



Environmental Strategy, Institutional Force, and Innovation Capability: A Managerial Cognition Perspective

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Abstract

Despite the rising interest in environmental strategies, few studies have examined how managerial cognition of such strategies influences actual innovation capability development. Taking a managerial cognition perspective, this study investigates how managers' perceptions of institutional pressures relate to their focus on proactive environmental strategy, which in turn affects firms' realized innovation capability. The findings from a primary survey and three secondary datasets of publicly listed companies in China reveal that managers' perceived business and social pressures are positively associated with their focus on proactive environmental strategy, which consequently fosters innovation capability development. Moreover, state ownership and government administrative control weaken the impact of managerial focus on proactive environmental strategy on innovation capability. These findings have important implications for how managerial cognition supports environmental strategy and organizational capability building under the influence of institutional pressures and government intervention.

Keywords Proactive environmental strategy · Managerial cognition · Institutional pressure · Government intervention · Innovation capability · China

Introduction

Corporate social responsibility (CSR) has received growing attention from academia and practitioners in the past two decades, and one of the central issues has been environmental CSR (ECSR) (Flammer 2013; Wei et al. 2017). The deterioration of the natural environment has prompted various stakeholders, including governments, customers, and the public, to pay increasing attention to environmental

protection and sustainable development (Marquis et al. 2015). Facing such pressures, firms need to develop proper environmental strategies to reduce waste and protect the environment. Research in this field has primarily assessed the relationship between environmental strategy and firm performance (e.g., Dupire and M'Zali 2016; Wei et al. 2017; Wijethilake et al. 2016) and different moderators of this relationship (e.g., Christmann 2000; Dixon-Fowler et al. 2013).

Despite the growing interest, the business ethics literature on environmental strategy has two major research camps. First, the literature is divergent, falling into two distinct camps. One camp, primarily based on survey data, aims to understand managerial perceptions of environmental strategies and practices, such as green management (Shu et al. 2016), corporate environmentalism (Banerjee et al. 2003), proactive environmental strategy (Alt et al. 2015; Darnall et al. 2010; Menguc et al. 2010; Walker et al. 2014), corporate environmental ethics (Chang 2011), and corporate sustainability (Pedersen et al. 2016). The other camp uses secondary data to observe the realized outcomes of environmental activities, including corporate environmental responsibility (Kim et al. 2017), environmental information disclosure (Cheng et al. 2017), environmental legitimacy by media evaluation (Berrone et al. 2017), and environmental

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strategy outcomes (Lin 2012). However, because managers devise strategies based on their cognitions and perceptions (Gavetti 2005; Laamanen and Wallin 2009), it is critical to understand how such managerial cognition leads to actual outcomes of environmental strategies. Therefore, bridging the gap between managerial cognition of environmental strategy and its realized firm outcomes represents a promising avenue in ECSR research (Gröschl et al. 2017).

The second research gap pertains to how institutional forces affect managerial cognition of environmental strategy and its implementation. Institutions consist of regulative, normative, and cognitive elements, which create different types of pressures that affect managers' perceptions and cognition in strategy formation (Scott 1995). When devising environmental strategies, managers encounter business-related pressures from direct stakeholders in the market segment, including customers, suppliers, and competitors (Dupire and M'Zali 2016; Flammer 2013). They also face social pressures from entities in the nonmarket segment, including the government, NGOs, media, and public organizations (Buysse and Verbeke 2003; Zhao 2012). Given that emerging markets face massive institutional changes, institutional pressures are more salient in those markets (Shu et al. 2016). However, how managers' perceptions of institutional pressures relate to their focus on environmental strategy and consequent outcomes has been under-researched (Wei et al. 2017). Moreover, government intervention, a critical institutional factor in emerging markets, represents a major external source of risk and uncertainty that influences firms' strategic implementation (Chen et al. 2011; Faccio 2010; Wang and Xu 2011). Hence, how government intervention affects the implementation of environmental strategy is a unique issue related to ECSR that requires further investigation.

To fill these two research gaps, this study builds on the managerial cognition perspective to investigate how managers' perceptions of institutional pressure relate to their focus on proactive environmental strategy (PES) and consequently to realized innovation capability, and how government intervention moderates the relationship between managerial focus on PES and innovation capability. *Innovation capability* refers to the ability to transform available resources into new products and processes (Zhou et al. 2017). Environmental regulations push firms to consider new solutions, such as material substitution, recycling, refining manufacturing processes, and designing environmentally friendly products (Christmann 2000; Hart 1995), which makes innovation capability highly relevant. In particular, we use a survey to obtain information on managers' perceptions of institutional pressures and managerial focus on PES, and use archival data to collect information on innovation capability (i.e., patents) and government intervention. We choose China as our context, as its unique institutional environment provides a good opportunity to examine the interaction of institutional

forces and managerial cognition of environmental strategy (Marquis et al. 2015).

Our study aims to contribute to the business ethics and environmental strategy literature in several ways. First, we bridge two divergent camps in the ECSR literature by showing how managers' perceptions of institutional pressures relate to their cognition of environmental strategy and consequently realized innovation capability. Second, we contribute to the institutional perspective of ECSR research by examining the essential role of institutional forces in the formation and implementation of PES. Third, we focus on the under-examined but increasingly important context of China and show how managerial emphasis on environmental strategies transfers perceived institutional pressures into innovation capability; in doing so, we provide additional insights into how to enhance environmental strategy and firm innovation in emerging markets.

Theoretical Framework

Managerial Cognition and Environmental Strategy

The managerial cognition perspective emphasizes the role of managerial attention and interpretations of the internal and external environments in determining managers' strategic actions (e.g., Kaplan 2011; Rouleau 2005). According to Gavetti and Levinthal (2000), cognition refers to "a forward-looking form of intelligence that is premised on an actor's beliefs about the linkage between the choice of actions and the subsequent impact of those actions on outcomes." Managerial cognition, i.e., how managers notice and interpret changes in their organizational contexts, greatly shapes a firm's strategic decisions and actions (Kaplan 2011, p. 113). Managerial cognition is especially important in uncertain contexts, when managers use cognitive framing to reduce complexity and make sense of ambiguous signals from the environment (Rouleau 2005). Sensemaking describes the process by which managers, in the face of uncertainty and ambiguity, develop subjective representations of a firm's internal and external environments that allow them to construct intended strategic change and subsequent firm actions (Gioia and Chittipeddi 1991). Furthermore, managers use social interactions to convey their vision to others and attempt to influence other people's sensemaking and meaning construction; such a process is known as sensegiving (Gioia and Chittipeddi 1991). Through sensegiving, managers diffuse their individual sensemaking to all levels of employees, thus generating a collective sensemaking that aligns everyone's efforts toward the intended strategic directions and changes.

In the ECSR context, environmental strategy reflects how managers perceive the importance of environmental

protection and balance the costs and benefits of adopting environmental processes and technologies (Gröschl et al. 2017). Environmental strategy can be implemented in various areas, including product development, supply chain management, manufacturing processes, and product distribution for recycling waste products (Hart 1995). As managers vary in their perceptions of the importance of environmental management, firms differ significantly in their environmental strategies, ranging “from the most reactive postures to the most proactive ones” (Aragón-Correa 1998). Managers with a *reactive environmental strategy* only comply with environmental regulations and view environmental obligations as burdens, whereas managers with a *proactive environmental strategy* (PES) attempt to prevent the occurrence of environmental problems at earlier stages and integrate environmental considerations into their business strategies (Liu et al. 2015). Accordingly, we choose *managerial focus on PES* as our key construct.

In emerging markets, the institutional environment plays a critical role in shaping managers’ cognition and decisions in the formation and implementation of firm strategies (Scott 1995). First, the formation of PES depends heavily on managers’ sensemaking of the regulative and normative pressures in the institutional environment. The institutional environment varies greatly across different economies, especially between Western and Eastern countries (Liu et al. 2015). Thus, considering institutional pressures in Eastern societies helps knowledge extension in this field (Moon and Shen 2010). Second, when managers use sensegiving to implement PES, its efficacy is conditional on various institutional constraints, among which government intervention is one of the most salient factors (Zhou et al. 2017). Whereas the role of government in promoting and regulating economic development is well recognized, such intervention is much more prevalent in emerging markets (Wang and Xu 2011). Thus, we examine the relationship between managers’ perceptions of institutional pressures and their PES focus, and the moderating role of government intervention on the impact of managerial focus on PES on innovation capability.

Environmental CSR and Institutional Forces in China

Despite its rapid economic growth over the past 30 years, China has faced constant criticism due to its severe environmental problems such as air and water pollution, degeneration of natural habitats, and waste of nonrenewable resources (Shu et al. 2016). Most of China’s surface water is moderately polluted, parts of its river systems are heavily polluted, air pollution is serious, and its renewable resources have been heavily exploited (Fay et al. 2014). Such severe problems make environmental protection an increasing

concern for the Chinese government, the public, and business communities.

At the government level, more legislation and regulations have been passed to address environmental problems. The new Environment Protection Law that went into effect in 2015 is the strictest legislation in the environment sector. This new law states that all organizations and individuals have the obligation to protect the environment and that local governments must be held accountable for local environmental protection; accordingly, it introduces a series of punishments for environmental misconduct.¹ In the central government’s 13th Five-Year Plan for Economic and Social Development in 2016–2020, environmental protection is among the six priority tasks, the “Green Concept” is included in the Five Understandings of Development, and 16 environmental projects are listed in the 100 Major Projects of the Five-Year Plan. All of these initiatives indicate that the government is placing a much greater emphasis on environmental protection.

At the public level, environmental organizations and public media attention have grown rapidly. As of 2017, there were about 2065 nongovernment environmental organizations in China, ranging from social organizations to university associations, foundations, and international organizations.² Public organizations are endowed with a powerful tool to monitor environmental misconduct: environmental public interest litigation. As of April 2017, the courts have accepted 189 public environmental cases, 60% of which have been brought forward by environmental NGOs.³ Public media, including official media, social media, and online platforms, also play important roles in environmental education and communication. For example, the self-produced online documentary “Under the Dome” by the former journalist Jing Chai, which revealed the severity of air pollution in China, received over 20 million views within 48 h of posting.

At the firm level, companies are paying more attention to CSR. The new regulations require listed firms on the Corporate Governance Index and Shenzhen Stock Exchange 100 Index to issue CSR annual reports, and many private and state-owned firms now provide CSR reports voluntarily (Wei et al. 2017). Many companies have taken proactive environmental initiatives and engaged in green business projects, such as Bank of East Asia’s Green Credit Program, Standard Chartered’s Green Credit Policy, and China Pingan’s Low Carbon Action (Walker et al. 2014). Business leaders are participating in various forms of environmental protection.

¹ http://www.gov.cn/zhengce/2014-04/25/content_2666434.htm.

² <http://www.hyi.org.cn/go/index.php>.

³ <https://www.chinadialogue.net/blog/9715-Six-important-environmental-cases/en>.

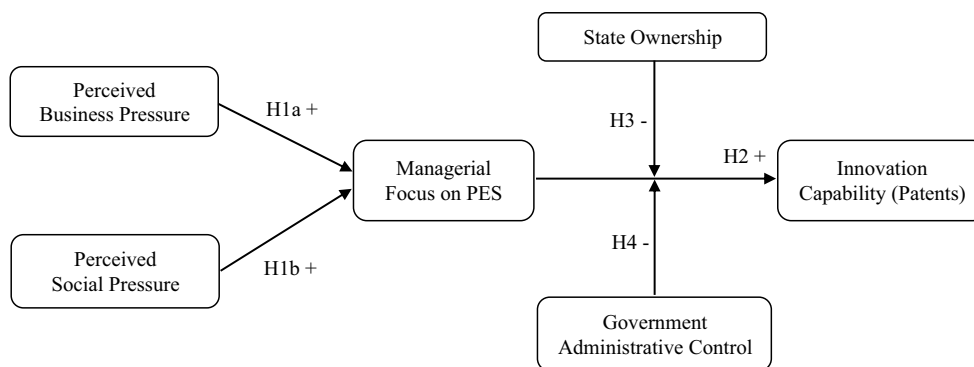


Fig. 1 Conceptual model

For example, the leaders of Alibaba and Tencent, Jack Ma and Pony Ma, jointly established the Paradise International Foundation, which aims to contribute to a better environment in China.⁴

Accordingly, when managers consider environmental strategies in China, they perceive two types of institutional pressure: *business pressure* from the *market* segment and *social pressure* from the *nonmarket* (i.e., governmental and public) segment. Formally, we define *perceived business pressure* as the pressure for environmental protection that managers face from market constituents such as suppliers, customers, competitors, and financial institutions, and *perceived social pressure* as the pressure for environmental protection that managers face from nonmarket constituents such as the government, media, and public organizations. Such perceived pressures reflect managers' sensemaking of institutional forces and likely relate to their focus on PES.

Meanwhile, government intervention is a critical factor that shapes the implementation of firm strategy (Shleifer and Vishny 1998). Governments intervene in economic activities to achieve political and social objectives such as generating job opportunities and maintaining social stability, which deviate from the profit-oriented and efficiency-driven goals of firms (Hao and Lu 2017). In China, the government controls a large portion of the country's resources and often regulates the market as a "grabbing hand" (Gao and Hafsi 2015). As a result, the government influences economic activities and firm operations in two major ways: via state ownership and administrative control (Shao et al. 2015). First, the government can directly influence the operations of state-owned enterprises (SOEs) by appointing top executives to run the company (Zhou et al. 2017). Due to the majority state share, SOEs are obliged to fulfill government objectives, and government-appointed executives are more motivated to meet government expectations above the

economic objectives of firms (Hao and Lu 2017; Li et al. 2018). Second, the government can indirectly affect firm operations through *administrative control*, which refers to the discretionary ability of local governments to devise and enforce policies and regulations via procedures and systems (Shao et al. 2015). Local governments in China are empowered to devise and enforce local business rules and policies, leading to varying levels of government intervention across regions (Gao and Hafsi 2015). Such administrative control greatly impacts the implementation of managers' sensegiving activities.

In summary, we build on the managerial cognition perspective to examine how perceived business and social pressures relate to managerial focus on PES and to consequently realized innovation capability, and how government intervention (i.e., SOEs and administrative control) affects strategy implementation by moderating the relationship between managerial focus on PES and innovation capability. Figure 1 depicts our conceptual model.

Hypotheses

Perceived Intuitional Pressure, Managerial Focus on PES, and Innovation Capability

We argue that perceived business pressure is positively associated with managerial focus on PES. When managers perceive strong business pressure, they must consider how to meet the expectations of market constituents and maintain the firm's business legitimacy (Wei et al. 2017). Demands from customers and suppliers raise managers' awareness about environmental issues (Pedersen et al. 2016). For managers, pressure from competitors increases the perceived importance of adopting environmental practices (Dupire and M'Zali 2016). Companies from developed countries also press their Chinese supply chain partners to increase PES practices (Walker et al. 2014).

⁴ <http://www.pfi.org.cn/>.

High business pressure also renders environmental strategy more imperative, as the negative consequences, such as loss of reputation or the image of being an irresponsible partner, are amplified if firms do not engage in environmental practices (Dupire and M'Zali 2016). Recognizing such negative outcomes, managers are more likely to consider adopting PES to survive and grow. However, when managers perceive low business pressure, they lack the motivation and diligence to pursue PES, lowering their attention and commitment to environmental strategy. Thus, we predict.

Hypothesis 1a Perceived business pressure is positively associated with managerial focus on proactive environmental strategy.

We also predict a positive association between perceived social pressure and managerial focus on PES. When managers perceive high environmental pressures from the government, media, and public organizations, they experience cognitive stress that leads them to engage in PES so as to obtain social legitimacy (Wei et al. 2017). Managers also need to communicate and interact with multiple stakeholders frequently to gain their support, which increases their awareness of the importance of PES (Gioia and Chittipeddi 1991; Zhao 2012). Facing pressures from public organizations and the media, managers have to pay close attention to environment-related information, which helps develop stronger commitment to PES (Wei et al. 2017).

Moreover, high social pressure has considerable environmental costs for firms, because failure to comply with the demands of government and the public can result in significant losses such as fines, penalties, and cleanup costs, in addition to negative brand image (Zhao 2012). Facing high social pressures, managers are more likely to view PES as a necessity, as it not only enables firms to gain legitimacy but also helps them to avoid losses (Berrone et al. 2013). However, when managers perceive weak regulatory pressure from the government and limited monitoring stress from the public, they may not consider PES a priority. Therefore, we predict.

Hypothesis 1b Perceived social pressure is positively associated with managerial focus on proactive environmental strategy.

We further argue that managerial focus on PES fosters a firm's innovation capability. When managers focus on PES, they are devoted to developing novel solutions to environmental problems (Sharma and Henriques 2005). Accordingly, they engage in sensegiving activities to cultivate a culture that encourages employees to proactively seek new methods, technologies, and management systems to achieve environmental objectives (Shu et al. 2016). When employees

seek new information and knowledge and pursue compliance technologies, firms engage in organizational learning, which facilitates the acquisition, dissemination, and assimilation of tacit knowledge and fosters innovation development (Hurley and Hult 1998). When employees are motivated to actively acquire new environmental knowledge and disseminate it throughout the organization, firms enlarge their knowledge breadth and depth and accordingly increase their innovative abilities (Zhou and Li 2012). When exposed to different views, employees are more likely to consider and try out different alternatives, thereby enhancing a firm's innovation capability (Shu et al. 2016).

Moreover, when managers focus on PES, they prompt the whole organization to search for new methods of pollution reduction and environmental protection by refining manufacturing processes and developing green products (Shu et al. 2016). The pursuit of environmental protection "requires changes in business models, appropriate technologies, scale of operations, organizational forms, and performance objectives" (Sharma and Henriques 2005, p. 160). Accordingly, managers must integrate pollution-prevention technologies into manufacturing processes and make full use of resource inputs to streamline processes with high levels of material and energy usage (Christmann 2000). Managers must also endeavor to develop new environmentally friendly products that minimize life-cycle costs and reduce waste disposal and pollution (Sharma and Henriques 2005). These efforts to upgrade and renew existing processes and products enhance a firm's innovation capability.

Hypothesis 2 Managerial focus on proactive environmental strategy positively affects a firm's innovation capability.

Moderating Effects of Government Intervention

We posit that the positive relationship between managerial focus on PES and innovation capability is weaker for SOEs than for non-SOEs. SOEs' operations are directly affected by government intervention through ownership control and senior executive appointment (Zhou et al. 2017). Managers of SOEs thus are obliged to achieve political and social objectives such as local employment and social stability, which often conflict with firms' economic objectives of value maximization and innovation development (Li et al. 2018). As a result, despite their focus on PES, SOE managers' attention is likely directed toward fulfilling government expectations, which lowers the impact of PES focus on innovation capability development.

More critically, even if SOE managers have a strong PES focus, they are less likely to invest significant resources into research and development (R&D), as their appointment and promotion are determined more by political connections than by managerial merits (Li et al. 2018; Xu and Zhang

2008). As a result, SOE managers likely prioritize the allocation of firm resources to fulfill government expectations, to secure their positions and increase their chances of promotion (Zhou et al. 2017). For example, Hao and Lu (2017) find that local governments tend to increase Chinese SOEs' investments in fixed assets and natural resources, which have a direct impact on short-term GDP growth, an important promotion criterion for local governmental officials. In contrast, R&D in new environmental technologies and innovation efforts are not attractive to SOE managers and local officials, due to the associated high uncertainty and long-term horizon (Berrone et al. 2013). This tendency to underinvest in R&D greatly reduces the implementation of PES in generating innovation outputs. Thus, we predict.

Hypothesis 3 The positive relationship between managerial focus on proactive environmental strategy and innovation capability is weaker for SOEs than for non-SOEs.

We further argue that administrative control weakens the positive relationship between managerial focus on PES and innovation capability. First, high administrative control is often associated with high probability of arbitrary intervention from local government officials, who are in charge of the enforcement of policies and regulations (Faccio 2010). With such discretionary power, local officials are likely to interfere in business operations for personal benefits such as rent seeking and insider trading. Under these circumstances, managers need to cultivate political connections, which shelter the firm from political risks (e.g., close monitoring) and legal uncertainties (e.g., tighter enforcement of existing regulations) (Berrone et al. 2013). However, cultivating political relationships inevitably consumes substantial firm and managerial resources, which diverts attention from implementing PES for successful innovation outputs.

Second, administrative systems with high control tend to be less efficient, overstuffed, and snarled in red tape (Shleifer and Vishny 1998). Such issues can slow down or even distort the implementation of PES. For example, the research and adoption of environmental technology often involves the invention of new designs and novel products and processes to reduce or eliminate the use and generation of hazardous substances (Berrone et al. 2013; Shu et al. 2016). Those environmental practices likely differ from existing industrial standards and require government support and endorsement (Walker et al. 2014). However, excessive administrative control would slow down such new initiatives and inhibit the implementation of PES to drive innovation outcomes.

Hypothesis 4 The positive relationship between managerial focus on proactive environmental strategy and innovation capability is weaker when government administrative control is higher.

Methodology

Research Design and Data Collection

To test our conceptual model, we used a primary survey and three archival data sources. For managerial perceptions and focus, we relied on a survey of top managers to obtain information. For innovation capability, we obtained patent information from the State Intellectual Property Office of China (SIPO). We collected information on firm ownership from the annual reports of the listed firms and information on administrative control from the National Economic Research Institute (NERI) index. By using separate information sources for antecedents, moderators, and dependent variables, we can effectively reduce common method bias (Podsakoff et al. 2003). We also lagged the patent information by 3 years to establish the causal relationship between managerial focus on PES and innovation capability.

For the sampled firms, we focused on industries with heavy influences on the environment, such as manufacturing, mining, water, and electricity (Sharma and Henriques 2005). We obtained the sampling frame of publicly listed firms in China from the Wind Financial Database. The sample included 935 firms listed on the Shenzhen and Shanghai Stock Exchange markets. We obtained the firms' basic demographic information, including their names, addresses, industries, total assets, and senior managers' names, from the database.

Following prior mailed survey studies targeting senior managers (e.g., Christmann 2000), we mailed the questionnaire, a cover letter, and a postage-paid return envelope directly to each senior manager. To increase the likelihood that the letters would reach the targets, we handwrote the addresses as though they were private letters (Christmann 2000). One and a half months later, we had received 136 response letters, representing a 14.5% response rate, which is comparable with prior firm-level survey research involving senior managers (e.g., Alt et al. 2015, Murillo-Luna et al. 2008). We collected the patent information from the SIPO. We dropped two incomplete questionnaires and eight observations for which patent information was unavailable, resulting in a final sample of 126 firms.

The 126 firms included 32 firms in the machinery industry; 30 in metal; 18 in petrochemicals; 11 in pharmaceuticals; ten in textiles; six in food and drink; six in paper and printing; four in electronics; five in water, electricity, and coal; and four in mining. The average total assets were RMB4.3 billion, ranging from RMB331 million to RMB28 billion.

We tested nonresponse bias by comparing the first third of the respondents with the last third in terms of firm characteristics (e.g., firm size) and focal constructs (e.g., Hult et al. 2005). The comparison results did not reveal significant

differences. Furthermore, we compared the responding and nonresponding firms with regard to their total assets and return on assets. The results did not reveal significant differences in either total assets ($t = .739, p > .10$) or return on assets ($t = .731, p > .10$). Thus, nonresponse bias is not a major concern for our study.

Measures

In our model, three constructs are managerial perceptions (i.e., managerial focus on PES, perceived business pressure, and perceived social pressure). We adapted these perceptual measures from prior studies (see the “Appendix”). The measures used a five-point Likert-type continuous scale. We developed the questionnaire in English and then translated it into Chinese using the back-translation technique (Brislin 1980).

We adapted the measure of *managerial focus on PES* from Sharma and Vredenburg (1998). Their original scale is comprehensive, consisting of ten dimensions with 95 items, yet many items pertain particularly to the Canadian oil and gas industry, and such a large number of items can lead to tediousness for respondents. Most recent environmental strategy studies use much smaller numbers of items (e.g., Chen et al. 2015; Menguc et al. 2010). For example, Chen et al. (2015) use a four-item measure that assesses a firm’s environmental management in goal setting, planning, quality control, and new product development. The scale of Menguc et al. (2010) includes two dimensions with seven items. To achieve a balance between comprehensiveness and parsimoniousness, we selected Sharma and Vredenburg’s (1998) items that are generalizable to different industries. As a result, we kept 20 items for eight dimensions and measured how managers perceive their PES on the eight dimensions and averaged their evaluations of these items such that a higher score indicated a stronger focus on PES.

We adapted the measures of *perceived business pressure* and *perceived social pressure* from Buysse and Verbeke (2003) to examine the pressure to deal with environmental protection initiatives within a firm’s strategic planning process. *Perceived business pressure* included pressure from customers, suppliers, industry rivals, and financial institutions. *Perceived social pressure* included pressure from nongovernmental organizations (NGOs), media, national (regional) governments, and local public agencies.

We obtained the information for our dependent and moderating variables from archival data sources. We measured *innovation capability* as the number of invention patent applications with a three-year time lag from the SIPO⁵

database. Because innovation takes time to develop, patent research normally uses a lag of 3–5 years to examine the effect of R&D input on actual outcomes (Ahuja and Katila 2001; Yayavaram and Chen 2015). According to Chinese patent law, there are three types of patents: invention, utility, and design. We used invention patent applications, which specifically refer to a new technical solution related to products or processes, or substantial improvement to existing ones (Zhou et al. 2017).

We coded *state ownership* as a dummy variable, SOE, that equals 1 if the ultimate controller is the central or local state government agencies, and 0 otherwise (Zhou et al. 2017). We obtained information on ownership from the annual reports of the listed firms.

We obtained information on *administrative control* from the provincial marketization index in China, developed by the National Economic Research Institute since 2001 (Fan et al. 2011). The index, consisting of five dimensions, is widely used to study the Chinese institutional environment (e.g., Shao et al. 2015; Zhou et al. 2017). We measured administrative control as the average of the two indicators under the “government-market relationship” dimension: (1) government intervention in business-related administration procedures and (2) government employment relative to provincial population. We assigned scores to listed firms based on their registration address at the provincial level.

Control Variables

We considered several control variables. At the firm level, smaller and medium-sized firms may lack the resources to address environmental issues, so we included *firm size* as the natural logarithm of a firm’s total assets in RMB. We also controlled for *firm age* as the natural logarithm of a firm’s operating age.

At the industry level, we controlled for *industry concentration* as low (1), medium (2), or high (3) on the basis of evaluations by senior managers, as industry concentration may affect the monitoring of competitive behaviors (Dupire and M’Zali 2016). We also controlled for the effect of industry type with four dummy variables: *machinery*, *metal*, *petrochemical*, and *pharmaceutical*, using *others* as the baseline group. Table 1 provides the descriptive statistics of the variables and bivariate correlation coefficients.

Construct Validity

We used confirmatory factor analysis to test the validity of our perceptual measures. The model fit the data satisfactorily ($\chi^2 = 183.30, df = 101; CFI = .94, IFI = .94, NNFI = .93; RMSEA = .08$), and all of the factor loadings were highly significant ($p < .001$). All of the values for composite reliability (CR) were above .70, and all of the values for average

⁵ According to the Derwent Innovation Index, most patent applications of Chinese listed firms are filed within China, so we did not include patent applications in foreign countries.

Table 1 Descriptive statistics and correlations

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Innovation capability (patents)													
2. Managerial focus on PES	.24**												
3. Perceived business pressure	.16	.24**											
4. Perceived social pressure	.15	.31**	.32**										
5. State ownership	-.15	.10	-.06	.16									
6. Administrative control	-.13	.04	.03	-.04	.24**								
7. Firm size	.09	.06	-.05	.07	.25**	-.05							
8. Firm age	-.25**	-.02	.08	-.05	.02	-.10	.05						
9. Industry concentration	.00	.19*	-.04	-.12	-.01	-.04	-.04	.10					
10. Petrochemical	.09	.00	-.04	-.10	-.09	.11	.01	.04	-.08				
11. Metal	.01	.11	-.08	-.01	.16	.15	.33**	.09	-.03	-.23*			
12. Machinery	.11	-.19*	-.03	-.09	-.10	-.24**	-.25**	-.17	.05	-.24**	-.32**		
13. Pharmaceutical	-.02	.13	.12	.17	.08	-.17	-.03	.17	-.06	-.13	-.17	-.18*	
Mean	6.25	3.86	3.15	3.65	.71	.01	21.40	2.46	2.31	.14	.24	.25	.09
SD	16.38	.54	.63	.77	.46	2.44	.91	.27	.71	.35	.43	.44	.28

* $p < .05$; ** $p < .01$ (two-tailed); $N = 126$

Table 2 Standardized coefficients of mediating analysis

Dependent variable	Managerial focus on PES		Innovation capability (patents)			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
<i>Controls</i>						
Firm size	-.00 (.06)	-.02 (.05)	.12 (1.67)	.12 (1.62)	.12 (1.64)	.12 (1.62)
Firm age	-.11 (.18)	-.11 (.17)	-.27** (5.54)	-.24** (5.42)	-.27** (5.46)	-.25** (5.42)
Industry concentration	.23 [†] (.07)	.27** (.06)	.05 (2.03)	-.01 (2.02)	-.07 (2.00)	-.02 (2.06)
Petrochemical	.04 (.15)	.09 (.15)	.19 [†] (4.64)	.18 [†] (4.51)	.22* (4.57)	.20 [†] (4.53)
Metal	.12 (.14)	.16 (.13)	.12 (4.11)	.09 (4.01)	.15 (4.04)	.12 (4.02)
Machinery	-.15 (.13)	-.11 (.12)	.20 [†] (3.92)	.24* (3.84)	.22* (3.86)	.24* (3.82)
Pharmaceutical	.16 (.18)	.12 (.17)	.11 (5.59)	.07 (5.50)	.09 (5.51)	.06 (5.47)
<i>Independent variable</i>						
H1a: Perceived business pressure		.17* (.08)			.17* (2.34)	.14 [†] (2.35)
H1b: Perceived social pressure		.26** (.06)			.12 [†] (1.95)	.07 (1.99)
H2: Managerial Focus on PES				.25** (2.71)		.19* (2.89)
R^2	.11	.23	.12	.15	.17	.20

Standard error in parentheses

[†] $p < .10$; * $p < .05$; ** $p < .01$; $N = 126$

variance extracted (AVE) were greater than .5 (see the “Appendix”). Our latent constructs thus possessed adequate convergent validity (Fornell and Larcker 1981). We tested discriminant validity by examining whether the AVEs of the latent variables were greater than the squared correlations between the latent variables. Table 1 shows the correlations between the latent constructs. All of the AVEs were larger than the squared correlations between the latent variables. Thus, our latent constructs displayed acceptable discriminant validity (Fornell and Larcker 1981).

Analyses and Results

We examined our hypotheses with two sets of regressions. First, we tested the relationships among perceived business/social pressure, managerial focus on PES, and innovation capability, and enhanced the test with the mediating analysis (Table 2). Second, we examined the moderating role of state ownership and administrative control on the relationship between managerial focus on PES and innovation capability (Table 3). To mitigate potential multi-collinearity, we

Table 3 Standardized coefficients of moderating analysis

Dependent variable	Innovation capability (patents)			
	Model 1	Model 2	Model 3	Model 4
<i>Controls</i>				
Firm size	.15 [†] (1.64)	.12 (1.63)	.13 (1.62)	.09 [†] (1.61)
Firm age	-.25** (5.35)	-.23** (5.30)	-.27** (5.27)	-.25** (5.21)
Industry concentration	-.02 (1.99)	-.03 (1.96)	-.01 (1.96)	-.02 (1.92)
Petrochemical	.17 [†] (4.44)	.15 (4.40)	.20* (4.38)	.17 [†] (4.33)
Metal	.11 (3.95)	.11 (3.88)	.13 (3.88)	.13 (3.81)
Machinery	.20* (3.88)	.21* (3.81)	.22* (3.81)	.23* (3.74)
Pharmaceutical	.06 (5.51)	.05 (5.42)	.06 (5.40)	.05 (5.30)
<i>Independent variable</i>				
State ownership (SOE)	-.17* (3.20)	-.19* (3.16)	-.16* (3.14)	-.18* (3.09)
Administrative control (control)	-.11 (.61)	-.11 (.60)	-.15* (.62)	-.15* (.60)
Managerial focus on PES	.27** (2.66)	.51** (4.16)	.25** (2.63)	.49** (4.08)
H3: Managerial focus on PES × SOE		-.30* (5.24)		-.31** (5.13)
H4: Managerial focus on PES × control			-.20* (1.14)	-.21** (1.12)
<i>R</i> ²	.22	.25	.25	.29

Standard error in parentheses

[†] $p < .10$; * $p < .05$; ** $p < .01$; $N = 126$

mean-centered the variables before creating the interaction terms (Aiken and West 1991).

Mediating Analysis

Hypothesis 1 proposes a positive relationship between perceived business/social pressure and managerial focus on PES. Model 2 in Table 2 shows that both perceived business pressure ($b = .17$; $p < .05$) and perceived social pressure ($b = .26$; $p < .01$) are positively associated with managerial focus on PES. These results support Hypothesis 1a and Hypothesis 1b.

Hypothesis 2 predicts a positive effect of managerial focus on PES on innovation capability. Model 4 in Table 2 shows that managerial focus on PES has a significant positive effect on patents ($b = .25$; $p < .01$), in support of Hypothesis 2.

Collectively, Hypotheses 1 and 2 suggest the mediating role of managerial focus on PES in the relationship between perceived pressures and innovation capability. According to Baron and Kenny (1986), four conditions must hold for the mediating effect: (1) perceived business/social pressure must relate to innovation capability; (2) perceived business/social pressure must also relate to managerial focus on PES; (3) managerial focus on PES must relate to innovation; and (4) when the mediator enters the model, the coefficient of perceived pressures becomes either nonsignificant for full mediation or less significant for partial mediation.

As Model 5 shows, both perceived business pressure ($b = .17$; $p < .05$) and social pressure ($b = .12$; $p < .10$) are positively associated with innovation capability, satisfying

condition 1. Model 2 indicates that perceived business pressure ($b = .17$; $p < .05$) and social pressure ($b = .26$; $p < .01$) positively relate to managerial focus on PES (i.e., H1a and H1b), satisfying condition 2. In Model 4, managerial focus on PES is positively related to innovation capability (i.e., H2; $b = .25$; $p < .01$), satisfying condition 3. In the full model (Model 6), the effect of perceived business pressure became smaller and only marginally significant ($b = .14$, $p < .10$) and the effect of perceived social pressure became nonsignificant ($b = .07$, $p > .10$), satisfying condition 4. Therefore, managerial focus on PES partially mediates the effect of perceived business pressure and fully mediates the impact of perceived social pressure on innovation capability.

Moderating Analysis

Hypothesis 3 states that state ownership negatively moderates the effect of managerial focus on PES on innovation capability. Model 4 in Table 3 shows that the interaction between managerial focus on PES and SOE has a significantly negative effect on innovation capability ($b = -.31$; $p < .01$), supporting Hypothesis 3. We depict the interaction effects following the methods suggested by Aiken and West (1991). Figure 2a shows that managerial focus on PES has a weaker positive effect on innovation capability for SOEs ($b = 4.70$, $p < .01$) than for non-SOEs ($b = 10.97$, $p < .001$).

Hypothesis 4 states that administrative control negatively moderates the relationship between managerial focus on PES and innovation capability. Model 4 in Table 3 shows that the interaction between managerial focus on PES and administrative control has a significantly negative effect

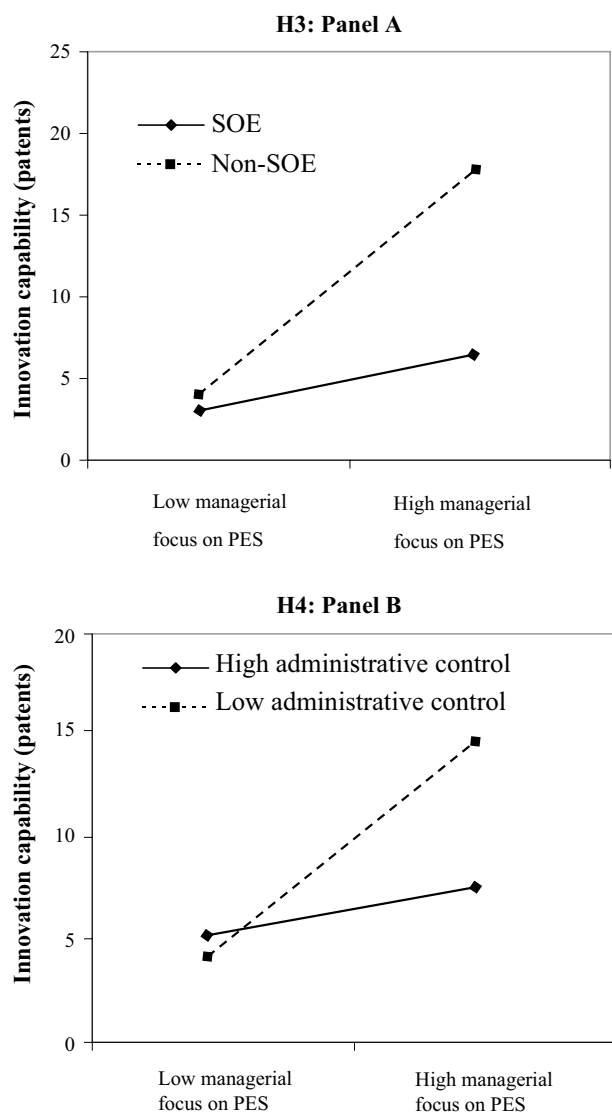


Fig. 2 Interaction effects

on innovation capability ($b = -.21$; $p < .01$), supporting Hypothesis 4. Figure 2b shows their relationships when administrative control is high and low (one standard deviation from the mean). As shown in the panel, managerial focus on PES has a weaker positive effect on innovation capability when administrative control is high ($b = 4.09$, $p < .05$) rather than low ($b = 8.68$, $p < .001$).

Effects of Control Variables

Among the control variables, industry concentration is positively associated with managerial focus on PES, which suggests that managers in more competitive markets tend to focus less on environmental strategies. Firm age and SOE are negatively related to patent applications, signaling that older firms and SOEs have lower innovation capability.

Firms in the petrochemical and machinery industries tend to have more patent applications.

Additional Analysis

We also tested the impact of PES focus on patents with one-year and two-year lags; the results were not significant, which is consistent with notion that innovation development is a long-term effort and a lag of 3–5 years is necessary for patent research (Ahuja and Katila 2001; Yayavaram and Chen 2015).

To account for the possibility that patent outcomes may not be fully observed in the third year, we collected patent information in the fourth and fifth years and added them to the patent information from the third year. We reran our analyses using this three-year composite innovation measure and obtained highly consistent results. For the mediation test, the effects of both perceived business pressure and social pressure on innovation capability changed from significant ($b = .11$, $p < .10$; $b = .16$, $p < .05$) to nonsignificant ($b = .08$, $p > .10$; $b = .10$, $p > .10$) when we added managerial focus on PES. For the moderation test, the interaction between managerial focus on PES and SOE remained significantly negative ($b = -.27$, $p < .05$), as did the interaction between managerial focus on PES and administrative control ($b = -.18$, $p < .05$). Thus, our results are robust to innovation measures with different time frames.

Discussion

Building on the managerial cognition perspective, our study has examined how managers' perceptions of institutional pressures relate to their focus on PES and consequently realized innovation capability, and how government intervention moderates the relationship between managerial focus on PES and acquired innovation capability. Our findings show that managers' focus on PES transforms their perceived business and social pressures into their firm's innovation capability. Moreover, government intervention (i.e., state ownership and administrative control) weakens the positive relationship between managerial focus on PES and innovation capability. Our findings make three contributions to the literature.

First, our study significantly enhances the business ethics literature on environmental strategy by revealing how managers' perceptions of institutional pressures relate to their focus on PES, which in turn fosters actual innovation capability development. The extant literature is divergent, with one camp focusing on managers' perceptions of environmental strategies (e.g., Alt et al. 2015; Pedersen et al. 2016; Wijethilake et al. 2016) and the other on the realized outcomes of environmental practices (e.g., Berrone et al. 2017; Kim et al. 2017; Lin 2012). Our study bridges these

two camps by revealing that managers' perceptions of business/social pressures set off their focus on proactive environmental strategy, which in turn fosters the firm's innovation capability.⁶ Our findings suggest that managerial cognition has strong implications for capability building, through managers' sensemaking of institutional pressures to devise environmental strategic decisions and their sensegiving to motivate the whole organization to achieve intended strategic objectives such as innovation. As such, our study also echoes the recent call from business ethics studies for more empirical investigations into the role of managerial cognition in CSR (Eggers and Kaplan 2013; Gröschl et al. 2017).

Second, our study contributes to the business ethics literature by examining how institutional forces interact with managerial cognition in PES formation and implementation. Prior business ethics studies have mainly looked at how institutional forces such as external pressures and government intervention directly affect firm strategies and performance (e.g., Dupire and M'Zali 2016; Peng and Lin 2008). Extending this line of research, our findings show that managers' perceptions of institutional pressures are associated with their focus on PES, which in turn transfers perceived pressures into realized innovation development. These findings highlight the role of managerial perception and cognition associated with PES in transforming perceived business/social pressures into the driving force for firm innovation. Additionally, we have examined two types of government intervention: state ownership and administrative control. Our results show that the positive impact of managerial focus on PES on innovation capability is weaker for SOEs than for non-SOEs, and when administrative control is higher. Business ethics studies have investigated the direct and moderating impact of firm ownership on driving ethical behaviors and strategies (e.g., Fallner and zu Knyphausen-Aufseß 2016; Li and Lu 2016), and also the important role of regional development in facilitating or inhibiting such relationships (e.g., Cheng et al. 2017; Li and Zhang 2010). Extending prior research, our findings explicate how institutional forces interact with managerial cognition of environmental strategies to affect firms' innovation capability building.

Third, this study enriches the environmental strategy literature in the challenging context of the Chinese emerging market, in which rapidly changing social, political, and legal institutions pose severe challenges to organizational survival (Wei et al. 2017). Extending prior studies based on the Western context (e.g., Dixon-Fowler et al. 2013), our findings show the positive role of managerial focus on PES in China and further reveal the important roles of institutional forces in capability building. In a review of 68 environmental strategy studies, Liu et al. (2015) find that institutional pressures,

as opposed to internal manager mindsets, have a stronger effect on environmental strategies in China than in Western countries and that the economic returns of environmental strategies are also stronger in China. Adding to this line of enquiry, our findings suggest that managers' perceptions of institutional pressures relate to managerial focus on PES, which in turn develops their firm's innovation capability. Overall, these findings suggest the importance of considering managerial cognition of environmental strategy and institutional forces in emerging markets.

Managerial Implications

Our findings also carry important ethical and practical implications for environmental protection in China. Although managers often view environmental responsibility as a burden to shoulder and react passively to environmental requirements, our findings reveal a positive impact of managerial cognition on PES. By emphasizing strategic initiation and change in terms of environmental management, such managerial cognition helps develop strong innovation capability. As such, managers should view pursuing environmental responsibility as an opportunity to develop organizational capabilities and create unique competitive advantages. For example, China National Petroleum Corporation (CNPC) has benefited greatly from its environmental initiatives. To reduce energy use and pollution, CNPC managers decided to invest significant resources into developing new oil collection technologies, which not only helped protect the environment but also contributed to greater economic returns through improved innovation capability.⁷ Thus, managers should focus more on the benefits of PES in developing innovation capabilities, rather than only its costs.

Moreover, managers should understand the dual roles of institutional forces. Whereas managers often view institutional pressures as liabilities that they have to comply with, such pressures actually stimulate managers' awareness of and commitment to environmental issues, which in turn foster innovation. Thus, when facing either business pressure from the market segment or social pressure from the non-market segment, managers should be proactive in dealing with environmental issues and converting these pressures into driving forces for innovation development. Furthermore, managers should be alert to the adverse consequences of government intervention in PES implementation. SOE managers need to balance their attention and commitment between political expectations and firms' economic objectives. In areas where government administrative control is high, managers should actively look for other external

⁶ We would like to thank a reviewer for suggesting this insight.

⁷ <http://news.cnpc.com.cn/system/2008/04/07/001167500.shtml>.

sources of support and endorsement, such as building strategic alliances (Huang and Li 2017; Sadovnikova and Pujari 2017) to facilitate PES implementation.

Our findings also suggest that policymakers should formulate policies that raise managers' awareness of environmental protection, and more importantly, frame compliance with environmental policies as an opportunity for innovation development. Policymakers should also increase the environmental awareness of various constituencies. In the business sector, policymakers can set product standards to increase customers' demands for green products, initiate regulations that facilitate environmental cooperation between value chain partners, and encourage financial institutions to give priority to environmentally responsible firms. In the social sector, policymakers should increase the power of governments, public agencies, and media in monitoring environmental practices, disclosing needed information, developing reward and punishment systems for environmental impacts, providing necessary training and supports, etc. Such policies could empower constituents to regulate firm behaviors, increase managerial cognition in adopting environmental practices, and eventually help firms develop strong innovation capability.

Moreover, policymakers should ensure that government objectives lean more toward market-oriented goals, and encourage the appointment and evaluation of SOE managers based on merit. Policymakers should also endeavor to reduce arbitrary government intervention in economic activities, such as improving the efficiency of administrative procedures and avoiding overstaffing in local government and authority agencies. These efforts would support firms' implementation of environmental strategies to enhance innovation outputs. Overall, our findings suggest the importance of stimulating a collective effort from the government, the public, business communities, and managerial agents to foster effective environmental protection.

Limitations and Further Research

Our study has several limitations. First, although we use both primary and secondary data sources with a lagged dependent variable, our research design only captures a snapshot. The

interplay of managerial cognition of environmental strategy and institutional forces is complicated and dynamic (Gröschl et al. 2017). A longitudinal design is necessary to assess it fully. Second, we only focus on innovation capability as the outcome of managerial focus on PES. Future research could examine other types of capability, such as marketing and operations; other types of outcomes, such as process innovation; and employees' performance. Similarly, we have only considered the moderating role of government intervention. It is worthwhile to examine how other types of institutional factors, such as dysfunctional competition and legal inefficiency, interact with environmental strategies (Wei et al. 2017). Third, our sample consists of Chinese listed companies. As listed firms are under strong regulation and public inspection, and as China is an emerging economy with unique features, we should be cautious about generalizing our findings to other contexts. Future research should examine our theoretical framework with reference to private firms and in other countries.

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Compliance with Ethical Standards

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Appendix: Measurement Scales

Constructs	Factor loadings
Perceived business pressure (Buisse and Verbeke 2003) (CR = 0.82, AVE = 0.61)	
Customers influence our environmental issues management	0.86
Suppliers influence our environmental issues management	0.77
Industry rivals influence our environmental issues management	0.71
Financial institutions influence our environmental issues management	0.60
Perceived social pressure (Buisse and Verbeke 2003) (CR = 0.83, AVE = 0.66)	
Non-governmental organizations influence our environmental issues management	0.75
Media influence our environmental issues management	0.90
National (regional) governments influence our environmental issues management	0.74
Local public agencies influence our environmental issues management	0.85
Managerial focus on PES (Sharma and Vredenburg 1998) (CR = 0.87, AVE = 0.61)	
To what extent has your company modified its manufacturing process to reduce the purchase of nonrenewable materials and chemicals input?	0.68
To what extent has your company reduced its use of traditional fuels by substituting fuels that create less environmental pollution?	0.61
To what extent has your company modified its manufacturing process to reduce energy use?	0.69
To what extent has your company reduced wastes and emissions from operations as a result of the following actions?	0.83
★Processed modifications to reduce waste at source	0.76
★Implemented new technology to reduce wastes	0.82
★Invested in pollution/emission control equipment	0.78
★Built recycling programs	0.76
★Modified materials and products	0.60
To what extent has your company undertaken the following actions to reduce the environmental impact of its products?	0.68
★Reduced production of or eliminated or replaced a product harmful to the environment	0.76
★Reduced product packaging	0.82
★Introduced recyclable packaging	0.85
★Acquired one ecological certification	0.72
To what extent has your company undertaken the following actions to reduce the risk of environmental accidents, spills, and releases?	0.81
★Invested in equipment and control system	0.85
★Trained employees and local communities in emergency response procedures	0.84
★Made fundamental changes to design of processes or products	0.84
To what extent has your company established partnerships to reduce its environmental impact?	0.79
★Established environmental standards for products, processes, operations, and materials with environmental groups, suppliers, distributors, and other companies	0.75
★Entered into agreements with other companies to process wastes	0.81
★Established consultative councils with local communities/governments and environmental groups	0.88
To what extent has your company undertaken the following actions to reduce environmental impact?	0.79
★Initiated employee training programs on environmental issues	0.93
★Participated in comprehensive environmental audit of business practices and manufacturing processes	0.93
Notes: CR = composite reliability; AVE = average variance extracted	

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