhibit innovative behavior (Bass, 1985; Singh and Sarkar, 2012).

H3: Psychological empowerment plays a mediation role in the relationship between LPIF and EIB.

The Mediation Chain Effect of Leader–Member Exchange

As per self-determination theory (Deci and Ryan, 1985), employees will judge the quality of exchanges with leaders based on their own perceptions (Kong and Qian, 2015). When the LMX relationship level is high, employees become the focus of the leader's attention and gain a positive influence (Dansereau et al., 1995), and they perceive themselves as having high autonomy (Liden and Graen, 1980). High LMX indicates mutual respect, liking between the parties, and positive interaction with followers, which extend beyond the formal job description

(Nahrgang et al., 2009). Conversely, subordinates who perform only in accordance with the prescribed employment contract are characterized as "out-group," with limited reciprocal trust and support and few rewards from their supervisors (Deluga, 1998). Employees with low LMX encounter a diminished scope for PE (Aggarwal et al., 2020). Previous research has shown that the quality of the relationship between leaders and employees influences employees' perceived levels of PE (Harris et al., 2009; Hill et al., 2014). A high level of LMX helps improve the PE of employees (Aggarwal et al., 2020), and PE will further lead to various organizational consequences, such as EIB (Hill et al., 2014; Wang et al., 2016; Newman et al., 2017; Hu et al., 2018). Thus, the following hypothesis is proposed.

H4: Leader–member exchange and PE play a mediation chain role in the relationship between LPIF and EIB.

RESEARCH DESIGN AND METHODS

Research Model

An analysis of the existing literature, combined with research hypotheses, Build LPIF, LMX, PE, and EIB influence mechanism model (**Figure 1**).

Operational Definition and Measurement of Variables

A classical scale with high international reliability is used to measure variables in order to ensure the validity of the measurement. The scale used in this study has been widely used in the Chinese context and has high reliability and validity. A 5-point Likert scale was used for measurement, ranging from "completely inconsistent" to "completely consistent." Operational definitions and measurement scales of the main variables are as follows.

1. Leaders' positive implicit followership. Leaders were asked to rate what they expect from their employees by using a nine-item questionnaire developed by Sy (2010). The sample items consist of "industry, enthusiasm," etc.
2. Employees' innovative behavior. This study uses the EIB questionnaire for nine items developed by Janssen (2000). For example, "I often introduce new ideas into the work environment." Employees self-evaluate this scale.
3. Leader–member exchange. This study uses the LMX questionnaire for seven items developed by Graen and Uhl-Bien (1995). For example, "I get along well with my boss and can work efficiently together." Employees self-evaluate this scale.
4. Psychological empowerment. The PE perceptions of employees were measured through the 12-item scale developed by Spreitzer (1995). For example, "What I have done is very meaningful to me." Employees self-evaluate this scale.
5. To improve the accuracy of the analysis results, control variables include eight projects: leaders' gender, age, education level; employees' gender, age, education level, and income; time spent together by leaders and employees.

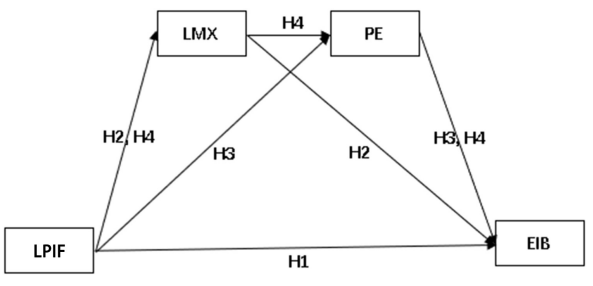

FIGURE 1 | Theoretical model. Note: LPIF, leaders' positive implicit followership; LMX, leader–member ex-change; PE, psychological empowerment; and EIB, employees' innovation behavior.

Sample Characteristics

In this study, the survey participants are 450 leaders and their corresponding employees from 45 large- and medium-sized enterprises in Shandong, Beijing, Hebei, Shanghai, Shanxi, Zhejiang, and other places. Before distributing the questionnaire, we contacted 45 managers or manager-level supervisors from the target company *via* telephone or the internet. These leaders examined their corresponding employees within the organization who could participate in this research. The ratio of leaders to employees is 1:1. The most significant feature of this study is that data were collected in two time waves through a time lag approach. At Time 1, we distributed LPIF questionnaires to leaders, and at Time 2 (i.e., 3 months later), we distributed EIB, LMX, and PE questionnaires to employees. We chose a 3-month interval when investigating the influence of LPIF to fully observe the impact of LPIF on outcome variables while reducing CMV (Podsakoff et al., 2003).

Of the 450 matched questionnaires distributed, 406 were collected after excluding invalid questionnaires. In total, 389 valid questionnaires for leader–employee matching were obtained, with a valid response rate of 86.4%. Regarding sample size adequacy, Bentler and Chou (1987) suggested that the appropriate sample size is about 5–10 times the number of items to perform structural equation modeling (SEM). The sample size used in this study (N = 389) was much larger than those calculated by the SEM software, and it fulfilled standards recommended by previous scholars (Bentler and Chou, 1987; Kock and Hadaya, 2016; Kyriazos, 2018). Therefore, the sample size of this study seemed adequate and justified to perform SEM for data analysis, fulfilling the minimum sample size requirement.

In the leadership sample, the proportion of male leaders was 70.4%, much higher than that of female leaders (29.6%). The age composition was 40–50 years (43.2%) and 30–40 years (28.5%). In terms of education level, leaders with a bachelor's degree accounted for the most significant proportion (58.6%). The largest proportion of time spent working together for leaders and employees was 1–3 years (37.6%).

In the employee sample, men accounted for a larger proportion (58.6%). Regarding age, the proportions of 20–30-year-olds (40.9%) and 30–40-year-olds (36.2%) were the highest,

totaling 77.1%. A bachelor's degree accounted for the highest proportion (58.4%) in terms of educational level. Regarding employee monthly salary, 54.2% of employees had a monthly salary of between 5,000 and 10,000 RMB.

Analysis Method

This study used SPSS 26.0 and AMOS 26.0 for empirical analysis. The structure model constructed by AMOS 26.0 was mainly used for confirmatory factor analysis of variables, analysis of convergence validity, and discriminative validity of measurement models.

SPSS 26.0 performs descriptive statistics, reliability analysis, correlation analysis between variables, and regression analysis to verify main effects. This study used SPSS's plug-in process macro program to analyze the intermediary and chain intermediary effects of the LMX relationship and PE.

EMPIRICAL ANALYSIS

Common Method Variance

We collected data from the respondents through the self-reported method; therefore, an issue of common method bias may exist (Podsakoff et al., 2003). To reduce common method variance, the current study adopted two methods. First, for questionnaires, the scale was paginated, and an appropriate rest time was provided between answering questions on each page. Thus, the resulting time difference reduced the influence of common method variance caused by the same continuity scale (Podsakoff et al., 2003; Aggarwal et al., 2020). Second, data were collected in two time waves through a time lag approach, with only the independent variable (LPIF) measured at Time 1. At Time 2, after a 3-month interval, mediator variables (LMX and PE) and dependent variables (EIB) were measured. Collecting data in this manner may reduce the impact of CMB (Atwater and Carmeli, 2009).

Then, we used two methods to check for CMV. First, we used Harman's single factor test for the common method bias test. The result of unrotated factor analysis shows that four factors with feature roots greater than 1 were extracted. The variance explanation rate of the first common factor is 33.26%, which is less than 40% proposed by Podsakoff et al. (2003). The judgment standard indicates that there is no apparent common method bias in this study's data. Second, we completed the correlation coefficient test of latent variables (**Table 2**). The absolute value of the correlation coefficient between latent variables is ≤0.672, far less than 0.9, indicating no significant common variance deviation in the research data (Podsakoff et al., 2003; Yang et al., 2022). The analysis indicates that CMV does not pose any risk or concerns for the results of this study.

Validity Test

To verify the validity and reliability of the questionnaire used, SPSS26.0 was used to conduct factor and reliability analyses. The measurement results show that the reliability of LPIF, EIB, LMX, and PE scales are 0.778, 0.825, 0.873, and 0.919, respectively, and the Kaiser-Meyer-Olkin values of each scale are 0.758, 0.790, 0.886, and 0.92, respectively. Bartlett's test is significant ($P < 0.000$), and the reliability and validity are above 0.7. All scales show good reliability and validity. Each question item corresponds to each corresponding factor, indicating the scale has high construct validity.

We use Amos26.0 to verify the convergent validity of variables. First, the factor loads of the four variables in the model corresponding to each topic are greater than 0.5, and the Average variance extracted (AVE) value of each variable is between 0.504 and 0.564. The Construct Reliability (CR) value is between 0.753 and 0.939 (**Table 2**), indicating good convergent validity. Second, we performed confirmatory factor analysis (**Table 1**). Compared with other factor models, the four-factor model has the best goodness of fit. Root mean square error of approximation is less than 0.05, X^2/df is less than 3, and Goodness-of-fit index and Comparative-fit index are greater than 0.8. All values are within the required range, indicating that the structural validity between variables is also at a good level.

Correlation Analysis

In **Table 2**, the correlation coefficient r value between the variables is mostly between 0.3 and 0.6, and the significance level is below 0.05. The highest correlation coefficient between the variables in this study is 0.672, which is lower than 0.7, indicating no multicollinearity among the variables. Next, we performed discriminant validity analysis. The square of the highest (LPIF and EIB) correlation coefficient between the variables is 0.452, lower than the lowest value of 0.504 (LPIF's AVE value) in the AVE values, verifying the discriminant validity of this research model. In this study, the correlation between the latent variables is significant, and subsequent empirical analysis can be conducted.

TABLE 1 | Confirmatory factor analysis results.

Model	x^2/df	RMR	GFI	RMSEA	CFI	PGFI
Four-factor model (LPIF, LMX, PE, EIB)	1.856	0.053	0.897	0.047	0.803	0.742
Three-factor model (LPIF + LMX, PE, EIB)	2.147	0.095	0.880	0.054	0.662	0.736
Three-factor model (LPIF + PE, LMX, EIB)	3.188	0.052	0.843	0.075	0.865	0.706
Two-factor model (LPIF + LMX + PE, EIB)	6.323	0.089	0.633	0.117	0.670	0.534
Single factor model (LPIF + LMX + PE + EIB)	6.304	0.089	0.632	0.117	0.669	0.535

LPIF, leaders' positive implicit followership; LMX, leader–member exchange; PE, psychological empowerment; and EIB, employees' innovation behavior.

TABLE 2 | Correlation analysis of variables and discriminant validity analysis.

	Mean	SE	1	2	3	4	AVE	CR
1. LPIF	3.50	0.63					0.504	0.753
2. LMX	3.51	0.67	0.474**				0.543	0.892
3. PE	3.53	0.71	0.498**	0.370**			0.541	0.939
4. EIB	3.57	0.65	0.672**	0.533**	0.587**		0.564	0.912

*LPIF, leaders' positive implicit followership; LMX, leader–member exchange; PE, psychological empowerment; and EIB, employees' innovation behavior. **P < 0.01.*

Hypothesis Testing

Testing of the Main Effect

The F value in **Table 3** is significant, indicating that the variable is suitable for regression analysis. The standardized regression coefficient of LPIF and EIB is $\beta = 0.658$, and the significance is $P < 0.001$. Therefore, LPIF has a significant positive effect on EIB, thus supporting Hypothesis 1. The Variance Inflation Factor values of Models 1 and 2 are less than 3. The Durbin-Watson value is significant at the 0.05 level, indicating that the model analysis results are acceptable.

Testing of the Mediation Effect

Following Hayes et al. (2011), Hayes (2013), and Chen et al. (2013), we used the SPSS plug-in process macro program to test whether the mediation effect of LMX and PE between LPIF and EIB are significant as well as examine the chain mediation effect of the LMX and PE. This method has been verified in many studies (Liu et al., 2019; Shang et al., 2021; Yang et al., 2022). We set bootstrap sampling at 5,000 and chose bias correction to calculate total, total direct, and total effects. If the 95% CI of the standardized path coefficient does not contain 0, it indicates a significant mediation effect. The results are shown in **Table 4**. The total effect is 0.610, at a 95% significance level; the bootstrap confidence interval is [0.535, 0.686], and the total direct effect value is 0.370. At a 95% significance level, the bootstrap confidence interval is [0.293, 0.448]. The total indirect effect value is 0.240, at a 95% significance level, and the bootstrap confidence interval is [0.185, 0.300]. None of the confidence intervals of the aforementioned effect values contain 0, indicating that the overall mediation effect is significant.

Specifically, on the "LPIF→LMX→EIB" mediation path, at a 95% significance level, the indirect effect value is 0.115. The confidence interval is [0.075, 0.159], excluding 0. This indicates that the mediation effect is significant, thus supporting Hypothesis 2.

On the "LPIF→PE→EIB" mediation path, at a 95% significance level, the indirect effect value is 0.100. The confidence interval is [0.068, 0.139], excluding 0, indicating that the mediation effect is significant, thus supporting Hypothesis 3.

For the chain mediation path, "LPIF→LMX→PE→ EIB," at a 95% significance level, the indirect effect value is 0.024. The confidence interval is [0.011, 0.041], excluding 0, indicating LMX and PE play a chain mediation role in the relationship between LPIF and EIB. As such, research Hypothesis 4 is supported.

TABLE 3 | Main effects test.

		EIB	
		M1	**M2**
Leaders'	Gender	0.149**	0.015
	Age	0.153**	0.004
	Education level	0.205***	0.038
Employees'	Gender	0.007	0.044
	Age	0.038	−0.023
	Education level	0.207***	0.151***
	Income	0.053	0.047
	Working time with leaders	−0.087	−0.051
LPIF			0.658***
R^2		0.145	0.487
Adjusted R^2		0.127	0.475
F		8.050***	39.963***

*LPIF, leaders' positive implicit followership; and EIB(, employees' innovation behavior. **P < 0.01; ***P < 0.001.*

TABLE 4 | Bootstrap analysis of significance test of mediation effect.

Type	Effect value	Relative effect value	Bootstrap SE	Bootstrap CI	
				Lower	Upper
Total effect	0.610		0.038	0.535	0.686
Direct effect	0.370		0.039	0.293	0.448
Indirect effect (Total)	0.240		0.029	0.185	0.300
1.LPIF→LMX→EIB	0.115	47.9%	0.022	0.075	0.159
2.LPIF→PE→EIB	0.100	41.7%	0.018	0.068	0.139
3.LPIF→LMX→PE→EIB	0.024	10.0%	0.007	0.011	0.041

LPIF, leaders' positive implicit followership; LMX, leader–member exchange; PE, psychological empowerment; and EIB, employees' innovation behavior.

SUMMARY, IMPLICATIONS, AND DISCUSSION

Summary

The study participants included 389 leaders and their matching employees from 45 large- and medium-sized enterprises in China. Through empirical analysis, we verified the influencing mechanism of leaders' implicit following and EIB, summarized as follows.

First, LPIF has a positive (+) effect on EIB. When a leader has high positive expectations for the characteristics of employees, it will promote the generation of EIB, and it is difficult to promote EIB when leaders have low LPIF of employees. This finding is consistent with that of Kong and Qian (2015).

Second, the LMX relationship plays a mediation role between LPIF and EIB. Leaders' positive expectations for employee characteristics will lead to more care and trust in employees (Sy, 2010). Leaders regard employees who meet their expectations as "insiders" who are willing to establish positive emotional connections with their leaders (Duong, 2011; Whiteley et al., 2012). Such insiders will be willing to take more out-of-role behaviors to repay the leader's care and trust (Hoption et al., 2015). When employees feel a better exchange relationship with the leader, they will improve their innovative behavior to promote corporate innovation. Conversely, leaders view employees who are dissatisfied with their LPIF as outsiders, because their leaders give fewer benefits to outsiders, communicate less, and trust outsiders less (Schneider, 1987). This is not conducive to the generation of EIB.

Third, PE plays a mediation role between LPIF and EIB. Leaders' positive expectations can improve employees' PE, thereby enhancing EIB. In other words, the process of implicit followership will affect employees' PE, which in turn affects employees' interpretation of LPIF. This causes employees to have different feelings about leadership, thus leading to varying outcomes. Leaders with high LPIF will give employees more

care, love, trust, and empowerment (Sy, 2010), thus making employees feel greater self-determination, self-confidence, work meaning, and self-efficacy, which in turn promotes the generation of employee EIBs (Kong and Qian, 2015).

Fourth, LMX and PE play a chain mediation role in the relationship between LPIF and EIB. Leaders' positive expectations of employee characteristics promote high-quality exchange relationships between leaders and employees. Meanwhile, employees with high LMX perform better in the organization, have a stronger perception of the work environment and a positive attitude to accept work challenges, and demonstrate innovative spirit (Aggarwal et al., 2020). When employees feel highly empowered in terms of meaning in the workplace, they feel more confident in their abilities and strive to achieve high levels of self-actualization (Gerstner and Day, 1997; Gomez and Rosen, 2001). In a high-quality LMX relationship, there is generally a sense of mutual trust and respect between the leader and members (Aggarwal et al., 2020). In return, leaders enhance their empowering working conditions, such as providing scarce resources and flexibility in decision-making. Previous research suggests that employees with a good relationship with their leaders perform better than those with a poor relationship; employees also have a strong ability to adapt to change (Liden et al., 2000; Chen and Klimoski, 2003; Carson and King, 2005).

Implications

First, this study enriches IFTs. LPIF provides a more in-depth analysis of the leadership process regarding how leaders and employees perceive, decide, and act. This concept broadens the application of IFTs in management.

Second, this study leads through the research on LPIF in EIB and reveals the internal connection between the two factors. Furthermore, it focuses on the role of LMX and employee PE in this process, providing a clue that human resource management should pay attention to employees' feelings toward leadership.

Research on the mediation effect of LMX shows that in the context of Chinese enterprise management, employees value exchange with leaders in social exchange relationships: whether the relationship with leaders is good is directly related to employees' attitudes and behaviors, which affects employees' psychological feelings and career development. Further, performance differences among employees stem largely from leaders' perceptions of employees and subsequent interactions (Collinson, 2006); thus, there is a need to strengthen LPIF research.

This study has particular significance to business management practice. First, because LPIF and EIB are significantly positively correlated, employee innovation is essential for organizations to obtain sustainable competitive advantages in a dynamic and changeable market environment. To further promote EIB, organizations can preferentially select leaders who have positive expectations of employees, that is high implicit followership. When developing leaders in lower-level business organizations, stakeholders must focus on developing their knowledge of employees' positive perceptions.

Second, based on social exchange theory, LPIF influences the behavior of employees through social exchange relationships (Kong and Qian, 2015). The relationship between employees and their leader plays a vital role in the leader's perception of employees and their behaviors. The current study findings can help managers reduce negative emotions among employees and enhance positive emotions related to work and organization. As the spokesperson of the organization, the leader should pay attention to the contribution and happiness of the employees in influencing behavior and provide opportunities for employees to participate in the communication process with the leader, formulate policies, and make contributions. Such actions will improve employee performance by establishing high-level exchange relationships.

Third, employees who conform to LPIF are "insiders" who leaders like. For employees, after becoming "insiders," they will engage in work that is valuable to the achievement of organizational goals and enhance their sense of belonging and identity (Eisenberger et al., 1990). Moreover, they will thus have better performance at work (Eisenberger et al., 1986). The role of LPIF in Chinese enterprise management is affected by employee PE level; hence, organizations should emphasize how employees feel about their leaders.

DISCUSSION

Although the current study provides valuable information pertaining to the variables under consideration, there are still some limitations, which need to be considered while generalizing the study results. (1) All variables in this study were obtained through self-assessment methods; therefore, there might be an issue of CMB. To handle this limitation, we collected the data in two phases. At the first point, we collected data for the independent variables, and at the second point, we collected the data for the mediator and dependent variables. Besides this, CMB is not a major concern in studies that use well-designed multifactor statements (Spector, 1987). Although researchers have tried their best to minimize the effect of CMB, each remedy has its own disadvantages (Podsakoff et al., 2003). To better test the proposed hypotheses and improve the reliability of the study results, follow-up research can consider a combination of self-evaluation and other evaluation methods. (2) Future studies needs a more comprehensive perspective; specifically, we should focus on investigating leadership, employees, context, hierarchy, and their dynamic interactions. Future studies can examine the impact of LPIF on employee behavior from the perspective of implicit followership matching and cognitive differences. (3) It is necessary to study different groups of people—for example, knowledge-based employees, new generation employees, etc.—to explore how different types of employees form their followers, how to affect their interaction with leaders, and how they achieve their performance. Future research will be crucial to promote the development of leadership research.

Based on the foundation of previous studies, this study builds a chain mediation model, focusing on how LPIF affects EIB. It offers a new perspective for scholars to examine the psychological mechanisms of EIB. Further, it provides an important method for understanding the process of leadership and followers in organizations. Additionally, this study has a certain guiding effect on employee selection and training. A crucial innovation of

this study is that it ensured the rigor of the research design by adopting the following approaches: (1) the leader–employee 1:1 matching questionnaire and (2) longitudinal research design, which helped avoid common method deviations as much as possible. Therefore, the present study's results are accurate and reliable, which can be further generalized to a large extent.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

AUTHOR CONTRIBUTIONS

WL: conceptualization, methodology, writing—original draft. CL: writing—review and editing. YY: resources. TL and PL: software. All authors approved it for publication.

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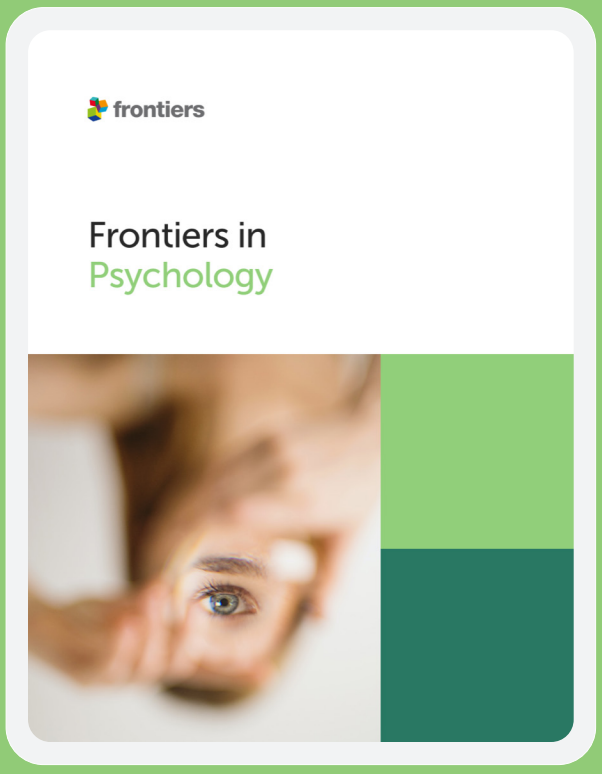

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