

Beyond Bounded Rationality: CEO Reflective Capacity and Firm Sustainability Performance

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ABSTRACT Optimal or rational decision making is not possible due to informational constraints and limits in computation capability of humans (March & Simon, 1958; March, 1978). This bounded rationality serves as a filtering process in decision making among business executives (Hambrick & Mason, 1984). In this study, we propose the concept of CEO reflective capacity as a behavior-oriented cognitive capability that may overcome to some extent the pervasive limitation of bounded rationality in executive decision-making. Following Hinkin's (1998) method and two executive samples, we developed and validated a three-dimensional measure of CEO reflective capacity. Based on two-wave surveys of CEOs and their executive-subordinates in 213 Chinese small-medium sized firms, we tested and confirmed three hypotheses on how CEO reflective capacity is related to a firm's sustainability performance (including economic, societal, and environmental dimensions) through the mediating mechanisms of strategic decision comprehensiveness and CEO behavioral complexity. We discuss the contribution of this study to the literature on the upper echelons and information processing perspectives. We also identify the implications for future research on strategic leadership and managerial cognition in complex and dynamic contexts.

KEYWORDS bounded rationality, CEO reflective capacity, firm sustainability performance, managerial cognition, upper echelons theory


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The founding entrepreneur can easily kidnap the corporation by becoming its 'ceiling', due to his genes and personality. Hence, the founding entrepreneur should reflect often on his systematic deficiencies, to rediscover, refresh and change him/herself, and to lift the height of his/her personal 'ceiling'.^[1]

(企业容易被创始人的基因和他的性格“绑架”，创始人会成为“天花板”。所以创始人应该经常反思是否有一些系统性的缺失，要重新发掘自己，改变自己，让自己的“天花板”再高一些。)

Chaoyang (Charles) Zhang, Founder, Chairman, and current CEO of
Sohu Inc.

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INTRODUCTION

It has been well-accepted that human decision-making is constrained by bounded rationality (March, 1978; March & Simon, 1958; Simon, 1957). This constraint is due to the impossibility of exhaustive information search, and the inability to process or compute the likelihood of outcomes associated with all possible choices. March (1978) identified many other forms of limitation to rational decision making beyond informational and computational constraint. Preferences, experiences, self-interest, structural context, dynamic change, and paradoxes are just a few forms of bounded rationality that may reduce the optimality of decision process and choice. Even Chief Executive Officers (CEOs) with their vast amount of experience and high level of intelligence are not immune from the narrowing field of vision as described in the upper echelons theory (Hambrick & Mason, 1984). However, like any other personal attribute, there is certainly variance in the extent to which CEOs are constrained by bounded rationality (Gavetti & Levinthal, 2000; Hambrick & Brandon, 1988). Some CEOs may have stronger computational capability or may be more inclined to seek a variety of information to reflect and extend their cognitive boundary, while others show a disinterest in learning and an inability to accept any information that does not match their a priori bias. How do CEOs reflect on their systematic deficiencies in order to lift the height of their personal ceiling? The modest goal of the current study is to introduce a personal attribute that may enable some CEOs to overcome the limit of bounded rationality in their information acquisition and processing activities.

This expanded information search and processing ability was observed in a study of thirteen highly successful Chinese CEOs (Tsui, Zhang, & Chen, 2017). These authors use the term *reflective thinking* to refer to the stepping-back thinking process for making major strategic decisions, based on expansive information gathering, processing, and using. Their preliminary evidence suggests that CEO reflective thinking drives the CEO's simultaneous attention to current operating needs, long-term development opportunities, as well as the relationship between the firm and the needs of society. Tsui et al. (2017) called for further research to develop the concept and build a framework linking CEO reflective thinking to important organizational outcomes such as sustainability performance.

Existing research on the upper echelons theory and managerial cognition suggests that cognition and information processing by the CEO and their executives play a key role in strategic decision-making (i.e., formulation, implementation, learning, and change) and related outcomes (for reviews, see Bromiley & Rau, 2016; Narayanan, Zane, & Kemmerer, 2011). These studies tend to treat CEO cognition as an underlying unobserved mechanism (Liu, Fisher, & Chen, 2018). Furthermore, conceptualizations of CEO cognition remain fragmented (Eggers & Kaplan, 2013). The extant research mainly focuses on the unobservable mental structures (i.e., attention, perception, reasoning), and ignores the mental

activities or process (Helfat & Peteraf, 2015). Thus, the preceding literature narrows the central role that CEO cognition plays in the firm's decision-making process and capability development. Further, mental structures and mental activities are intertwined (Gavetti & Levinthal, 2000; Helfat & Peteraf, 2015; Huff, Huff, & Barr, 2000). The mental activities are manifestation of their mental states such as value and perception, while mental structures are generated, retrieved, and modified in carrying out mental activities. We go beyond mental activities (which are still cognitive in nature) by including associated behaviors or actions such as acquiring information from different sources and avenues. We use the term *reflective capacity* to capture CEO cognitive capability and actual behaviors involved in information searching and processing. 'Reflective' is emphasized as it is the reflection of the firm's past experience, current challenges, and future potential that motivates the CEO to engage in expansive search for information that may be potentially useful for strategic decision making.

The concept of reflective capacity provides a behavioral view of CEO cognitive capability, drawing together different pieces of cognitive content, structure, and style (Finkelstein, Hambrick, & Cannella, 2009: 70). Moreover, by combining the underlying mental structure with outward actions, we suggest that reflective capacity can be learned and improved through practice. Furthermore, we propose that reflective capacity leads to a broadening of vision by weakening the filtering process associated with bounded rationality (Hambrick & Mason, 1984: 195). It offers the potential to overcome the informational and computational limitation as a usual characteristic of most CEOs.

By considering the possibility of pushing or expanding the boundary of rationality, we can understand how the CEO's reflective capacity may have implications for firm sustainability performance. Sustainability performance refers to a firm's ability to achieve environmental, social, and economic standards (Kocmanová & Šimberová, 2014). Sustainability that simultaneously benefits all stakeholders in the long run, rather than the short-term-focused financial indices, is gaining attention in both industry and academia. The Business Roundtable, a network of CEOs in the United States, issued a statement on August 19, 2019,^[2] signed by almost 200 CEOs, committing to focusing on increasing the wealth for all people and meeting the needs of all stakeholders, and not just shareholders. Scholars have argued that confronting the tensions between complex economic, environmental, and social issues requires complex cognitive frames of the executives (Hahn, Preuss, Pinkse, & Figge, 2014). Reflective capacity may be a valuable and difficult to imitate micro-foundation that plays a key role in a company's attention to sustainability performance.

Furthermore, to reach a better understanding of how CEO reflective capacity may relate to a firm's sustainability performance, this study explores the mediating mechanisms. Due to the expansive information-processing activities involved in reflective capacity, we propose strategic decision comprehensiveness and CEO behavioral complexity as two mediators, drawing on the upper echelons framework.

Herein, we develop a conceptual model of CEO reflective capacity by first defining the core construct and explaining how it relates to the firms' sustainability performance through the mediating mechanisms. Then we develop and validate a measure of reflective capacity using two executive samples. We test three hypotheses using a sample of CEOs and their subordinate-executives in the 213 small-and-medium-sized firms in China.

A CONCEPTUAL MODEL OF CEO REFLECTIVE CAPACITY

Definition of Reflective Capacity

'Reflection' is a well-developed concept in psychology, which refers to careful consideration and examination of issues related to experiences and extracting meaning from these experiences (Dewey, 1938; Kolb, 1984). In management studies, beyond the mental process, reflection is a critical link between the concrete experience, the interpretation and taking new action, as well as a means to enable and facilitate learning (Hilden & Tikkamäki, 2013; Seibert & Daudelin, 1999). Specifically, reflection means bringing personal experience or outside events inside the mind and making connections to the decision-making process by articulating problems, developing possibilities, formulating theories to explain the situations, and deciding the actions (Daudelin, 1996). Despite recognition of the significance of reflection in the process of managerial functioning, there is still minimal theory dealing with this cognitive activity that happens as managers seek to respond to new and stretching experiences (Seibert & Daudelin, 1999). Tsui et al. (2017) considered it as a fundamental attribute of successful entrepreneurs and proposed the term 'reflective thinking', referring to the critical and stepping-back thinking process of analyzing and making a judgment about what has happened and what has been learned, also looking into the future of what might be possible. Most importantly, this thinking is based on extensive information that the CEO gathers from multiple sources, especially externally. Since what Tsui et al. (2017) have described goes beyond 'thinking', but includes both behaviors (information gathering and processing activities) and cognition (mental activities of thinking and reasoning), we use the term '*reflective capacity*' as a higher-order concept. We define it as a cognitive capability to increase awareness of the firm's current and future opportunities by collecting, analyzing, making sense, integrating, and applying diverse information obtained from diverse sources. By this definition, CEO reflective capacity emphasizes both internal mental structure and external behavioral manifestations (Huff et al., 2000). Diverse information searching and processing behaviors are driven by the deep-level mental reflection (Daudelin, 1996). Meanwhile, the stepping-back and careful thinking process of reflection can be enhanced by the practices of deliberately viewing things from different perspectives stimulated by new, diverse, and potentially paradoxical information (Kolb & Kolb, 2009).

We emphasize that CEO reflective capacity is *not* a self-focused concept about self-awareness or self-consciousness. It is the CEO's reflection on the *outside world*, especially those across organizational boundaries: what information they deem helpful to their firms, where to get the information, how to analyze the information, what they learn from the information, and how to apply or integrate their newfound knowledge in making strategic decisions for the company. Reflective capacity encompasses more than just 'looking back' to persistently ponder its meaning, but also internal dialogues involving moments of inquiry and interpretation during a developmental activity (Seibert & Daudelin, 1999). What's more, reflective capacity is not a predisposition but can be learned by practice. It is a purposeful process of learning to learn for continuous improvement. As Schumpeter (1950) suggests, economic agents can manage – challenge, stretch, and change – cognitive structures and act on them, which makes discovering and pursuing cognitively distant opportunities possible. Thus, we assume that CEOs with a high level of reflective capacity derives the connections between time, space, and relationships. Specifically, they simultaneously address the short-term needs of the organization while strengthening the organization's competence for long-term development. These reflective CEOs may cross the border of their own firms or industry to explore an innovative path. Further, they intend to take the interests of all stakeholders into consideration and strive to satisfy them even if not simultaneously. In this way, reflective CEOs should be more attentive to the firms' sustainability performance.

Conceptual Structure of CEO Reflective Capacity

From the preliminary ideas of reflection in management research (Daudelin, 1996; Kolb, 1984; Tsui et al., 2017), and based on the factors in human information processing (Schneider & Shiffrin, 1977; Shiffrin & Schneider, 1977), we derive three sequential yet mutually interconnected dimensions of reflective capacity: (1) search of diverse information sources, (2) attention to diverse information contents, and (3) efforts on learning and integration for strategic decision-making. An underlying assumption is that reflective capacity is higher with greater diversity in information sources, content, and integration.

Diverse information sources mean that the CEOs use a variety of sources to search for information inside and especially outside the firm. Diversified information scanning for all possibilities provides a firm *basis* of evidence and rationality to establish beliefs and make unbiased decisions (Daudelin, 1996; Dewey, 1938). According to the paths of knowledge acquisition (Anderson, 1982), the information sources include not only the usual ways (i.e., executive meetings, working emails, routine reports), but also the additional sources that fall between formal and informal approaches, such as the internet, industry activities, business visits, professional seminars, and executive development programs.

Diverse information content refers to making sense of differentiated information, mainly from beyond the organizational border, both in depth and in breadth. This dimension focuses on both positive and negative information, as well as both the long-term and short-term issues of their own companies, other companies, the industry, and even the trend of the whole world. CEOs with extended knowledge will improve the *effectiveness* of information processing, which may further contribute to rational decisions.

Learning and integration imply that the CEO synthesizes the interconnected information, disaggregates the multi-perspectives, and integrates new information into an adaptive framework in the decision-making process. It is a process through which loosely connected information transforms into a systematic structure, functioning as the *key* to cognitive capability. The CEO's mode of thinking, feeling, and acting may shift thereafter. CEOs' learning and integration will facilitate strategic upgrading and stakeholder relationship balancing (Hitt & Tyler, 1991; Wong, Ormiston, & Tetlock, 2011).

The Perspective Broadening Role of Reflective Capacity

We argue that CEO reflective capacity could be a means to weaken the limitation of bounded rationality. Commonly recognized, bounded rationality is composed of three interrelated dimensions – processing capacity, cognitive economizing, and cognitive biases (Foss & Weber, 2016; Simon, 1997), manifesting in habit formation, experiential learning, and routinized action (Gavetti, 2012) and leading to limited attention. CEO reflective capacity may provide a feasible scheme to overcome the three aspects progressively. Specifically, instead of local searches from trial and error and the consequently inattentive blindness (Cyert & March, 1963), CEOs with a high level of reflective capacity can broaden their knowledge reservoir by scanning and processing a wide range of information. With a comprehensive understanding of the company's current situation and the developmental logics, CEOs with a high level of reflective capacity are likely to forgo heuristics and adopt a systematic analyzing process. In this way, the unconscious biases and attribution error can be mitigated to some extent.

What is more, CEO reflective capacity facilitates transforming the three-stage information filtering process (Hambrick & Mason, 1984: 195) from a narrowing to a broadening vision. The CEOs with a high level of reflective capacity have the potential to broaden their vision by paying attention to more diverse information sources and contents, as well as integrating and disaggregating information into a new framework of problem-solving. Meanwhile, although the three elements of reflective capacity correspond to the three filtering stages, they take a step further. Normally, the CEO's information sources reflect the idea of a 'limited field of vision'; but reflectively capable CEOs attempt to bypass the restrictions of limited vision by expanding their range of information and increasing the multiplicity of information. While most CEOs tend to have 'selective perception' when

making decisions about what content to focus on, high reflective capacity CEOs commit themselves to seeking a comprehensive set of information, identifying many possible courses of action, and critically evaluating them. Learning and integration correspond to ‘interpretation’, but it is more than ‘interpretation’ as reflectively capable CEOs understand, explain, extrapolate, and learn from the information simultaneously. In this way, the reflective capacity concept helps to unpack the black box of the perceptual process as well as converting a filtering vision to a broadening one.

We further suggest that the three elements of CEO reflective capacity are sequential but interwoven. Specifically, CEOs adjust their focus in seeking relevant information and paying attention according to the emergent framework in the reflecting process (Kolb, 1984). Also, the information sources can be easily influenced by the attentive content, as different sources may contain different types of information. Figure 1 is a graphical representation of the conceptual model of vision broadening process due to CEO reflective capacity, in contrast to the cognitive filtering process and the corresponding narrowing field of vision in Hambrick and Mason’s (1984) original framework.

Differentiation from Conceptually Related Constructs

We propose reflective capacity as a new construct, but it certainly has some conceptual overlap with other theoretical concepts such as self-reflection, cognitive complexity, or holistic thinking. These concepts provide insights for reflective capacity, but they are distinct in nature. Table 1 summarizes the distinctions and similarities between CEO reflective capacity and ten related constructs. We discuss below five key concepts that appear to have the most important conceptual overlap with reflective capacity to highlight their distinction.

Self-reflection. Self-reflection, a well-developed concept in psychology, refers to the attention, inquiry, inspection and evaluation of one’s own thoughts, feelings, and behaviors, with the goal of understanding the self and purposefully reasoning and learning from a person’s experiences (Grant, 2001). Both reflective capacity and self-reflection contain a thinking process with the purpose of interpreting and learning. The differences are twofold. The first is the object of reflection. With reflective capacity, CEOs reflect mainly on the organization and the outside world, while self-reflection is on a person’s own experiences. The second is the function of reflection. Reflective capacity is to collect and integrate the multifaceted information to facilitate strategic decision-making, while self-reflection is to better understand the self and thus affect psychological well-being.

Reflection or reflexion. Reflective capacity and the two thinking modes, reflection and reflexion (Lieberman, Gaunt, Gilber, & Trope, 2002), are different in nature. Reflective capacity is a higher-order cognitive capability to recognize and integrate

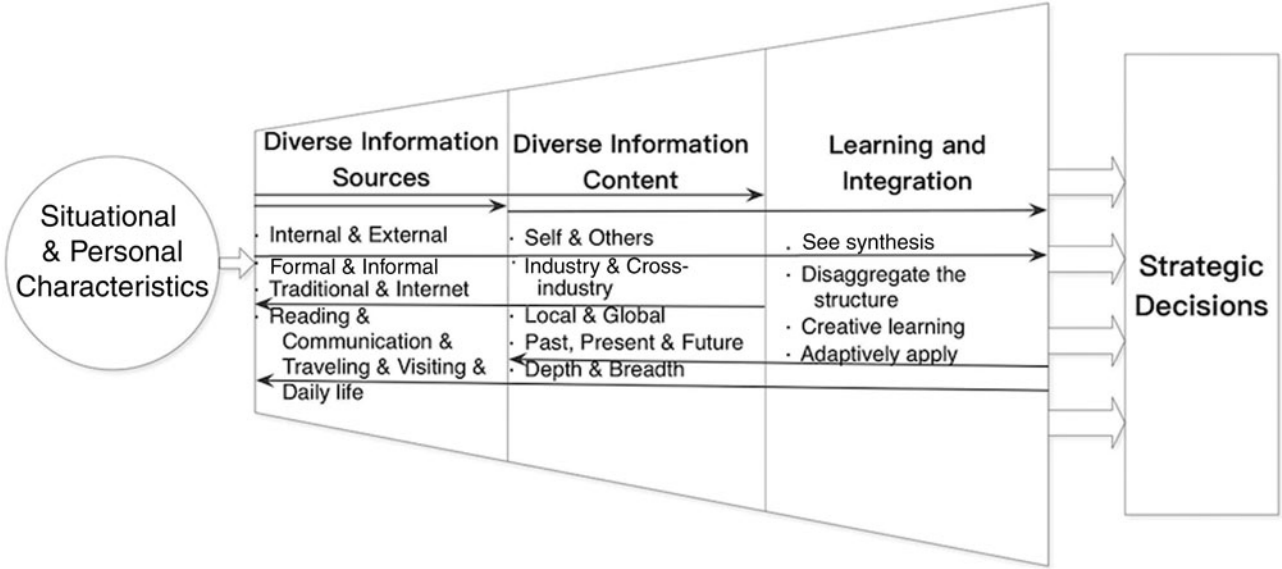


Figure 1. The conceptual model of CEO reflective capacity: Beyond bounded rationality

Table 1. Similarities and differences between CEO reflective capacity and related constructs

<i>Constructs</i>	<i>Definitions</i>	<i>Similarities</i>	<i>Differences</i>
CEO Reflective Capacity (RC)	The behavior of collecting, analyzing and the cognition in making sense, in deriving implications of and the learning from the diverse information gathered from diverse sources.		
1. Self-reflection (Grant, 2001)	The attention, inquiry, inspection and evaluation of one’s own thoughts, feelings, behaviors and insights.	Both include step-back thinking with the purposes of understanding and learning.	RC is for firm strategic decision-making; Self-reflection is for understanding the self.
2. Reflection and reflexion (as two thinking modes) (Lieberman et al., 2002)	Reflection, relative to reflexion, is deliberately conscious, effortful, employing rule-based inferences, and is assumed to consume cognitive resources.	Reflective capacity includes both reflection and reflexion; activates more reflection than the normal state.	They are different in nature. RC is a behavioral cognitive capability, while reflection is a thinking mode.
3. Cognitive complexity (Bieri, 1961; Zyung, 2017)	The differentiation of information and the linkage or integration in each cognitive domain.	Diversification in information processing and integrating.	Cognitive complexity is a primarily cognitive structure; RC focuses on both mental structure and behavioral activities.
4. Cognitive flexibility (Scott, 1962)	The readiness to match the type of cognitive processing with the type of problems.	Both value diversity.	Cognitive flexibility emphasizes cognitive adaptability in complex environment; RC focuses on information acquisition and processing behaviors.
5. Holistic thinking (Choi et al., 2007)	Involving an orientation to the context or field as a whole.	Highly reflective individuals are holistic thinkers, but not the reverse.	Holistic thinking is attentive only to the whole picture; RC pay attention to both details and the whole.
6. Dialectical thinking (Peng & Nisbett, 1999)	Consists of sophisticated approaches toward seeming contradictions and inconsistencies, such as Yin Yang in ancient Chinese philosophy.	Both have holistic and dynamic tenets of diverse elements in unity.	Dialectic thinking emphasizes two opposite yet interdependent elements to mutually affirm and negate; RC includes a more comprehensive set of elements.

Table 1. Continued

<i>Constructs</i>	<i>Definitions</i>	<i>Similarities</i>	<i>Differences</i>
7. Attention (Ocasio, 1997).	The noticing, encoding, interpreting, and focusing of time and effort on issues and answers.	RC is based on diversified and comprehensive attention.	The focus of Attention can be an individual, team or organization; The focus of RC is the firm.
8. Absorptive capacity (Cohen & Levinthal, 1990)	The ability of a firm to recognize the value of new, external information, assimilate and apply it to its innovative capabilities.	Both refer to the ability to identify and assimilate information from the external environment.	Absorptive capacity represents an important part of a firm's innovation ability to create new knowledge; RC is a CEO's cognition and behavior for better strategic decision making.
9. Learning goal orientation (VandeWalle, 1997)	Seeking to develop competence by acquiring new skills and mastering new situations.	Both are curious and ambitious in learning.	Learning goal orientation is an individual disposition; for RC, learning is a result of information processing.
10. Sense-making (Thomas et al., 1993)	Develop a vision or mental model to understand, interpret, and make sense of how the environment and the firm work.	Both have parallels in information searching and interpreting.	RC emphasizes information diversity and integrative learning; Sense-making is mainly about search and interpretation of the environment.

diverse information, while the thinking modes of reflection or reflexion are physiological neuro-mechanism (controlled and logical reflection mode vs. automatic and affective reflexion mode) (Lieberman et al., 2002). CEO reflective capacity involves both thinking modes, since both are continuously active when a CEO's information processing system detects, searches, pays attention, and perceptually learns. Although reflexion mode determines our thoughts most of the time, if the CEO has a high reflective capacity, he/she frequently activates reflection mode in logically reasoning, planning, and hypothetical thinking, which facilitates a clear sense of the environment. Reflexion facilitates reflective capacity through associative links and motivational orientations that may identify and respond to opportunities and threats more effectively (Healey, Vuori, & Hodgkinson, 2015; Hodgkinson & Healey, 2011). In general, the reflection and reflexion of a CEO who has high reflective capacity are more vibrant than the average level. However, individuals high in reflection or reflexion may not be high on reflective capacity as defined herein.

Cognitive complexity. Cognitive complexity represents both the differentiation of information (number of distinct elements or dimensions) in a particular cognitive domain (i.e., self or other knowledge), and the linkage or integration which denotes the degree of coherence, or interrelatedness in each cognitive domain (Bieri, 1961; Calori, Johnson, & Sarnin, 1994). Both cognitive complexity and reflective capacity involve information processing and integration of diverse information. They have a major difference. Cognitive complexity is a cognitive structure (Calori et al., 1994) that can respond to complex information input without active solicitation of such information. Reflective capacity focuses on both mental structure and behavioral activities that actively seek out diverse information from diverse sources.

Cognitive flexibility. Cognitive flexibility is highly similar to cognitive complexity. It is defined as the readiness to match the type of cognitive processing with the type of problem in response to appropriate environmental stimuli (Laureiro-Martínez & Brusoni, 2018; Scott, 1962). Their conceptual overlap is in valuing diversity and unifying differentiated information. However, reflective capacity includes the active acquisition behaviors of diverse information, while cognitive flexibility maybe understood as 'a matrix of minds' to embrace the multifaceted situations in the environment. In cognitive flexibility, the environment is given, while in reflective capacity, the environment is a construction of the information attained through active searching.

Holistic thinking. Holistic thinking is defined as 'involving an orientation to the context or field as a whole' (Nisbett, Peng, Choi, & Norenzayan, 2001: 293). Holistic thinking enables individual to view elements in the universe as continuous, interconnected, and interpenetrated (Choi, Koo, & Choi, 2007), rather

than independent and dispersed. The CEO with high reflective capacity is more than a holistic thinker. Holistic approaches rely on experience-based knowledge rather than on abstract logic (Nisbett et al., 2001), while reflective CEOs are adept in activating their logical and reasoning system. Moreover, highly reflective CEOs not only attend to the whole picture, they also draw information and insight from the details- and are able to see paradoxes which may depart from holism.

HYPOTHESES

Hypotheses on CEO Reflective Capacity and Firm Sustainability Performance

Sustainability is about meeting ‘the needs of the enterprise and its stakeholders today while protecting, sustaining and enhancing the human and natural resources that will be needed in the future’ (International Institute for Sustainable Development, 1992). For organizations, sustainability requires executives to simultaneously address widely diverging but interconnected concerns for the natural environment, social welfare, and economic prosperity (Elkington, 1998; Hahn et al., 2014). Prior studies have referred to the company’s corporate social responsibilities, environmental performance, social equity, and eco-efficiency as representations of sustainability, and have confirmed that they are determined by legislation, ethical motives, and stakeholder pressure (Bansal & Roth, 2000; Sharma, 2000). Bansal and Roth (2000) pointed out that personal values of organizational members, especially the top management team and other powerful members, could influence the company’s strategic choices related to sustainable development. Hahn et al. (2014) suggested that firm’s attention to sustainability called for complex cognitive frames of the key decision-maker, i.e., the CEO. These studies inspire our exploration of how CEO reflective capacity may influence a firm’s sustainability performance.

To achieve sustainability performance, CEOs need to address multiple desirable but sometimes conflicting economic, environmental, and social outcomes at the firm and societal levels that operate in different time frames and follow different logics (Bansal & Roth, 2000; Hahn et al., 2014). These challenges require CEOs to sense, seize, and reconfigure multiplex opportunities in the external environment, through the mental activities and associated behaviors involved in searching, organizing, and processing diverse information, i.e., to have a high level of reflective capacity. These CEOs are more likely to have a greater awareness of the needs and expectations of different stakeholders and have greater exposure to practices, through their diverse information search that are useful in addressing different stakeholder situations. Hence, we argue that CEO reflective capacity may be a valuable and difficult to imitate capability that enables the CEO to embrace sustainability issues.

Intangible elements of the firm, such as know-how and management abilities, are recognized to be valuable to sustainability issues (Russo & Fouts, 1997). CEO reflective capacity allows the firm to ‘exploit opportunities or neutralize threats’ (Barney, 1991: 106) through scrutinizing almost every aspect of a variety of information and evaluating them to generate alternative strategies. Based on comprehensive analysis and reframing, highly reflective CEOs can integrate the contradictory demands of the external environment and society as well as that of the proximal stakeholders. The information broadening process of CEO reflective capacity drives sustainability step-by-step. Diverse information sources provide the CEO with extensive knowledge. By interpreting potential and existing demands, the CEO can design a feasible plan for all stakeholders. In integrating and reframing, the CEO considers the paradoxical demands to derive a balanced schema for satisfying stakeholders’ short-term and long-term requirements (Hahn et al., 2014).

Though we have argued for the learnability of CEO reflective capacity, it is difficult to imitate readily. Unlike products, technologies, and even strategic paths that are easily observed and learned by competitors, reflective capacity involves mental processes that are not easily detected by others (Eggers & Kaplan, 2013). Highly reflective CEOs have a bigger picture in their minds, and they pay attention not only to their firm’s business but also to the needs of the whole society. They have a bigger picture because of the diverse information content acquired through diverse sources.

Some prior studies suggest possible but incomplete support for the connection between CEO reflective capacity and the firm’s sustainability performance. For example, the knowledge breadth of the CEO helps to discover sustainable development opportunities (Patzelt & Shepherd, 2011). The CEOs with a more complex cognition are more likely to have a long-term vision; they can balance contradictions, value diversity, and consider the alternatives (Calori et al., 1994), which in turn enhance decision quality and facilitate social performance (Wong et al., 2011). Given the above conceptual analysis and some indirect empirical evidence, we hypothesize:

Hypothesis 1: CEO reflective capacity relates positively to a firm’s sustainability performance, including (a) economic, (b) social, and (c) environmental dimensions.

Hypotheses on the Mediating Mechanisms

The central premise of the upper echelons theory is that executives’ demographics, experiences, and cognitions greatly influence their construed reality and, in turn, give rise to strategic choices and processes (behaviors), and ultimately affect organizational performance (Hambrick & Mason, 1984). While research that directly examines the mediators between CEO attributes and firm performance is still emerging, some evidence has suggested that the influence of a CEO’s characteristics (such as age, gender, functional background, and the personality traits of

narcissism or humility) on firm outcomes are mainly through two ways – strategic choices and CEO/TMTs behaviors (Finkelstein et al., 2009; Liu et al., 2018). Following the upper echelons perspective, we consider two most likely mediating mechanisms that would link CEO reflective capacity to firm sustainability performance, namely strategic decision comprehensiveness and CEO behavioral complexity.

Strategic Decision Comprehensiveness as a Mediator

Strategic decision comprehensiveness refers to the extent to which an organization attempts to be exhaustive and inclusive in making and integrating strategic decisions (Forbes, 2007; Fredrickson, 1984). It is among the most salient and enduring strategic decision-making characteristics in organizations (Miller, 2008). We argue that CEO reflective capacity has direct implications for decision comprehensiveness, which in turn leads to firm sustainability performance.

According to the information perspective of strategic decision-making (Daft & Weick, 1984), cognitive limitations make it nearly impossible for the CEO to account for every relevant problem. This is due to the filtering process of how CEOs construe the reality of strategic situations and evaluate strategic options (Finkelstein et al., 2009). Highly reflective CEOs, who can broaden their information sources and content, improve their strategic decision comprehensiveness. Specifically, CEOs with a high level of reflective capacity have a broad field of vision since they seek information from diverse sources, enabling the company to develop a comprehensive awareness of new opportunities and resources. Then, this diverse information lowers selective perception bias. Alternative decisions are evaluated comprehensively to address current problems and develop future opportunities. The sequential, extensive, and analytical processes contribute to the comprehensiveness of strategic choices.

Further, highly reflective CEOs may facilitate strategic decision comprehensiveness by shaping rational information interactions within the top management team. The CEO promotes information exchanges, discussions, and integration of implications within the top management team to facilitate the processing of different points of view (Wei & Wu, 2013). This helps to improve the quality of the solutions to problems.

Prior literature has provided some evidence that the CEO's cognitive characteristics are reflected in their strategic decisions, such as strategic change (Cho & Hambrick, 2006), the speed of new market entry (Eggers & Kaplan, 2009) and acquisition decisions (Wally & Baum, 1994). Thus, we expect that CEO reflective capacity, functioning as a higher-order cognitive capability, influences strategic decision comprehensiveness.

Compared with the controversial effects on short-term outcomes (Atuahene-Gima & Li, 2004; Forbes, 2007), strategic decision comprehensiveness is more likely to benefit a firm's sustainability performance due to the incorporation of

substantial information related to a long-time horizon (Forbes, 2007). The comprehensive information will help the decision-makers to balance between long-term and short-term, economy and society, and divergent needs of multiple stakeholders, conducive to achieving firm sustainability.

Thus, the mediating effect of strategic decision comprehensiveness occurs as reflective capacity helps the CEOs to broaden the company's information processing and team-level information-centered interactions and interpretation, facilitating comprehensiveness, and finally enhancing sustainability performance. Thus, we propose the following hypothesis:

Hypothesis 2: Strategic decision comprehensiveness mediates the relationship between CEO reflective capacity and a firm's sustainability performance.

CEO Behavioral Complexity as a Mediator

In the competing values framework, Quinn (1984) introduced the term 'behavioral complexity' to describe executives' ability to perform multiple, competing roles and behaviors that circumscribe the requisite variety implied by an environmental context (Hart & Quinn, 1993). Guided by Quinn's framework, Tsui, Wang, Xin, Zhang, and Fu (2004) identified a set of strategic leadership behaviors among Chinese executives. They introduced six leadership behaviors; five are positively interconnected, including risk-taking, relationship-building, caring for employees (benevolence), operations monitoring, and vision articulating. Their study shows that an effective CEO demonstrates a high level of all five behaviors, i.e., behavioral complexity.

A CEO's behavioral complexity can be best understood as an analog to his or her broadened information acquisition and processing (Hart & Quinn, 1993). This means that a CEO builds behavioral complexity through observation or mastery of information-related experiences, which in turn enables a broad repertoire of behavioral responses (Hart & Quinn, 1993). Simply stated, CEOs with a high level of reflective capacity operate in a complex informational environment which triggers or calls for a higher level of sensitive attention to and discrete behaviors across multiple roles (Hooijberg, Hunt, & Dodge, 1997). The CEO's leadership toward his followers, the firm, and the external stakeholders inevitably is performed through manifested roles and behaviors, not only mental structures. As such, we suggest that CEO reflective capacity is useful for implementing multiple and contradictory roles of a CEO by providing a rich information context, leading to thoughtful responses to multi-faceted stakeholder demands, resulting in a high level of sustainability performance.

CEO behavioral complexity can play a mediating role through the vicarious interaction processes with top executives. While it is difficult to capture CEO's mental structure, executives can learn from the CEO's expansive information search behavior and leadership actions, and respond accordingly. This reinforces

and further facilitates implementation of strategic decisions regarding the company's sustainability performance. Furthermore, the behaviorally complex CEOs tend to focus on both task-oriented and people-oriented aspects, helping top managers to gain positive attitudes as well as task achievement (Wang, Zhang, Xin, & Tsui, 2011). Consequently, the top management team is inclined to achieve a harmonious working atmosphere, which is beneficial for identifying opportunities to meet demands from various stakeholders.

Prior studies provide some empirical evidence that CEO behavioral complexity produces better firm performance, particularly concerning stakeholder effectiveness, firm growth, and innovation, rather than only short-term financial performance (Hart & Quinn, 1993). Hence, we propose:

Hypothesis 3: CEO behavioral complexity mediates the relationship between CEO reflective capacity and a firm's sustainability performance.

EMPIRICAL STUDIES

Study 1: Scale Development and Validation of CEO Reflective Capacity

Before hypotheses testing, we developed and validated a reliable scale for the newly proposed CEO reflective capacity construct. The concept encompasses two interrelated parts – mental structure (internal cognition) and outward activities (external behavior). This conceptual structure is used as a guide for item generation and retention in the scale development process. Thus, differentiated from the existing executive cognition measures applying a psychological approach to draw up casual mapping or fill in the Bieri grid (e.g., Hitt & Tyler, 1991; Nadkarni & Barr, 2008), the new measure of reflective capacity aims to reveal cognition through behavioral manifestations of information acquiring, processing, and applying in strategic decision-making. We followed Hinkin's (1998) procedures to develop a reliable and valid scale of CEO reflective capacity. The process involved three phases.

Phase 1: Initial Item Development and Content Validity Assessment

We applied both an inductive and deductive approach to generate an initial pool of items (Hinkin, 1998). We began with the quotations on reflective thinking from Tsui et al.'s (2017) interviews. Using this inductively derived material, we generated four items for diverse information sources, eight items for diverse information content, and seven items for learning and integration. Next, we initiated a deductive item-generation approach and added three items to the third dimension, based on the interpretation of similar conceptions (e.g., Thomas, Clark, & Gioia, 1993). The two senior scholars on our research team reviewed the 22 initial items and proposed six new items. This generation process yielded a total of 28 items.

We invited a panel of six scholars (active researchers on leadership or upper echelons) and ten executives (CEOs, chairmen, or founders) to assess the content validity. They were asked to review whether these items clearly and accurately capture the meaning of reflective capacity, as well as suggest some additional items. The scholar experts instructed us to revise the ‘double-barreled’ items and to keep both the internal- and external-focused information content items to assure the scale’s integrity. The executives affirmed the importance of reflective capacity and suggested several items on sources and contents. The item pool increased to 53 based on their suggestions.

Phase 2: Scale Refinement Through Factor Analysis

We adopted both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) with two independent samples to assess the reliability and construct validity of the scale. In the first step, we performed an exploratory factor analysis using a sample of 349 executives who were part-time EMBA students in eastern China. We invited 2181 executives to voluntarily participate in the survey through the WeChat Group of their EMBA classes. They submitted the responses online. After dropping the unqualified samples (i.e., the middle managers), we have valid responses from 349 executives, an approximate response rate of 16%. The sample is 72.5% males, 51.6% in the age range of 31–40, and 33.0% in the 41–50 age range. Further, 25.5% are founding owners of the firm, and 61.6% are hired executives.

The respondents rated the 53-items on a 5-point Likert scale ranging from ‘never’ to ‘very frequently’ for the first dimension, ‘strongly inattentive’ to ‘strongly attentive’ for the second dimension, and ‘strongly disagree’ to ‘strongly agree’ for the third dimension. We used principal-axis factor analysis with varimax rotation to impose a three-factor solution.

The results supported the proposed three-dimension structure of CEO reflective capacity. We retained 24-items (six for the first dimension, ten for the second dimension, and eight for the third dimension) that met the criteria of higher than 0.40 factor loadings and no cross-loadings on other factors (Hinkin, 1998). We kept a few items that had minor cross-loading but important in meaning. Cronbach’s alpha is 0.921 for the whole scale and are 0.842, 0.901, and 0.869 for the three dimensions, respectively. These results provide preliminary evidence for the structure and internal consistency of the new construct.

In the second step, we conducted a confirmatory factor analysis to refine the scale and reassure its structure. We used the data from a new sample of 246 CEOs who participated in the hypotheses testing study.^[3] The CEOs rated the 24 items on the same 5-point Likert scale as that in the EFA sample. We ran the second-order CFA^[4] to confirm the theorized three-dimensional construct. We deleted six items due to high modification indices (higher than 50). The remaining 18-items show satisfactory goodness-of-fit indices (χ^2 [132] = 286.86, RMSEA = 0.069, CFI = 0.94, TLI = 0.93, and RMR = 0.047). All items load on the intended

factors with acceptable standardized loadings, and each dimension has six items. The composite reliability and Cronbach's α are above 0.70 for both the whole scale and for each dimension. The final list of items, factor loadings, and reliability coefficients are in [Table 2](#).

Phase 3: Convergent and Discriminant Validity of the Scale

We tested the convergent validity of the three dimensions to reflect the extent to which they are correlated with each other but independent from each other. We compared the baseline three-factor model with the three two-factor (combining any two factors) models and the one one-factor (combining the three factors) model (Anderson & Gerbing, 1988). The results reveal that the baseline model has the best fit indices and the one-factor model has the poorest fit indices. The three dimensions are positively correlated with each other ($r = 0.349$ to 0.555). Taken together, we confirmed the three dimensions of CEO reflective capacity.

To assess discriminant validity, we used the 246 CEO sample to examine the relationship between CEO reflective capacity and a few theoretically related but distinct constructs, which have been discussed and listed in [Table 1](#). We expected these relationships to be moderate but generally not as strong as the relationships found among the three dimensions of the main construct.

Specifically, we looked at the degree of association between CEO reflective capacity and the following five variables. Firstly, the scale of self-reflection, adapted from several psychological studies (e.g., Grant, Franklin, & Langford, 2002), includes seven items ($\alpha = 0.793$). Secondly, the two thinking modes of reflection and reflexion are represented by two cognitive styles, namely systematic and intuitive, measured by ten items (Sagiv, Arieli, Goldenberg, & Goldschmidt, 2010; $\alpha = 0.829$, $\alpha = 0.773$, respectively). Thirdly, cognitive flexibility^[5] was measured by nine items ($\alpha = 0.865$) from Martin and Rubin (1995). The fourth validation scale is the six-item holistic thinking scale (Choi et al., 2007; $\alpha = 0.865$).

The results show that the reflective capacity measure has a positive and weak-to-moderate ($r = 0.2$ – 0.5) correlation with the five validation variables. Among them, the correlation coefficient with cognitive flexibility is the biggest ($r = 0.472$), and with holistic thinking is the smallest ($r = 0.232$). Furthermore, we assessed that reflective capacity, as a comprehensive construct, is distinct from the five variables. The results in [Table 3](#) show that the 6-factor baseline model always has the lowest chi-square in the comparing set, suggesting that reflective capacity dimensions are distinct from related constructs. Thus, we confirmed the measure's discriminant validity.

In sum, the above analyses and results support an 18-item three-dimension CEO reflective capacity scale. The measure exhibits good reliability, content, convergent, and discriminant validity. This gave us confidence in using this scale for hypotheses testing.

Table 2. Confirmatory factor analysis for CEO reflective capacity

<i>Items</i>	<i>Mean</i>	<i>Std.</i>	λ	<i>S.E.</i>	<i>t-value</i>
Second-order factor: Reflective Capacity (Composite reliability = 0.912, Cronbach's α = 0.860)					
First-order factor 1. Diverse Information Sources	2.93	0.64	0.70	0.10	6.70
First-order factor 2. Diverse Information Content	3.99	0.53	0.62	0.11	5.89
First-order factor 3. Learning and Integration	3.56	0.61	0.99	0.12	8.01
1. Diverse Information Sources (Composite reliability = 0.773, Cronbach's α = 0.762)					
1-1. I often attend industry related activities (e.g., meetings, shows, exhibitions).	3.45	0.86	0.58		
1-2. I attend executive education programs regularly.	3.20	0.89	0.62	0.076	7.25
1-3. I often attend professional activities for executives (e.g., entrepreneur forums, private advisory board).	3.26	0.89	0.74	0.082	8.12
1-4. I frequently visit other companies in China.	3.07	0.86	0.60	0.072	7.08
1-5. I often visit companies in other countries.	2.31	1.02	0.58	0.085	6.98
1-6. I employ professional institutions to acquire business intelligence.	2.28	1.14	0.48	0.091	6.07
2. Diverse Information Content (Composite reliability = 0.768, Cronbach's α = 0.764)					
2-1. I pay attention to the strategic framework of other companies.	3.73	0.87	0.52		
2-2. I pay attention to the innovation of business models in other companies.	3.98	0.78	0.50	0.067	5.79
2-3. I pay attention to the current events of the industry.	4.35	0.68	0.70	0.067	7.04
2-4. I pay attention to the development logic of the industry.	4.24	0.77	0.68	0.075	6.98
2-5. I pay attention to the potential influences of other industries to our industry.	3.63	0.78	0.67	0.075	6.92
2-6. I pay attention to the policy orientation based on governmental or institutional policy adjustments.	4.02	0.82	0.49	0.070	5.75
3. Learning and Integration (Composite reliability = 0.786, Cronbach's α = 0.782)					
3-1. I make or see the connection between my company and the world.	3.74	0.81	0.61		
3-2. I apply the successful practices of other companies in other industries to my firm.	3.57	0.90	0.58	0.072	7.21
3-3. I consider the developmental potential of my firm based on the state of the global market.	3.43	1.04	0.68	0.087	8.12
3-4. I recognize when my thinking or interpretive scheme is faulty or obsolete.	3.85	0.80	0.56	0.063	7.02
3-5. I try to learn from the leading firms in the industry or around the world.	3.43	0.79	0.58	0.067	7.27
3-6. I use the historical evolution of the industrial world for reference.	3.32	0.98	0.68	0.082	8.10

Notes: λ is standardized coefficients; S.E. is standard errors of the coefficients.

Study 2: Hypotheses Testing Study

Sample. To test the hypotheses, we used a multi-source multi-time survey with a sample of CEOs and their direct subordinates, i.e., top executives, conducted in June to August in 2018. We chose small-to-medium-sized firms (SMEs; annual sales less than ¥200 million and no more than 1,000 employees) as a sampling frame. Compared to large firms, SMEs have fewer intervening factors that can

Table 3. Confirmatory factor analysis for CEO reflective capacity discriminant validity with related constructs

<i>Model</i>	χ^2	df	RMSEA	CFI	TLI	SRMR	$\Delta\chi^2$	Δdf
<i>Model 0</i> (baseline model): 6-factor model	2373.01	1112	0.068	0.93	0.92	0.073		
<i>Model 1</i> : 5-factor model combining RC & SR	3337.84	1117	0.090	0.90	0.90	0.089	964.83**	5
<i>Model 2</i> : 5-factor model combining RC & CF	3243.29	1117	0.088	0.90	0.90	0.089	870.28**	5
<i>Model 3</i> : 5-factor model combining RC & SCS	3108.33	1117	0.085	0.91	0.90	0.091	735.32**	5
<i>Model 4</i> : 5-factor model combining RC & ICS	2825.65	1117	0.079	0.91	0.91	0.082	452.64**	5
<i>Model 5</i> : 5-factor model combining RC & HT	3675.64	1117	0.097	0.89	0.89	0.094	1302.63**	5
<i>Model 6</i> : 1-factor model combining all 6 variables	5107.70	1127	0.120	0.85	0.84	0.10	3734.69**	15

Notes: $N = 246$, ** $p < 0.01$, Seven variables in Model 0: RC = reflective capacity, SR = self-reflection, CF = cognitive flexibility, SCS = systematic cognitive style, ICS = intuitive cognitive style, and HT = holistic thinking.

dilute the influence of their CEOs on firm-level outcomes. Moreover, SMEs are less constrained than large public firms by extraneous influences, like those coming from a powerful board of outside directors and capital markets (Ling, Simsek, Lubatkin, & Veiga, 2008).

We identified CEOs through two channels. First, we used a directory of DBA, EMBA, and MBA alumni of a top-level business school in eastern China. Among the 298 CEOs that we identified, 199 responded to our invitation to participate in the study (66.8% response rate). An additional 92 CEOs were recruited through a secretary of a Chamber of Commerce and a senior leader of a private advisory board. We obtained cooperation from an additional 49 CEOs (a response rate of 53.3%). After deleting two CEOs with incomplete data, the final sample is 246 CEOs. This sample has 64.5% males, 45.2% aged 31–40, and 35.1% aged 41–50, 63.0% CEOs as major shareholders and 35.9% hired CEOs, and 50.8% duality CEOs.

The average firm age is 8.736 years ($SD = 9.749$) and 48.78% of the firms have between 30–100 employees. The 246 firms are located in 18 provinces and represent 15 industries. About 88% of the firms are in Shanghai, Beijing, Zhejiang, Jiangsu, and Guangdong, which have the fastest growing and most well-developed SME clusters in China. About 29% of these firms are in manufacturing, 17% in finance, 12% in information technology, and 11% in commerce service. This sample has similar descriptive characteristics as samples of Chinese SMEs used in previous studies (e.g., Chen & Nadkarni, 2017).

Data Collection Procedure

We obtained data from these 246 CEOs and their subordinate-executives in two time periods to minimize the common method variance problem (Podsakoff,

MacKenzie, Lee, & Podsakoff, 2003). We sent an invitation letter to the CEOs through WeChat or email, introducing the aim, content, and procedure of the survey, the importance of truthful answers, confidentiality, and a customized CEO report after the study as an appreciation for their contribution to the study. Each CEO was given a four-digit code, both for him/her and for matching with the subordinate-executives. The survey was conducted through an online survey platform (Wenjuanxing) using a mobile phone or laptop. The CEOs clicked the link and completed the first survey, including their reflective capacity, cognitive variables (for scale validation), and personal and firm information. Each CEO was asked to send the executive survey link to all of the TMT members (through their TMT WeChat Group) with the four-digit code and to encourage them to participate.^[6] The TMT survey included the measures of CEO's behavioral complexity, the firm's sustainability performance, and the respondent's personal information. Two weeks later, we administered the second-round survey with the CEOs, which contained the strategic decision-making characteristics and firm sustainability performance measures. We received responses from 237 CEOs.

Among the 237, 126 CEOs successfully invited at least one top executive and we received 306 matching executive surveys.^[7] After eliminating a few firms with unqualified data, we have a final sample of 213 CEOs. Among them, 109 CEOs can be matched with 256 executives. The tests of the hypotheses used that data from these 213 CEOs and 109 firms with both CEO data and subordinate data aggregated to the firm level.

Measures

Dependent variable. Using archival data to measure firm *sustainability performance* (i.e., triple bottom line) has been well considered in GRI and ESG reports,^[8] although a scale of a reasonable length is not available. We adapted a most recently developed scale – Corporate Stakeholder Responsibility (CSrR) (El Akremi, Gond, Swaen, De Roeck, & Igalens, 2018) – whose structure is based on the perceived triple bottom line, including environment dimension and society dimension (community-, employee-, supplier-, customer- and shareholder-oriented). We deleted the items with insignificant loadings, simplified or added items based on other CSR measures (e.g., Turker, 2009), and added an economic dimension of short-term and long-term financial performance (e.g., Delaney & Huselid, 1996), to achieve a 'sustainability performance' measure with seven dimensions and 29 items.

The CEOs rated firm sustainability performance items on a 6-point scale (1 = strongly disagree to 6 = strongly agree) in the second-round survey. We used a 6-point scale to avoid choosing the midpoint in odd-numbered scales on sensitive topics (Ou, Tsui, Kinicki, Waldman, Xiao, & Song, 2014). The scale showed good psychometric properties with a Cronbach's α of 0.932 (the α for each of

the seven dimensions varies from 0.812 to 0.916) and good fit indices with χ^2 [356] = 775.82, RMSEA = 0.075, CFI = 0.96, TLI = 0.95, RMR = 0.052.

For a robustness check, we used the executive data on firm sustainability performance. The Cronbach's α is 0.939 for the whole scale and for each dimension, α varies from 0.742 to 0.926. It has good fit indices (χ^2 [356] = 822.31, RMSEA = 0.072, CFI = 0.97, TLI = 0.96, RMR = 0.045). We aggregated the executive responses to the firm level, with acceptable agreement indices: ANOVA F statistic = 1.39, $p < .05$, average $r_{wg(j)}$ = 0.968, ICC(1) = 0.144.

The Appendix lists these 29 items and the CFA results for the two samples.

Independent variable. We used the newly developed 18-item 3-dimensional *reflective capacity* scale. The CEOs responded to the items using the 5-point scale. The scale demonstrates a high level of internal consistency ($\alpha = 0.859$) and good fit indices (χ^2 [132] = 261.17, RMSEA = 0.068, CFI = 0.94, TLI = 0.93, RMR = 0.049). We validated the reflective capacity scale by using six items on the average number of hours or times that the CEO engaged in information gathering activities within a given time period.^[9] We developed a score that is the sum of the standardized score of these six items. The correlation of this score of information collecting activity with reflective capacity is $r = 0.419$ ($p < 0.01$) and with sustainability performance for H1 is $r = 0.249$ ($p < 0.01$), providing a modest degree of validation.

Mediating variables. *Strategic decision comprehensiveness* was measured by the 5-item scale developed by Atuahene-Gima and Li (2004). The CEOs rated these items in the second-round survey, using a 5-point scale ranging from 1 = 'almost never' to 5 = 'always'. A sample item is 'developed many alternative courses of action to achieve intended objectives'. The measure has high internal consistency ($\alpha = 0.816$) and moderate fit indices (χ^2 [5] = 20.51, RMSEA = 0.12, CFI = 0.97, TLI = 0.93, RMR = 0.019). The second mediator is *CEO behavioral complexity*, which was measured by the 24-items of the strategic leader behavior scale (Tsui et al., 2004; Wang et al., 2011). We retained 21-items for the five types of behavior excluding the negative dimension of authoritarian behavior. Executives described their CEOs using a 7-point scale, varying from 1 = 'almost never' to 7 = 'almost always'. The measure displayed good psychometric properties ($\alpha = 0.965$) and good fit indices (χ^2 [126] = 423.37, RMSEA = 0.74, CFI = 0.98, TLI = 0.98, RMR = 0.044). The aggregated-to-firm level agreement indices were also acceptable (ANOVA F statistic = 1.75, $p < 0.01$, average $r_{wg(j)}$ = 0.983, ICC(1) = 0.244).

Control variables. We controlled for CEO age (years), CEO gender (1 = female, 0 = male), CEO work experience diversity (working and managing in different functions, standardized) and duality (1 = CEO and chair, 0 = only CEO). We also controlled the CEO's attention on internal-focused information including marketing, operating, financing, R&D, and backstage (a 5-point scale ranging from 'strongly

inattentive' to 'strongly attentive'). We further controlled for firm age (years), firm ownership (1 = Privately Owned Enterprises, 0 = others),^[10] firm size (number of employees, 1 = 30–50; 2 = 50–100; 3 = 101–200; 4 = 201–500; 5 = 500–1,000), and industry (1 = manufacturing, 0 = others).

Analytical Approach

We used data from the 213 CEOs to test Hypothesis 1 (main effect) and Hypothesis 2 (mediation of decision comprehensiveness), while Hypothesis 3 (mediation of CEO behavioral flexibility) used data from the 109 CEO and executive-aggregated paired sample. We employed multivariate linear regression to test Hypothesis 1. We tested Hypothesis 2 and 3 by using structural equation modeling with Mplus 6.12, which provides a parsimonious way to test mediation effects, controlling measurement errors. We first conducted confirmatory factor analysis to examine the discriminant validity of the latent variables in each model. We created two to five parcels for each latent variable by their dimensions or combined dimensions, in order to reduce the number of parameters to be estimated with a moderate sample size.

For the mediation hypotheses, Hayes (2009) suggests the use of joint significance and bias-corrected bootstrapping testing of indirect effects, instead of the traditional causal steps proposed by Baron and Kenny. This approach helps to control Type I error and has the strongest power to detect mediation effects. A bias-corrected, bootstrapping test of the indirect effect is appropriate for our small samples, as it adopts a resampling method to provide a quantitative estimate of the mediation effect and suggests the significance of mediation when the confidence interval (CI) excludes zero. We resampled 5,000 times to yield an accurate distribution of CIs. Following Hayes (2013: 200), we report the unstandardized coefficients.

In addition, we tested three possible mediation effects by comparing three alternative, nested models: the fully mediated model (indirect relationships of the mediator with IV and with DV), a partially mediated model (direct relationship of IV to DV and indirect relationships of the mediator with IV and with DV), and a non-mediated model (direct relationship of IV to DV), as Kelloway (1998) recommends. The model with a significant improvement compared to others would be considered to be the best fit model.

Results

Table 4 shows the means, standard deviations, and correlations for all the variables in this study, presented at their appropriate levels. CEO reflective capacity and sustainability performance are positively correlated ($r = 0.384$, $p < 0.01$ for CEO self-rating; $r = 0.217$, $p < 0.01$ for subordinate-rating). The correlation coefficient between CEO-rated and executive (subordinate)-rated sustainability performance

Table 4. Means, standard deviations, and correlation matrix in study 2

	<i>Mean</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.CEO gender	0.359	0.481	1																		
2.CEO age	40.986	6.536	-0.075	1																	
3.CEO diver	0.00	1.000	0.043	0.023	1																
4.Duality	0.545	0.499	-0.021	0.208*	0.181*	1															
5.Firm age	10.741	9.935	-0.074	0.335*	0.067	0.093	1														
6.Firm owner	0.718	0.451	-0.058	-0.051	0.083	0.220*	-0.047	1													
7.Firm size	2.695	1.290	-0.044	-0.011	-0.104	-0.202*	0.192*	-0.177*	1												
8.Industry	0.295	0.457	0.097	0.087	0.133*	0.191*	0.019	0.051	0.029	1											
9.Internal content	4.185	0.585	0.135*	0.039	0.206*	0.174*	-0.008	0.150*	-0.047	0.088	1										
10.CEO RC	3.485	0.478	0.097	0.021	0.192*	0.144*	0.106	0.094	0.122	0.062	0.377*	1									
11.SDC	3.849	0.513	0.149*	-0.015	0.154*	0.112	-0.002	0.102	0.045	0.001	0.316*	0.424*	1								
12.Economic	5.229	0.565	0.171*	0.044	0.164*	0.119	0.023	0.104	0.001	0.158*	0.377*	0.209*	0.329*	1							
13.Society	4.908	0.515	0.091	0.079	0.112	0.223*	0.062	0.219*	-0.034	0.028	0.396*	0.380*	0.430*	0.491*	1						
14.Environment	4.610	0.840	0.010	0.153*	0.080	0.101	0.123	0.095	0.151*	0.051	0.221*	0.255*	0.301*	0.209*	0.626*	1					
15.Sustainability	4.927	0.485	0.113	-0.102	0.138*	0.193*	0.077	0.189*	0.031	0.084	0.415*	0.384*	0.457*	0.663*	0.943*	0.747*	1				
16.CEO BC	5.905	0.573	-0.085	0.097	0.225*	0.143	0.057	0.157	-0.137	-0.032	0.179	0.255*	0.213*	0.176	0.369*	0.205*	0.360*	1			
17.Economic	5.466	0.441	-0.002	0.135	0.070	-0.041	0.062	0.062	0.029	0.071	0.147	0.159	0.144	0.259*	0.135	0.194*	0.237*	0.524*	1		
18.Society	5.180	0.416	-0.119	0.174	0.190*	0.121	0.043	0.166	0.063	-0.001	0.114	0.192*	0.093	0.130	0.261*	0.276*	0.290*	0.694*	0.606*	1	
19.Environment	4.861	0.643	-0.079	0.173	0.225*	0.109	0.052	0.101	0.001	0.154	0.278*	0.192*	0.189*	0.191*	0.208*	0.287*	0.285*	0.558*	0.563*	0.692*	1
20.Sustainability	5.180	0.411	-0.093	0.200*	0.200*	0.076	0.064	0.136	0.058	0.061	0.182	0.217*	0.143	0.195*	0.245*	0.297*	0.311*	0.701*	0.783*	0.944*	0.834*

Notes: * $p < 0.05$, two-tailed test. RC = reflective capacity, SDC = strategic decision comprehensiveness, BC = behavioral complexity. Variables 1–15 are based on data provided by the CEO, $N = 213$. Variables 16–20 are based on data provided by matching executives. For cross-level correlations, we aggregate them by averaging within group to firm/CEO level, $N = 109$.

is also significant ($r = 0.311$, $p < 0.01$), validating the measure from different sources.

Table 5a provides confirmatory factor analysis results for the measurement models of the three latent variables measured by CEO responses (CEO reflective capacity, strategic decision comprehensiveness, and sustainability performance). Model 1 (the baseline model) reveals good model fit indices ($\chi^2 [24] = 49.337$, RMSEA = 0.071, CFI = 0.959, TLI = 0.939, SRMR = 0.047). Comparing with the four alternative models which combine two or three latent variables, Model 1 generates a significantly lower chi-square value ($p < 0.01$). Thus, the discriminant validity of the three latent variables can be assured. In the same vein, Table 5b presents CFA results for the measurement models of the three latent variables using the CEO-executive paired data (CEO reflective capacity, CEO behavioral complexity and sustainability performance measured by aggregated executive ratings). Model 1 (the baseline model) reveals the best fit indices ($\chi^2 [51] = 80.543$, RMSEA = 0.073, CFI = 0.957, TLI = 0.944, SRMR = 0.044) and all the four alternative models show significant increase in chi-square ($p < 0.01$), providing evidence for the discriminant validity.

Then we tested our three hypotheses in sequence. The results of Hypothesis 1 are shown in Table 6a. CEO reflective capacity is positively related to sustainability performance ($\beta = 0.239$, $p < 0.01$). It is also significantly related to society and environment dimensions ($\beta = 0.273$, $p < 0.01$; $\beta = 0.277$, $p < 0.05$, respectively). The coefficient is positive but insignificant for the economic dimension ($\beta = 0.058$, *n.s.*). Table 6b is a validation using the aggregated executive ratings of sustainability performance. The coefficients between CEO reflective capacity and firm sustainability performance and its three dimensions are all positively significant. Thus, Hypothesis 1 is fully supported.

Table 7 presents the alternative models to test the mediating effect of strategic decision comprehensiveness (H2).^[11] Among the three models, the partially mediated model (Model 1) generates the best fit indices ($\chi^2 [40] = 69.438$, RMSEA = 0.059, CFI = 0.95, TLI = 0.94, SRMR = 0.061). The changes in the value of chi-square between this model and the other two competing models are significant (for full mediation model, $\Delta\chi^2 [1] = 7.12$, $p < 0.01$; for non-mediation model, $\Delta\chi^2 [1] = 13.86$, $p < 0.01$). The results indicate that strategic decision comprehensiveness partially, instead of fully, mediates the link between CEO reflective capacity and sustainability performance. The path between CEO reflective capacity and decision comprehensiveness is significant ($\beta = 0.698$, $p < 0.01$), as well as the path between comprehensiveness and sustainability ($\beta = 0.399$, $p < 0.01$). The path coefficient of the direct effect of CEO reflective capacity and sustainability performance is positively significant ($\beta = 0.339$, $p < 0.05$), and the indirect effect is also significant ($\beta = 0.278$, $p < 0.01$), with the 95% confidence interval (CI) excluding zero ([95% CI = [0.103, 0.509]). Hence, Hypothesis 2 is supported whereas strategic decision comprehensiveness partially mediates

Table 5a. Confirmatory factor analysis for CEO data

<i>Model</i>	χ^2	df	<i>RMSEA</i>	<i>CFI</i>	<i>TLI</i>	<i>SRMR</i>	$\Delta\chi^2$	Δdf
Model 1 (baseline): 3-factor model	49.337	24	0.071	0.959	0.939	0.047		
Model 2: 2-factor model combining SDC & SP	124.774	26	0.134	0.840	0.779	0.076	75.437	2
Model 3: 2-factor model combining RC & SDC	111.244	26	0.124	0.862	0.809	0.066	61.907	2
Model 4: 2-factor model combining RC & SP	144.474	26	0.147	0.808	0.735	0.086	95.137	2
Model 5: 1-factor model combining all variables	196.696	27	0.172	0.725	0.634	0.093	147.359	3

Notes: *N* = 213, RC = reflective capacity, SDC = strategic decision comprehensiveness, SP = sustainability performance.

Table 5b. Confirmatory factor analysis for CEO-executive data

<i>Model</i>	χ^2	df	<i>RMSEA</i>	<i>CFI</i>	<i>TLI</i>	<i>SRMR</i>	$\Delta\chi^2$	Δdf
Model 1 (baseline): 3-factor model	80.543	51	0.073	0.957	0.944	0.044		
Model 2: 2-factor model combining BC & FSP	123.763	53	0.111	0.897	0.871	0.057	43.22	2
Model 3: 2-factor model combining RC & BC	135.468	53	0.120	0.879	0.850	0.084	54.925	2
Model 4: 2-factor model combining RC & FSP	137.665	53	0.122	0.876	0.846	0.086	57.122	2
Model 5: 1-factor model combining all variables	178.590	54	0.146	0.818	0.777	0.091	98.047	3

Notes: *N* = 109, RC = reflective capacity, BC = behavioral complexity (aggregated), FSP = sustainability performance. Subordinate-executive data are aggregated to the firm level.

the relationship between CEO reflective capacity and firm sustainability performance.^[12]

The results for the mediation of behavioral complexity (H3) are in Table 8, which shows the fit indices of the three competing models, among which the full mediation model (Model 2) has the best fit indices (χ^2 [74] = 107.592, RMSEA = 0.065, CFI = 0.95, TLI = 0.94, SRMR = 0.073). Compared with the non-mediation model (which has the same degree of freedom), the value of chi-square of Model 2 is much lower ($\Delta\chi^2$ = 60.03). Compared with the partial mediation model, the change in the value of chi-square is non-significant ($\Delta\chi^2$ [-1] = -0.10), yet Model 2 has a lower ratio of chi-square to degree freedom. The above results support a full mediation effect of CEO behavioral complexity. The two path coefficients are significant (β = 0.351, p < 0.01 for the relationship in the first arrow; β = 1.203, p < 0.01 for the second one). A bootstrap

Table 6a. Results on relationship between CEO reflective capacity and sustainability performance (CEO evaluation)

<i>Dependent variables</i>	<i>Sustainability</i>		<i>1. Economic dimension</i>		<i>2. Society dimension</i>		<i>3. Environmental dimension</i>	
CEO reflective capacity	0.239** (0.071)		0.058 (0.077)		0.273** (0.075)		0.277* (0.141)	
CEO gender	0.078 (0.062)	0.064 (0.059)	0.137* (0.068)	0.134† (0.068)	0.068 (0.068)	0.053 (0.065)	0.005 (0.116)	-0.011 (0.113)
CEO age	0.005 (0.006)	0.005 (0.005)	0.002 (0.006)	0.002 (0.006)	0.003 (0.006)	0.003 (0.006)	0.016 (0.010)	0.016 (0.010)
CEO work diversity	0.020 (0.039)	0.004 (0.037)	0.047 (0.040)	0.043 (0.040)	0.004 (0.042)	-0.015 (0.040)	0.036 (0.077)	0.018 (0.077)
CEO duality	0.087 (0.070)	0.065 (0.069)	0.022 (0.081)	0.016 (0.082)	0.132* (0.075)	0.107 (0.074)	0.071 (0.134)	0.046 (0.131)
Firm age	0.002 (0.003)	0.001 (0.002)	0.000 (0.004)	0.000 (0.003)	0.002 (0.003)	0.001 (0.003)	0.004 (0.004)	0.003 (0.004)
Firm ownership	0.144* (0.062)	0.134* (0.062)	0.066 (0.072)	0.064 (0.072)	0.173* (0.068)	0.162* (0.067)	0.166 (0.120)	0.155 (0.122)
Firm size	0.032 (0.025)	0.017 (0.024)	0.013 (0.027)	0.010 (0.028)	0.011 (0.027)	-0.005 (0.026)	0.116* (0.050)	0.099* (0.050)
Firm industry	0.007 (0.069)	0.010 (0.066)	0.123 (0.077)	0.124 (0.076)	-0.050 (0.072)	-0.047 (0.069)	-0.008 (0.130)	-0.005 (0.127)
Internal content	0.298** (0.052)	0.233** (0.054)	0.314** (0.068)	0.298** (0.070)	0.301** (0.056)	0.227** (0.058)	0.279** (0.098)	0.204† (0.113)
Constant	3.190** (0.300)	2.701** (0.329)	3.635** (0.364)	3.517** (0.391)	3.260** (0.322)	2.702** (0.356)	2.269** (0.536)	1.701** (0.592)
R ²	0.218		0.178		0.207		0.129	
ΔR ²	0.054**		0.002		0.050**		0.019*	

Notes: $N = 213$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$

Table 6b. Validation results on relationship between CEO reflective capacity and sustainability performance (executive evaluation)

<i>Dependent variables</i>	<i>Sustainability performance</i>	<i>1. Economic dimension</i>	<i>2. Society dimension</i>	<i>3. Environmental dimension</i>
CEO reflective capacity	0.190* (0.074)	0.150* (0.071)	0.170* (0.080)	0.264* (0.114)
Constant	4.520** (0.258)	4.945** (0.256)	4.589** (0.277)	3.944** (0.401)
R ²	0.047	0.025	0.037	0.037
F (1,107)	6.61*	4.45*	4.51*	5.35*

Notes: $N = 109$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$

analysis using 5,000 iterations indicates that the indirect effect is significant ($\beta = 0.423$, $p < 0.01$) with 95% CI = [0.150, 0.801]. These results provide support for Hypothesis 3 that CEO behavioral complexity fully mediates the relationship between CEO reflective capacity and firm sustainability performance.

Table 7. SEM model fit indices to test the mediating effect of strategic decision comprehensiveness

<i>Model</i>	χ^2	df	<i>RMSEA</i>	<i>CFI</i>	<i>TLI</i>	<i>SRMR</i>	$\Delta\chi^2$	Δdf
RC→SDC→SP								
Model 1: partial mediation	69.438	40	0.059	0.953	0.937	0.061		
Model 2: full mediation	76.563	41	0.064	0.943	0.925	0.067	7.125	1
Model 3: non-mediation	83.303	41	0.070	0.933	0.911	0.074	13.865	1

Notes: *N* = 213, RC = reflective capacity, SDC = strategic decision comprehensiveness, SP = sustainability performance (CEO rated)

Table 8. SEM model fit indices to test the mediating effect of behavioral complexity

<i>Model</i>	χ^2	df	<i>RMSEA</i>	<i>CFI</i>	<i>TLI</i>	<i>SRMR</i>	$\Delta\chi^2$	Δdf
RC→BC→FSP								
Model 1: partial mediation	107.491	73	0.066	0.950	0.938	0.073		
Model 2: full mediation	107.592	74	0.065	0.951	0.941	0.073	0.101	1
Model 3: non-mediation	167.619	74	0.108	0.864	0.835	0.188	60.128	1

Notes: *N* = 109, RC = reflective capacity, BC = behavioral complexity (aggregated), FSP = sustainability performance (subordinate-executive rated, aggregated)

DISCUSSION

We developed a conceptual model of CEO reflective capacity by first defining the new construct and explaining how it relates to firm sustainability performance through the mediating mechanisms of strategic decision comprehensiveness and CEO behavioral complexity, based on the upper echelons framework and information perspective. We developed and validated the scale using two executive samples. We tested three hypotheses using a sample of 213 CEOs and 256 of their subordinate-executives in small-and-medium-sized firms in China. The results of Study 1 support our conceptualization of CEO reflective capacity, and the results of Study 2 support our theoretical model connecting CEO's reflective capacity to firm sustainability performance through the mediation of comprehensive strategic decisions and CEO behavioral complexity. The findings confirm the value of CEO reflective capacity as a potential contributor to a firm's sustainability performance, building on the preliminary discovery by Tsui et al. (2017).

Theoretical Implications

Our study has several implications for further theory development and empirical research in strategic leadership and managerial cognition. First, the construct of CEO reflective capacity extends the research on the upper echelons framework, which treats cognition as an underlying but unmeasured linking mechanism between CEO personal traits and firm outcomes (Liu et al., 2018). Second, by

extending cognition to behavioral actions, this study provided a holistic view as an alternative to the fragmented conceptual treatment of managerial cognition (Eggers & Kaplan, 2013; Helfat & Peteraf, 2015). The conceptual structure of the three-dimensional measure of CEO reflective capacity provides further insights into interaction between cognitive elements, i.e., content, structure, and style (Finkelstein et al., 2009; Narayanan et al., 2011).

Most importantly, the new construct sheds light on the possibility of pushing the limits of bounded rationality among the important decision makers of organizations (March & Simon, 1958; Simon, 1997). Our study is a response to the call for a radical extension in the dominant interpretation of bounded rationality (Gavetti, 2012). We contribute to this call by addressing how CEO reflective capacity functions in the three-stage information filtering process (Hambrick & Mason, 1984: 195) and transforms this process from a vision narrowing to a vision broadening perspective. CEOs with high levels of reflective capacity can broaden their vision, to some extent, through collecting diverse information from diverse sources, and integrating the diverse information into a new framework to identify unusual opportunities.

The value of CEO reflective capacity for firm sustainability performance is consistent with the views of Hahn et al. (2014), who argue that sustainability involving tensions between complex economic, environmental, and social issues requires complex cognitive frames of the executives. We take a step further to propose a specific construct, measure it and test the relationship empirically, as well as examining the mediation of strategic decision comprehensiveness and CEO behavioral complexity based on the upper echelons framework. Our work lays a foundation for future investigation of the nomological network of CEO reflective capacity exploring its antecedents and other important consequences.

This study contributes to the conversation among strategic cognition scholars. For example, we extend the attention-based view (Ocasio, 1997). Ocasio suggests that organizational outcomes are a reflection of managerial attention patterns, influenced by their particular experiences and the decision-making context. Hence, it is strictly based on executives' selective attention due to bounded capacity. In contrast, the core idea of reflective capacity is that some CEOs strive to dispose of presupposed attention and attend to different types of information to improve rational information-processing. Our study also puts forward a possible solution to Zajac and Bazerman's (1991) competitive blind spots for strategic decisions, which are caused by insufficient consideration of the contingent decisions of other competitors. Although Tversky and Kahneman (1986) argue that the basic judgment biases are unlikely to be corrected in everyday decision making, we suggest that highly reflective CEOs are able to reduce the biases and avoid the blind spots through broadening their information search and processing. This ability may be especially important in contemporary contexts when there is great pressure for firms to satisfy multiple stakeholders beyond

shareholders for the long-term sustainability in which the firms draw their resources and support.

Finally, beyond providing a feasible means to overcome the limitation of bounded rationality, CEO reflective capacity also honors March's ideas about experiential learning introduced in his later years. March (2010) suggested 'low-intellect' (replicates certain success-associated issues) and 'high-intellect' (understands and applies causal structure) as two learning modes to obtain intelligence. Our concept, reflective capacity, has a good alignment with the two learning modes. For 'low-intellect' learning, the informational biases and suboptimal solutions can be solved by increasing the breadth and depth of information, employing multi-perspectives, multi-sources, multi-preferences, multi-experiences, and even 'near history' imagination (March, 2010: 117). Our first two dimensions of diverse information sources and diverse contents highlight March's multi-faceted views of solving the efficiency of 'low-intellect' learning. For 'high-intellect' learning, the causal relationships may be clarified in narratives, models, or theories. Reflective capacity involves finding connections and reframing mental models through the third dimension of learning and integration. Thus, with a high level of reflective capacity, the CEO is able to combine a diversified 'low-intellect' learning and a causal structure-based 'high-intellect' learning. In this way, the imperfect truth due to isolated experiences can be mitigated to a large extent.

Limitations and Future Research Directions

Our study has limitations which provide opportunities for future research. Although the concept of reflective capacity is derived through investigations of Chinese CEOs in small-to-medium sized firms, we do not expect it to be a uniquely indigenous phenomenon (Li, Leung, Chen, & Luo, 2012). Future studies could investigate this concept both globally and locally, in both entrepreneurial firms and established firms, exploring its conceptual structure and influences both within- and cross-cultural contexts. Even within the Chinese context, we encourage replication and extension of the core idea and exploration of other firm outcomes beyond firm sustainability performance. Future research exploring possible antecedents (such as functional and career heterogeneity as well as childhood experiences) would be necessary before we can confidently advise any application of this knowledge. Also, future studies could explore other mediating mechanisms to firm-level outcomes, such as TMT behavioral integration and organizational culture (Ou et al., 2014).

For the concept's internal structure, we proposed a possible sequencing of the three dimensions but we did not expound and test this theoretical sequence. Future studies might adopt three alternative methodologies to investigate the dynamic process. First, we may consider designing a bounded rationality game of multi-round strategy simulation to test the process of information searching and processing. Second, a promising approach is content analyzing archival texts such as

CEOs published speeches, interviews, or biographies (Zyung, 2017). Third, it is becoming possible to apply the interdisciplinary approach of neuro-scanning, neuro-imaging, or neuro-sensing technologies (Waldman, Wang, & Fenters, 2019) to understand CEO's thoughts, emotions, and behavior by associating brain functions/structures with elements in cognitive processes.

We have emphasized the benefits of CEO reflective capacity, leaving the downsides such as a slower decision pace and lower efficiency for future studies. Prior study indicates that an executive's cognitive ability to process numerous alternatives simultaneously appears to expedite the pace of strategic decision-making (Wally & Baum, 1994), while the collection, generation and evaluation process of alternatives may not be compatible with fast strategic decision making (Eisenhardt, 1989). These conflicting tensions inspire future studies to explore the possible drawbacks of CEO reflective capacity on strategic decision speed.

This study mitigated the threat of common method bias through multiple ways in data collection and analysis, including taking two-wave surveys, using multi-respondents of CEOs' executive-subordinates, and validating the hypothesized models with alternative measures, measures from different respondents and various sets of control variables. However, these results are still susceptible to perception bias since the data were obtained from subjective reports of the CEOs and their subordinates. Although we validated the subjective measure of CEO reflective capacity using an objective proxy, it is also based on CEO's verbal reports which may contain measurement (recall) error. Using the 'diary' method to keep track of the CEO's information gathering activities such as CEO travel records and reading portfolio might be a possible option in future research. Weakness also exists in the measurement of the outcome variable. To ask for objective measure of economic, social and environmental performance is nearly impossible with these Chinese SMEs. Future studies may consider using B (Benefit) corporations (Kim, Karlesky, Myers, & Schifeling, 2016) for which data on the triple bottom line may be available.

CONCLUSION

This current study offers a new concept of CEO reflective capacity consisting of both cognitive and behavioral dimensions, develops a new scale, and tests its relationship to a firm's sustainability performance via the mediation of the strategic decision comprehensiveness and the CEO's behavioral complexity. It extends and systematizes Tsui et al.'s (2017) findings on this intriguing CEO attribute. We hope this new concept of CEO reflective capacity is a meaningful addition to the literature on the upper echelons framework and contributes to intellectual conversations on the limits of bounded rationality in strategic decision-making process. This idea of reflective capacity may be particularly relevant in dynamic and complex environments where the cognitive capability of top executive might

be a competitive advantage for the long-term sustainability of both the firm and the society. To this end, we hope more CEOs will develop this reflective capacity to further the firms' long-term viability and their potential to be contributing institutions of the world community.

APPENDIX I

Confirmatory Factor Analysis for the Scale of Firm Sustainability Performance

<i>Items and Dimensions</i>	<i>CEO self-evaluation</i>		<i>Subordinate evaluation</i>	
	λ	<i>T-value</i>	λ	<i>T-value</i>
A. Environment-targeted				
1. Our company takes action to reduce pollution related to its activities (e.g., choice of materials, eco-design, and dematerialization).	0.83	14.47	0.83	15.94
2. Our company contributes toward saving resources and energy (e.g., recycling, waste management).	0.86	15.58	0.78	14.42
3. Our company makes investments to improve the ecological quality of its products and services.	0.69	11.16	0.62	10.55
4. Our company measures the impact of its activities on the natural environment (e.g., carbon audit, reduction of greenhouse gas emissions, global warming).	0.88	16.08	0.86	16.92
5. Our company encourages its members to adopt an eco-friendly behavior (sort trash, save water and electricity) to protect the natural environment.	0.89	16.18	0.87	17.15
B. Community-targeted				
6. Our company gives adequate contributions to charities.	0.85	14.98	0.85	16.76
7. Our company contributes to campaigns and projects that promote the well-being of the society.	0.86	15.43	0.90	18.38
8. Our company gives financial assistance to the poor and deprived in the areas where it operates.	0.85	14.98	0.90	18.34
9. Our company assists populations and local residents in case of natural disasters and/or accidents.	0.72	11.85	0.84	16.47
10. Our company encourages its employees to participate in voluntary activities.	0.74	12.36	0.74	13.54
C. Customer-targeted				
11. Our company respects consumer rights beyond the legal requirements.	0.84	14.09	0.78	13.46
12. Our company provides full and accurate information about its products to its customers.	0.87	14.85	0.71	11.95
13. Customer satisfaction is highly important for our company.	0.61	9.30	0.61	9.94
D. Employee-targeted				
14. Our company policies encourage the employees to develop their skills and careers.	0.74	12.12	0.66	11.54
15. The management of our company is primarily concerned with employees' needs and wants.	0.85	14.64	0.88	17.09
16. Our company implements policies that improve the well-being of its employees at work.	0.82	14.00	0.88	17.32
17. Our company promotes the safety and health of its employees.	0.71	11.34	0.70	12.33

Continued

<i>Items and Dimensions</i>	<i>CEO self-evaluation</i>		<i>Subordinate evaluation</i>	
	λ	<i>T-value</i>	λ	<i>T-value</i>
E. Shareholder-targeted				
18. Our company respects the financial interests of all its shareholders.	0.84	14.62	0.89	18.09
19. Our company ensures that communication with shareholders is transparent and accurate.	0.89	16.12	0.90	18.27
20. Our company takes action to ensure that shareholders' investments are profitable and perennial in the long-term.	0.89	16.06	0.91	18.63
21. Our company makes sure that shareholders exert effective influence over strategic decisions.	0.60	9.27	0.75	13.81
F. Short-term performance				
22. Our company performs well in profit-to-sales ratio.	0.86	14.95	0.86	16.64
23. Our company has a good return on assets.	0.81	13.77	0.86	16.58
24. Our company performs well in growth in sales.	0.77	12.71	0.85	16.46
25. Our company has good market share.	0.65	10.08	0.69	12.20
G. Long-term performance				
26. Our company has a good investment in new product development.	0.77	12.72	0.71	12.51
27. Our company emphasizes personnel development.	0.83	14.41	0.81	15.15
28. Our company emphasizes market development.	0.80	13.62	0.78	14.26
29. Our company has a plan for long-term strategies establishment.	0.80	13.49	0.75	13.54

Notes: λ is the coefficient of the completely standardized solution. CEO sample, $N=213$; Subordinate-executive sample $N=256$. Items 1, 2, 3, 4, 5, 8, 9, 16, 17, 18, 19, 20, and 21 were adapted from El Akremi et al. (2018). Items 7, 10, 11, 12, 13, 14, and 15 were adapted mainly from Turker (2009). Items 6 and 29 were adapted from Maignan and Ferrell (2000). Items 22, 23, 24, 25, 26, 27, and 28 were adapted mainly from Delaney and Huselid (1996).

NOTES

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[1] Quoted from an interview of Chaoyang Zhang by Shuo Qin. It was published in 'Change the World' (p. 82).

[2] Business Roundtable, <https://www.businessroundtable.org/business-roundtable-redefines-the-purpose-of-a-corporation-to-promote-an-economy-that-serves-all-americans>.

[3] The 246 CEOs are the same samples who completed the first-round survey in Study 2 (the hypotheses testing study). The data collection procedure and sample demographics are reported in the Sample section of Study 2.

- [4] The fit indices of the three-dimensional second-order CFA are the same as the three-dimensional first-order CFA, keeping other conditions consistent.
- [5] We did not include cognitive complexity due to the lack of an appropriate scale. It is generally measured by Bieri grid (e.g., Hitt & Tyler, 1991; Wally & Baum, 1994) and cognitive mapping (Calori et al., 1994), which are quite complex to complete.
- [6] Asking CEOs to invite their executives to participate is widely used in published papers with similar data structure, i.e., Ling et al., 2008.
- [7] Subsequent analyses reveal that the difference between the two sources and the difference between the participating executives and those that did not participate are not significant, showing no self-selection bias.
- [8] GRI (Global Reporting Initiative) Sustainability Reporting Standards are the first and most widely adopted global standards for sustainability reporting, <http://www.globalreporting.org/>. ESG (environmental, social, and governance issues) factors are implemented by Principles for Responsible Investment (PRI), supported by the United Nations, <https://www.unpri.org/>.
- [9] The list of items and detailed results are available upon request from the first author.
- [10] In Chinese government policy, SMEs are based on standards of firm size in number of employees and sales. This standard can be used in all types of ownership, not only the privately-owned firms. In our sample, over 70% of the samples are privately owned. The others may be state-owned or foreign-invested ventures.
- [11] To save the degree of freedom and guarantee the models' convergence, we did not put all the eight control variables into the structural models. Instead, only the ones which correlated with the dependent variable were used. The reported results of Hypothesis 2 included CEO duality and firm ownership as control variables, and results of Hypothesis 3 included CEO gender and CEO work diversity. We also checked the robustness of the mediating results with different sets of control variables, as well as without any control variable, and found the mediating results were consistent with that we reported. All results can be provided upon request from the first author.
- [12] We also used an aggregated executive-rated idea generation scale (Zhang & Bartol, 2010) as an alternative mediator, and the results give further support of Hypothesis 2. The result of this robustness test is available from the first author.

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