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DOI:

[10.1016/j.jenvman.2019.04.050](https://doi.org/10.1016/j.jenvman.2019.04.050)

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Document Version

Peer reviewed version

Citation for published version (Harvard):

Liu, T, Liang, D & Zhang, Y 2019, 'The antecedent and performance of environmental managers' proactive pollution reduction behavior in Chinese manufacturing firms: insight from the proactive behavior theory', *Journal of Environmental Management*, vol. 242, pp. 327-342. <https://doi.org/10.1016/j.jenvman.2019.04.050>

[Link to publication on Research at Birmingham portal](#)

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Checked for eligibility: 01/05/2019

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The antecedent and performance of environmental managers' proactive pollution reduction behavior in Chinese manufacturing firms: Insight from the proactive behavior theory

ABSTRACT

This paper contributes to our understanding of how to improve manufacturing firms' green operations underpinned by the proactive behavior theory. Chinese manufacturing firms are focused on because of their significant impact on global climate change and distinctive governance structure. Specifically, we survey 155 highest-level environmental managers (EMs) in these firms who have an ultimate decision-making power on environmental issues, and investigate the antecedents and consequence of their proactive pollution reduction behavior (PPRB). Through identifying the psychological motivation implied in EMs' environmental management behavior, we find that both EMs' role breadth self-efficacy (including in-role self-efficacy and extra-role self-efficacy) and felt responsibility (including felt responsibility establishment and felt responsibility coordination) can improve their PPRB. Further, available resources in firms only positively moderate the impact of extra-role self-efficacy on PPRB, and incentives from external stakeholders only moderate the impact of felt responsibility establishment on PPRB. Our empirical results also confirm that PPRB can improve corporate operational performance, strategic competitiveness, and environmental performance, but a higher level of PPRB's performance comes more from the driving force of PPRB's antecedents rather than PPRB itself.

Keywords: green operations, Chinese manufacturing firms, psychological motivation, contextual factor, proactive pollution reduction behavior, environmental manager

1. Introduction

The received wisdom indicates that the worsening natural environment is largely caused by the less climate-friendly industrial operations, especially in the manufacturing sector (Burrell, 2005; Pinkse and Kolk, 2012). Prior studies analyzed how to improve firms' green operations (GO) through the effective policy instrument that focuses on the compliance of threshold environmental standard and organization that develops voluntary environmental programs, e.g. the EPA's 33/50 program (Arora and Cason, 1995). As a result, an increasing number of manufacturers are attempting to undertake more environmental

responsibilities, and the promoter of GO is shifting from the government to manufacturers themselves in developing countries. In practice, the personnel who is with primary responsibility in environmental issues is positioned as the environmental manager (EM) based on [Cordando and Frieze \(2000\)](#). That is, EMs' main duty is to promote business operations to be more climate-friendly. The remarkable progress at the policy level is that governments began to emphasize the driving effect of managers' psychological motivation in enhancing the effectiveness of environmental regulations ([Campbell, 2007](#); [Etzion, 2007](#); [Papagiannakis and Lioukas, 2012](#)). Since around 2000s, jointly driven by firms' operation demands and external pressures, researchers began to focus on firms' proactive environmental management behavior (PEMB), including proactive environmental strategy ([Aragón-Correa and Sharma, 2003](#); [Aragón-Correa and Rubio-López, 2007](#)) and environmental proactivity ([González-Benito and González-Benito, 2005, 2006](#); [Calza et al., 2016](#); [Primc and Čater, 2016](#)), to advocate voluntarily reducing the negative impact of their operations on the natural environment.

There is a growing research interest in PEMB as well as its antecedents and consequence. It has been assumed that managers' proactive behavior may contribute to environmental performance. However, the complexity of GO requires further studies on whether these antecedents can lead to the expected effect in practice, especially in countries with significant impacts on global climate change. [Winkel et al. \(2009\)](#) identified theoretical and methodological challenges in the field of environmental psychology. At the level of theoretical development, multidisciplinary theories are urgently needed to explain the issue related to environmental management. As the essence of environmental management lies in the people-environment relationship, recent studies have put more emphasis on how to embed individual perception into physical, economic, and social factors. At the level of measurement design, more possible moderating or mediating processes need to be developed to expand the analysis on how context-related factors affect person-environment relation. Our research addresses such theoretical and methodological knowledge gaps in exact terms. Another important study on the antecedent of PEMB identified that the analysis of internal and external driving forces of firms' proactive environmental strategies will help top managers to more efficiently develop pro-social behaviors ([Menguc et al., 2010](#)). The review of recent literature on environmental management enlightens us to examine how psychological motivation and critical contextual factors can promote firms' GO in some situations where need an urgent improvement, i.e. in China. Further, some manufacturers in industrialized

countries are evading GO because this practice may not bring the expected performance, especially the performance related to business competitiveness (Earnhart and Lizal, 2006; Lioui and Sharma, 2012). Accordingly, both governments and manufacturers need to understand what environmental management can actually bring to firms, thereby improving environmental policy or firms' operations in an effective way. In sum, the significance of analyzing antecedent and performance of PEMB is that the resultant theoretical model can help decision-makers to attach great importance to EM's psychological motivation and guide them to make more efficient GO decisions.

With respect to the recent research trend on PEMB, some empirical studies designed PEMB as an independent variable and accordingly examined its impact on firm performance (González-Benito and González-Benito, 2005; Graham and Potter, 2015). Some conceptual work positioned EMs' attitudes (or values/perceptions) as an antecedent of their PEMB, but less focused on specific types of psychological motivation (González-Benito and González-Benito, 2006; Gavronski et al., 2012). Some studies examined the impact of specific motivation (e.g. competitive and ecological motivations, and self-concordance) on environmental proactivity or pro-environmental behaviors (Walker et al., 2014; Unsworth and McNeill, 2017), but they did not structure hypothetical models within a robust theoretical boundary in the field of individual psychology. Recent studies revealed the complex relation between GO and firm performance (Gimenez et al., 2012; Esfahbodi et al., 2016; Wijethilake, 2017). In the same line of development, other recent studies analyzed how to develop the strategic capability for GO practice through using managers' environmental proactivity as a generic moderator (Liu et al., 2017). Lack of focus on the antecedent of PEMB underpinned by the mature theory related to psychology or organizational behavior suggests a need to develop a dialogue that links different literature bodies to possibly generate a comprehensive view for GO from the angle of EMs' environmental psychology.

This paper focuses on Chinese manufacturing firms because of the significance of their environmental management practices to mitigate global climate change and their distinctive governance structures. In 2013, the amount of China's CO₂ emissions reached 10 billion tons that exceeded the total of US and EU (Friedlingstein et al., 2014). In this case, improving manufacturers' GO mode is broadly recognized as a critical way to promote China's green economy. We also note the distinctive governance structure of Chinese manufacturers and their top managers' code of conduct for GO are different from Western firms. Major shareholders who have connections to the government often have a significant impact on critical

decisions related to GO because of the widespread state-owned property of Chinese manufacturers. Additionally, these top managers have a high degree of obedience to established rules or policies when organizing social activities (Smith et al., 1996; Liu, 2005). Nevertheless, existing studies on PEMB in firms is mainly drawn on the empirical evidence from industrialized countries, and little attention was paid to role of EMs' motivation in promoting PEMB. It is fairly evident that understanding EMs' psychology is both theoretically and practically valuable for achieving better GO performance in China.

To address this research challenge, this paper integrates critical psychological motivation, contextual factor, behavioral process, and behavioral performance into one conceptual framework guided by the proactive behavior theory that will lead us to understand how EMs' psychological motivation affect the proactivity of their environmental management behavior and what PEMB can bring to manufacturers. Specifically, it has been argued that PEMB in firms is always jointly driven by their internal available resources (IAR) and incentives from external stakeholders (IES) (González-Benito and González-Benito, 2006). Accordingly, the process of EMs' psychological motivation evolving into actual PEMB is likely to be affected by these critical contextual factors. Ates et al. (2012) set the organizational commitment as a primary antecedent of proactive environmental strategy and suggested future research on identifying EMs' motivation. Integrating limitations of prior studies, this paper selects the pollution reduction as the targeted research setting because this activity is usually the core link of environmental management in manufacturing firms, and a comprehensive planning for pollution reduction issues will largely promote GO process. Specifically, within the conceptual framework of the proactive behavior theory, this paper surveys top-level EMs who also have the supreme decision-making power in environmental issues in Chinese manufacturing firms, to analyze the impact of EM's psychological motivation on their proactive pollution reduction behavior (PPRB) under the moderating effect of critical contextual factors. Further, this paper analyzes the impact of PPRB on firms' multiple performance to present the actual significance of this behavior in China's context.

In doing so, this paper is in a position to make following contributions to the GO literature. First, this paper expands the scope of antecedents of PEMB, which helps to better understand the difference in the environmental management status among firms. Specifically, this paper theoretically and empirically analyzes EMs' psychological motivation to be a core antecedent of forming their PPRB. Compared with prior studies, this paper closely links psychological elements and PEMB, which is an essential view for

China where is with a sharp conflict between economic growth and environmental protection as well as a generally weak green perception of manufacturers. Second, prior studies overemphasized the role of macro-policies in firms' environmental management but less focused on the initial driving effect of EMS' psychological motivation. It may lead to a cognitive misunderstanding in social groups that pollution reduction performance more relies on governments' leadership than manufacturers' initiatives. This paper sets contextual factors of firms as the moderating variable between EMS' psychological motivation and PPRB rather than an initial driving force of PPRB, which differs from prior studies. For instance, [Papagiannakis and Lioukas \(2012\)](#) set both psychological motivation of managers and environmental regulation as independent variables. Our design returns to a basic logic that compared with contextual factors whose effect are often overestimated, individual motivation is more likely to initially determine the direction of GO. Third, this paper applies the proactive behavior theory in the field of environmental management, which enriches the theoretical ground of this field. Specifically, our analysis on the whole process of PPRB (involving psychological motivation, contextual factor, behavioral manifestation, and behavioral performance) is organized within the conceptual framework of the proactive behavior theory, which develops a dialogue that can help GO to reach out to other knowledge areas (e.g. environmental psychology) because the proactive behavior theory fully considers the role of individual psychological motivation in his/her proactive behavior and emphasizes the significance of such behavior in promoting the development of things.

The rest of this paper is organized as follows. After this introduction, we review the relevant literature and develop hypotheses to expand the boundary of existing knowledge. Our research methodology is introduced followed by results of our data analysis. After that, we more broadly discuss theoretical and practical implications based on key findings. Finally, we conclude this paper with clarifying limitations and directions for future research.

2. Literature review and hypotheses development

2.1. The general research paradigm of proactive behavior theory

Initiated in 1980s, Western firms experienced the challenge from strategic transformation triggered by increasingly intensive market competition, which leads them to proactively create competitive edges to response to potential crisis ([Ashford and Cummings, 1985](#); [Bateman and Crant, 1993](#)). After that, what proactive behavior can bring to firms and how to measure this behavior within the specific context were

discussed. Proactive behavior was described as that individual makes full use of his/her psychological motivation and favorable contexts to improve present unreasonable situations or create new situations with challenging spirits rather than passively adapt (Crant, 2000; Parker et al., 2006; Grant and Ashford, 2008). Generally, the positive role of such behavior in organizations is significantly increasing because of the scarcity of resources (Shankar, 2006). However, Grant et al. (2011) found that proactive behavior will not always play positive effects, and sometimes it leads to a conflict between managers and employees' behavioral orientations.

The general research paradigm of proactive behavior involves the investigation on its antecedent and consequence. Specifically, the antecedent has been further divided into individual differences (mainly the psychological motivation) and contextual factors (Parker, 1998; Morrison and Phelps, 1999; Crant, 2000; Frese and Fay, 2001; Grant and Ashford, 2008; Ohly and Fritz, 2010; Parker et al., 2010), and the consequence includes a series of individual or organizational performance, e.g. career success, personal creativity, and organizational socialization (Crant, 2000; Wanberg and Kammeyer-Mueller, 2000; Seibert et al., 2001; Ohly and Fritz, 2010; Parker et al., 2010). Additionally, factors that are related to individual capability were also used to describe individual difference, e.g. educational experience, knowledge area, and professional qualification (Parker et al., 2010). Further, Crant (2000), Fuller et al. (2006), Parker et al. (2006), and Parker and Collins (2010) argued that IAR (e.g. raw materials, human resources, and funds) and external context (e.g. political intervention, public supervision, and market demand) constitute the contextual factor that can affect the level of proactive behavior. In recent years, proactive behavior was used to address new organizational problems, e.g. the manager-newcomer interaction for organizational socialization, and employees' political skill (Sun and van Emmerik, 2015; Ellis et al., 2017).

With respect to proactive behaviors at the manager level, it can strongly affect organizational prospect and employees' job involvement through managers' salience, responsibility, and authority (Crant and Bateman 2000; Tosi et al., 2004; Wang et al., 2011). For instance, employees will give a higher priority to work-related performance if managers present the task-focused leadership (Wang et al., 2011). Further, top managers' proactive behavior is recently used to address business ethics issues, and their self-rated ethical leadership can improve members' aggregated perception of organizational ethical climate (Shin, 2012). Accordingly, the proactivity of managers' behavior can largely determine what extent the whole organization will be in a proactive status. Specific to PEMB, Bansal and Roth (2000) explained why we

need to understand EMs' psychological motivation in GO. First, it helps to predict future environmental problems that should be addressed, thereby organizing targeted management activities. Second, it helps to develop new channels to improve environmental sustainability, e.g. linking policy, market demand, and EMs' green perception. According to [Sharma et al. \(1999\)](#), a critical premise for promoting GO is viewing environmental problems solving as an opportunity for organizational development rather than a threat. Additionally, [González-Benito and González-Benito \(2006\)](#) argued that EMs' green perception is actually their commitment, and higher commitment can promote GO to be the priority, which further implies the significance of using the proactive behavior theory into GO field.

2.2. Potential psychological motivations in PEMB within the proactive behavior theory

Through integrating prior studies on the proactive behavior theory and PEMB, this paper will analyze the impact of EMs' role breadth self-efficacy (RBSE) and felt responsibility (FR) on their PPRB based on following considerations. With respect to the identification of RBSE, [Rodrigue et al. \(2013\)](#) divided the environmental management behavior into symbolic and substantive ways. The symbolic way mainly aims to conform to basic social norms, but lacks a meaningful change to sustainably improve the natural environment around firms. The symbolic way is also described as the impression management. That is, managers aim to present their environmental commitment to the society and improve firms' reputation through environmental management. In practice, their behavior as well as corresponding psychological motivation more focuses on the short-run environmental plan. In contrast, the substantive way aims to broadly and concretely improve elements related to the natural environment, e.g. developing effective environmental strategies. Compared with the symbolic way, the motivation involved in substantive way more focuses on expanding firms' moral awareness and governance scope. As it lacks the compatibility between environmental management and business performance in Chinese firms, most EMs may firstly develop the symbolic way because benefits created by the substantive way are more easily shared by social groups, which will decrease the size of firms' earnings. This case indicates that in China's context, creating environmental performance that is related to firms' daily operations is usually EMs' primary goal when developing environmental management, namely, implying a kind of in-role cognition, but sustainably improving the natural environment may reflect their extra-role cognition. Accordingly, this paper argues that RBSE, which was defined as that individual feels confident that he or she can execute a broader and more positive role beyond traditional prescribed requirements, can help to explain the

difference of environmental management behaviors (Parker, 1998). Additionally, this definition implies that individual usually simultaneously holds both in-role self-efficacy (IRSE) and extra-role self-efficacy (ERSE) for the same thing. Further, in-role behavior is required to provide the basic driving force for individual or organizational development, which indicates a relatively stable level of individual IRSE in specific contexts (Organ and Konovsky, 1989; Pearce and Gregersen, 1991). Integrating above analysis, we argue that the symbolic way reflects EMs' IRSE (confident in short-run environmental plans), and substantive way reflects their ERSE (confident in long-run improvement of natural environment). Figge and Hahn (2012) analyzed whether manufacturers' environmental strategies should be to firstly create environmental value alongside business value rather than the opposite, which supports that the impact of IRSE on PPRB is quite different from that of ERSE in reality, also suggesting separately examining the effect of IRSE and ERSE in improving EMs' PPRB.

With respect to the identification of FR, Bateman and O'Connor (2016) found that public FR strongly drives climate actions, and compared with technical matter, individual perceptions to climate-related issues should be better understood. Pearce and Gregersen (1991) and Fuller et al. (2006) defined FR as a kind of psychological status that describes the extent to which individual feels personally accountable and responsible for the results of work he or she does. Accordingly, this paper argues that compared with RBSE, FR presents a more powerful motivation. However, Morrison and Phelps (1999) found that excessive amounts of taking charge that arises from individual FR may trigger the dysfunction of target system, which raises a question that focusing on environmental management may impair other kinds of performance. That is, EMs with a high enthusiasm to GO may invest more FR but weaken the focus on other operation areas (Aragón-Correa and Rubio-López, 2007; Clarkson et al., 2011). Accordingly, this paper will examine the impact of both FR establishment (FRES) and FR coordination (FRCO) on PPRB, aiming to present whether the input of EMs' FR is appropriate (neither too much nor too little) in GO.

2.3. The impact of EMs' psychological motivation on PEMB

Prior studies viewed managers' psychological motivation as a driving force to GO (Bansal and Roth, 2000; Aragón-Correa and Sharma, 2003; Aragón-Correa and Rubio-López, 2007), but specific motivation has not been identified within the framework of the proactive behavior theory. Following, we analyze the potential impact of EMs' RBSE and FR on PPRB in China's context. Hirst et al. (2008) found that both hierarchy sense and power distance in Chinese manufacturing firms are stronger than those in Western

firms, which enlightens that the psychological motivation of Chinese managers can more (1) decisively affect business development, and (2) directly lead to their own behavior. [Lu \(2009\)](#) reviewed present and future business ethics in Chinese firms and found that such ethic was improved a lot but still facing two challenges, i.e. how to quickly curtail uncivilized behaviors and address problems related to ethical management. Further, [Walker et al. \(2014\)](#) found that EMs' ecological responsibility is replacing their competitive motivation to be a more critical antecedent of GO in Chinese firms, but their research is limited to only one less developed city being surveyed. Therefore, their findings will not present the status of whole China. Overall, as both carbon trading and voluntary GO programs in China are at the initial stage, EMs may lack a strong perception for GO.

With respect to the impact of IRSE and ERSE on PPRB, [Organ and Konovsky \(1989\)](#) and [Pearce and Gregersen \(1991\)](#) argued that in-role behavior must be developed to meet basic needs of organizational development, which implies that IRSE usually stably contributes to proactive behaviors. In contrast, extra-role behavior provides a more convincing explanation for diversified individual or organizational performance. The motivation of extra-role behavior is that individual believes that his/her behavior can bring satisfactory or more than expected performance rather than only completing established tasks. [Zu and Song \(2009\)](#) surveyed managers of manufacturing firms that are located in North, Southeast, and West China and found that their primary motivation of fulfilling corporate social responsibility (CSR) is to obtain business performance (more business oriented than moral oriented). [Ramasamy and Yeung \(2009\)](#) concluded that Asian consumers can more clearly identify what kind of CSR (including business, legal, ethical, and charitable responsibilities) firms should fulfill in different periods compared with Western countries. Accordingly, most Chinese EMs can basically understand what social responsibility they need to focus on currently. In this paper, we infer that the impact of EMs' IRSE on PPRB is more positive than that of ERSE based on following reasons. First, the overall perception of EMs and major stakeholders for CSR in Western countries is usually stronger than that in China. Specifically, such perception of Chinese EMs is more focused on policy requirements but partly neglects the essence of CSR that is sustainably improving the social value. Further, the level of country's globalization usually positively affects EMs' perception of GO, and higher level implies a broader range of stakeholders that firms have. Compared with Western countries, China's globalization is still at a disadvantage currently ([Christmann and Taylor, 2001](#)). Accordingly, EMs may be not highly sensitive to issues related to GO,

and both their IRSE and ERSE have not reached high levels. Second, Chinese manufacturers undertake multiple social roles at the cost of financial input, and GO cannot always enhance business performance of heavy-polluting firms (Zeng et al., 2011; Chang et al., 2015). Additionally, the development of GO strategy is in the infancy in China, but pollution reduction actions that are taken with the aim to remain the stability of firms' daily operations is usually in normality (Walker et al., 2014; Liu et al., 2017). Accordingly, EMs may be more confident in organizing GO to improve short-run business value, but such confidence may play a weaker role in sustainably improving the natural environment. To sum up, we propose following two hypotheses.

H1a: Both EMs' IRSE and ERSE can improve their PPRB.

H1b: The impact of IRSE on PPRB is more positive than that of ERSE.

With respect to the impact of FRES and FRCO on PPRB, compared with the sense of self-confidence that RBSE emphasizes, FR more focuses on morality level. That is, individual argues that he or she has a responsibility to engage in something rather than only present confidence. Similar to RBSE, FR can also promote proactive behavior (Fuller et al., 2006). Cumming et al. (2016) presented that Chinese firms are currently establishing FR for social issues, and the level of this FR is unstable. Additionally, their study argued that Chinese government is committed to enhancing economic efficiency, but the institutional guarantee for CSR needs to be further strengthened. It indicates that the process of FR evolving into firm performance requires IES, also implying the effect of contextual factors in moderating the impact of psychological motivation on proactive behavior. Xun (2013) argued that the priority of CSR is increasing in developing countries, but what role government should play in CSR has not well positioned. With respect to managers' FRES for CSR in Chinese manufacturing firms, Zu and Song (2009) presented that their responsibility is concentrated in 3 to 4 score (5-score scale). Li and Zhang (2010) surveyed 692 firms and found that the average CSR score is 31.71 (out of a maximum of 36) with a slight difference between state-owned and non-state-owned firms. Besides environmental management, improving employment and responding to major stakeholders' demands are also critical aspects of CSR, but compared with GO, the impact of other social activities on business performance is usually more positive because of the relatively lower cost-benefit ratio. Cumming et al. (2016) analyzed prior literature published from 1999 to 2016 on the sustainability of Chinese firms and found that since 1990s, Chinese business leaders' FR for GO has been increasing, including both private and family firms (Fryxell and Lo, 2001; Berrone et al.,

2013). However, we query why increasing GO responsibilities are not well evolved into EMs' favorable behaviors. Further, FRCO focuses on whether the distribution of targeted FR is in a reasonable status among different operation areas. Young and Makhija (2004) presented that regardless of multinational or cross-cultural context, managers' initial motivation for social activities is mainly focused on business profit. This paper aims to analyze whether EMs can engage in reducing pollutants without at the cost of damaging other performance. However, environmental responsibility that has long existed under the business orientation can easily lead to a problem that is once firms encounter economic recession, EMs' FR will inevitably decrease. Accordingly, it is hard for Chinese EMs to rapidly coordinate their FR in GO and other areas currently. Prior studies focused on PEMB from angles of priority of GO in firms, status of environmental values in firm's culture, and GO sustainability (González-Benito and González-Benito, 2006; Liu et al., 2017). However, once the environmental responsibility is not well coordinated, the level of PEMB will be weakened. Above discussions lead to following two hypotheses.

H2a: Both EMs' FRES and FRCO can improve their PPRB.

H2b: The impact of FRES on PPRB is more positive than that of FRCO.

2.4. The moderating effect of critical contextual factors

Crant (2000) suggested that the model of proactive behavior process should consider moderating or mediating variables. In the field of business ethics, the moderating effect of contextual factors has been recently analyzed. For instance, Jiang et al. (2017) presented that market competitive intensity positively moderates the impact of ethical climate on business performance but the market turbulence cannot. As suggested by the Resource-based View, we can describe such moderating effect as follows. As a kind of management tool, favorable contexts will promote individual motivation to be better evolved into actual proactive behavior and help to prevent individual from disordered behavior arising from his/her higher expectation with following evidence. The Resource-based View argued that the favorable context, e.g. suppliers' GO capability, can improve firms' business value (Russo and Fouts, 1997; McWilliams and Siegel, 2011; Wong et al., 2012). Additionally, routine work contexts can support or inhibit individual proactive behavior through affecting his/her self-efficacy (Parker et al., 2010), which further implies that during manufacturers' daily operations, internal and external contexts may moderate the impact of individual psychological motivation on actual proactive behavior.

With respect to the moderating effect of IAR, the universal large-size of manufacturers firms and high

liquidity of market information in China imply that they can easily access to available resources through multiple channels (Song et al., 2017). However, although the productivity efficiency of China's energy, environment, and economy system is rising, the scale effect of technical progress in most regions of China is lower. Additionally, lower management efficiency of pollutants discharge as well as lack of GO investment also hinders this system to be improved (Wang and Feng, 2015; Wu et al., 2015). In this case, IAR cannot always positively moderate the impact of EMS' motivation on their PPRB.

With respect to the effect of IES, the limited scope of voluntary pollution reduction programs as well as intensive mandatory policies bring Chinese manufacturers negative pressure. Major stakeholders (e.g. government, supplier, customer, surrounding community, and media) of firms increasingly agree on the value of GO, but such focus has not provided firms enough incentives as a whole (Qi et al., 2013; Xun, 2013). Geng and Doberstein (2008) also presented that the development of greening government procurement in China lags behind Western countries. Additionally, lack of IES will trigger firms to take GO actions separately, and the operation of collective programs in China is in a backward status (Zhang and Wang, 2014). Overall, the defects of IAR and IES that broadly exist in Chinese manufacturing firms. However, given the fundamental role of IAR in GO, its incentive for EMS' motivation may be stronger compared with IES. To sum up, we propose following two hypotheses.

H3a: Both IAR and IES can positively moderate the impact of EMS' RBSE and FR on PPRB, but their moderating effects are not very strong currently.

H3b: The moderating effect of IAR is more positive than that of IES.

2.5. *The performance of PEMB*

González-Benito and González-Benito (2005) examined the impact of operational performance (OP), marketing performance, and financial performance on environmental proactivity. As financial indicators are closely related to firms' daily operations, we design it as a part of OP. In recent years, the technical progress promotes the rise of both low-carbon productivity and energy use in Chinese manufacturing firms (Wang and Feng, 2015), which can help to improve financial indicators. Although the large-size investment targeting at GO will increase firms' financial burden in the short-run, resultant high-efficient operations may rapidly counter prior financial loss. It enlightens that for OP, we should more focus on whether production and financial indicators can be simultaneously improved. In view of OP involves all aspects of firms' daily operations, if production links are improved but financial indicators suffer a loss,

it cannot be considered that OP is in a high quality.

Further, according to [Hart \(1995\)](#) and [Primc and Čater \(2016\)](#), PEMB can also improve firms' strategic competitiveness (SC) that is mainly reflected in the expansion of market shares, broader financing channels and improvement of firms' reputation. Many Chinese manufacturers are largely dominated by state-owned shares, which indicates their significant impact on national economy. In this case, the level of firms' reputation can be largely attributed to their social contribution, and public groups' response to GO will be sensitive. Compared with Western countries, consumers' understanding of GO is relatively weak in China, but with the publicity of green perception, they will be increasingly interested in such operation ([Li et al., 2016](#)). Accordingly, we expect that improving PPRB will enable manufacturers to obtain more public attentions that can help to expand market shares and external investment, thereby improving firms' SC.

Finally, suggested by [Etzion \(2007\)](#), [Rodrigue et al. \(2013\)](#), and [Van Halderen et al. \(2016\)](#), compared with business performance, sustainably improving the natural environment should be a higher mission of firms. Currently, the rapid expansion of Chinese manufacturing sectors is aggravating environmental pollution. As Chinese manufacturers need to undertake a broad range of social responsibilities, we infer that EMs' PPRB will more directly improve firms' environmental performance (EP). To sum up, we propose following three hypotheses.

H4a: EMs' PPRB can improve manufacturers' OP.

H4b: EMs' PPRB can improve manufacturers' SC.

H4c: EMs' PPRB can improve manufacturers' EP.

According to the analysis in Subsections 2.3 to 2.5, the relation among variables describes a mediated moderation model (psychological motivation as independent variable, contextual factor as moderating variable, PPRB as mediating variable, and PPRB's performance as dependent variable). As suggested by [Edwards and Lambert \(2007\)](#), on the basis of examining the causality between mediating variable and dependent variable, we will further examine how independent variable, moderating variable, and their interaction affects the change of dependent variable. Based on above developed hypotheses, we further propose following three hypotheses to link the antecedent and performance of PPRB.

H5a: The antecedent of EMs' PPRB can improve manufacturers' OP.

H5b: The antecedent of EMs' PPRB can improve manufacturers' SC.

H5c: The antecedent of EMs' PPRB can improve manufacturers' EP.

2.6. The conceptual model

Based on above discussions, we develop the theoretical framework as Fig. 1. Above all, we examine the impact of RBSE (IRSE and ERSE) as well as FR (FRES and FRCO) on PPRB. Then, we examine the moderating effect of IAR and IES. Finally, we examine the impact of PPRB and its antecedents on firm performance. Guided by this model, our analysis will explain how EMs' initial motivation evolves into final behavioral performance from the angle of the proactive behavior theory.

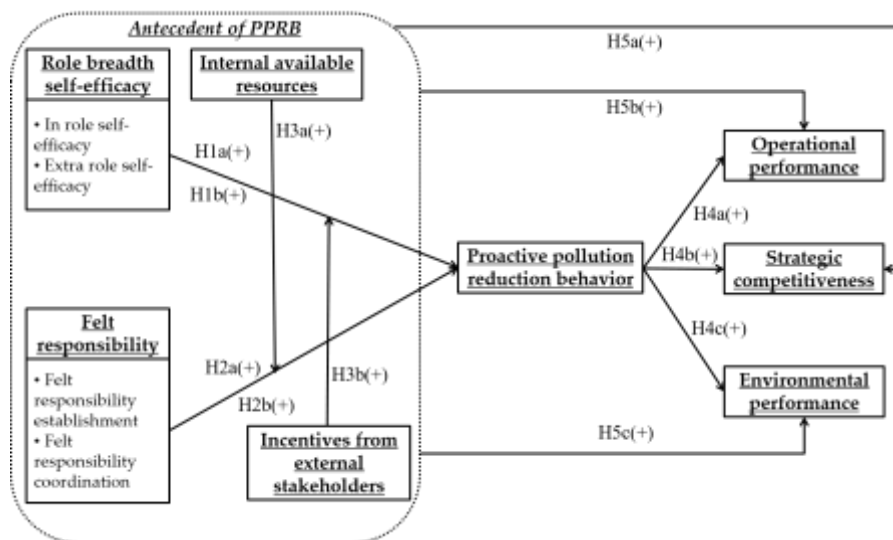


Fig. 1. The conceptual model

3. Research methodology

3.1. Data collection

To help respondents well understand measuring items, we explain the definition of critical constructs in the questionnaire (see Table A1). With respect to the process of this survey, McGee et al. (1998) suggested that subject to the pressure from stakeholders, managers working in different departments will hold different motivations for the same thing, but the particularity of GO requires special EMs to be arranged. Further, Fryxell and Lo (2003) and Zu and Song (2009) presented that the relation between Chinese firms and the government is closer than that in Western countries, especially for state-owned firms and township firms. Specific to GO, this relation implies that although some manufacturing firms have set up the environmental department or professional environmental managers, the highest-level administrator will always participate in environmental decision-makings, even having a final decision power. Accordingly, this paper surveys the highest-level EMs with the ultimate decision-making power

on environmental issues.

Based on our survey premise, we firstly collect firms' contact information through the Shanghai Stock Exchange, Shenzhen Stock Exchange, and online platform of Chinese small-and medium-sized firms. The initial contacts include chairman, CEO, chairman's secretary, human resources department, etc. Then, we introduce the research goal to each firm and explain what kind of informants we need to survey. To improve the efficiency of this process, only when firms declare that professional EMs have been arranged, we will contact the highest-level EM to ensure whether he/she has the ultimate decision-making power on environmental issues. When EMs declare that they have such decision power with the willingness to participate in our survey, we will send them the questionnaire through network platform or emails. From July 2017 to January 2018, we contacted more than 500 firms, and there are 191 firms in line with our requirements. As of 31st January 2018, we collect 155 qualified responses that account for 81.15% of all respondents.

Participated firms are located in provinces or municipalities which have intensive manufacturing activities, i.e. Heilongjiang, Shandong, Shaanxi, Jiangsu, Zhejiang, Guangdong, and Beijing, covering the East, Northeast, and West China. These regions cover a broad spectrum of economy levels as indicated by GDP per capita ranging from US\$33,245 (Shanghai) to US\$11,531 (Heilongjiang) in 2017. Through the survey, we find that participated EMs are mainly in following job positions. For light industrial sectors without a dedicated environmental department, their chairman or CEO are often in charge of GO. For manufacturers with an environmental department, the director of department undertakes the primary duty. The head of R&D department is also in charge of GO in some technology intensive manufacturers to control pollutants discharge from the source of production link and minimize environmental accident. CFO (Chief Financial Officer) also takes charge of GO in a small number of firms for the convenience of real time cost-benefit analysis.

We recognise a possible connection between our research theme and CSR, and some firms may view the process of their social activities as secrets. Therefore, it is critical to ensure that we can acquire the real response from EMs through the questionnaire when designing the survey. There are three important reasons for us to use questionnaire. First, although firms' data at the objective level can present indicators related to GO, e.g. the annual energy use published by the social responsibility report of Chinese listed firms, these reports hardly record the data related to top managers' psychology.

Therefore, we need to collect these unpublished data through designing adequate measuring items. Second, from June 2017 to July 2017, we selected small-and medium-sized manufacturing firms in Northeast China to conduct a piloting pre-survey which confirmed that the reliability and validity of variables and items are both of high quality. It confirms that our questionnaire can help acquire the required data for our research. Third, the recent research related to environmental psychology at the firm level has frequently used questionnaire as the instrument of data collection, e.g. Papagiannakis and Lioukas (2012) and Latan et al. (2018). These studies drew lessons from prior established measuring items to present the level of individual psychology variables, which have been adopted by this paper. Meanwhile, all our respondents participated in the survey voluntarily which ensures the credibility and reliability of the data.

3.2. Variables design

3.2.1. Psychological motivation

We measure EMs' IRSE and ERSE by following items on individual RBSE in Parker (1998) and the possible psychological status involved in symbolic and substantive environmental management as the analysis in Subsection 2.2. Specifically, IRSE focuses on EMs' confidence in proposing innovative ideas for firm's pollution reduction plans, optimizing firm's pollution reduction plans in time, and improving firm's reputation through pollution reduction. ERSE focuses on their confidence in developing firms' pollution reduction strategy, optimizing firms' pollution reduction programs through cooperating with stakeholders, and over-fulfilling pollution reduction tasks that policies or laws require.

We measure FRES and FRCO by following items on individual FR in Fuller et al. (2006) and the analysis on the negative impact of excessively taking charge discussed by Morrison and Phelps (1999) in Subsection 2.2. Specifically, FRES focuses on EMs' FR in correcting defects existing in firms' pollution reduction plans, overcoming difficulties during firms' pollution reduction, and strictly complying with environmental policies and laws when developing pollution reduction. FRCO focuses on their FR in giving a higher priority to pollution reduction in firm's operation, preventing the dysfunction of firm's daily operations in the case of organizing pollution reduction, and coordinating the relation between pollution reduction performance and other performance.

3.2.2. Contextual factors

Following Aspinwall (2005) and Fuller et al. (2006) that analyzed common types of internal resources

in the context of promoting the proactive behavior in organization (e.g. funds, technology, human resources, and information), we measure the resources in Chinese manufacturing firms that may help to promote the proceeding of their pollution reduction, including the investigation on aspects of sufficient funds, advanced technical support, and professional human resources.

Following Burress (2005) and Ingenhoff and Koelling (2012) that defined the role of different external stakeholders in responding to climate change issues, we analyze the external context faced by Chinese manufacturers during reducing pollutants through measuring the level of incentives from suppliers, consumers, and media.

3.2.3. Proactive pollution reduction behavior

Prior studies have designed items for measuring PEMB, e.g. Aragón-Correa (1998), Gonzalez-Benito and Gonzalez-Benito (2005), and Liu et al. (2017). As this paper organizes the research path following the proactive behavior theory, we should consider common outward manifestations of this behavior. Crant (2000) described the general actions of proactive behavior as identifying opportunity to improve things, challenging the status quo, and creating favorable conditions. Accordingly, we measure whether EMs have identified opportunities for reducing pollutants and made full use of them, whether they have organized knowledge training for improving all members' pollution reduction perception, and whether they have organized to innovate pollution reduction plans for decreasing firm's future operation risk.

What needs to be noted is that a typical action of challenging the status quo during GO in Chinese manufacturing firms is EMs' promotion for all members' participation that is not only a reform for improving organizational structure in GO, but also a challenge for EMs. This action is underpinned by the promotion of ethical leadership to organizational citizenship behavior (Walumbwa et al., 2011). A critical premise of developing this action is members' high perception to GO, and EMs' ethics as well as morality was examined to positively lead to the impact of employees' self-efficacy on ethical behaviors (Walumbwa et al., 2011; Chen and Hou, 2016). Accordingly, EMs' attention to all members participation in GO can be viewed as a challenging behavior.

3.2.4. The performance of proactive pollution reduction behavior

Based on our analysis on general performance of PEMB in Subsection 2.5 and Esfahbodi et al. (2016, 2017) that focused on the performance of green production, we design items to measure manufacturers' OP (including low-carbon product/service productivity, energy use cost, and financial performance), SC

(including new business opportunities, financial channels, and firm's reputation), and EP (including the size of pollutants discharge, frequency of environmental accident, and firm's surrounding environment quality) triggered by EMs' PPRB.

3.2.5. Control variables

To enhance the credibility of empirical results, we design following control variables that may affect the role of EMs' psychological motivation in GO, PPRB's performance, or reflect the difference between Chinese and Western firms.

(1) EMs' profile, including gender (male=0; female=1), age (no more than 35 years old=1; 36 to 45=2; 46 to 55=3; over 55=4), educational level (GCSE/A-Level=1; bachelor=2; master=3; Ph.D.=4), and working age in the present position (year). [Waldman et al. \(2006\)](#) found that when dealing with issues on CSR, EMs or major stakeholders' profile will always affect the final value of CSR, even if there is no unified conclusion on the direction of their relation. Further, [Parker et al. \(2010\)](#) analyzed the driving force of individual educational level and career experience on his/her proactive behavior. Usually, individual with higher education level or richer career experience is more likely to present proactive behaviors in the work.

(2) Firms' establishment age (year). Prior studies presented that firms' management structure may change with the increase of their establishment age to better meet stakeholders' multi-demands ([Chang et al., 2015](#); [Li and Lu, 2016](#)). Accordingly, we infer that there is a significant difference in GO between new and mature firms. Usually, EMs working in new firms relatively lack of experience in GO, which may make their actions be in a disordered status. We define the age when firms being established as 1, the next year as 2, and on the analogy of this.

(3) Firms' ownership property and shareholding proportion of the largest shareholder. We define the state-owned firm as 1 and other firm (including properties of business group, joint venture, foreign funded, private, and others) as 0. Prior studies presented that factors related to ownership may affect how EMs engage in environmental issues. For instance, [Gao \(2009\)](#) and [Xu et al. \(2015\)](#) presented that state-owned firms more focus on social performance than the private in China because the state-owned has merits in both total asset and obtained policy incentives. Further, with respect to the special role of state-owned firms in CSR, the widespread state-owned shares in Chinese manufacturing firms implies that EMs' decisions often reflects government's willingness, which also strengthens the effect of political

intervention (Li and Zhang, 2010). Prior studies described the general feature of state-owned firm as that they need to undertake a task of improving social value rather than only focusing on business profit even if encountering the temporary financial loss (Estrin and Perotin, 1991; Shleifer and Vishny, 1997). Chinese state-owned firm was also described as a public sector (Gao, 2009), but the opposite opinion argued that with the increase of private shares, political intervention should be relieved. In reality, the principle of profit-maximizing may weaken the social performance of state-owned firms, e.g. neglecting social equality (Ip, 2009; Moon and Shen, 2010). Given the primacy of business profit, we argue that not well fulfilling CSR should not be completely viewed as the immoral behavior, and ownership structure optimization as well as intensive market competition will promote firms to better coordinate business and social performance. In this case, Chinese government should fully respect the essence of market economy and encourage all firms to serve the society rather than excessively use mandatory policy.

Prior studies also presented that Chinese state-owned firms are experiencing a reform of ownership structure. With the change of state-owned share proportion, the orientation of CSR will also experience the reform (Tam, 2002; Lu, 2009). Through surveying the annual report of Chinese manufacturing firms, we find that the proportion of state-owned shares in few state-owned firms is less than 20%, but such proportion in some non-state-owned firms is higher. It enlightens us that only focusing on ownership property may not fully reveal the role of ownership in GO. Further, we set the shareholding proportion of the largest shareholder as another control variable because it can affect ownership concentration, the controlling capability of the largest shareholder to firm operations, and the size of available resources for organizing GO (Li and Zhang, 2010; Calza et al., 2016).

(4) Number of employee. It reflects the size of firms' labour-input, and firms with more employees often more proactively engage in business or social activities that can help to improve firm performance (Darnall et al., 2010; Rodrigue et al., 2013). In the case of efficient operations, there is a small possibility on the substantial change of total number of employees as well as their job positions. Accordingly, EMs can organize stable human resources plans in a certain period.

(5) Pollution level of firms' main business. According to the catalogue of manufacturing sector (21 industries) from the United States Department of Labor (NAICE Code 311-339), we survey firms' main business. Further according to the Environmental Information Disclosure Guidelines of Chinese Listed Firm (Draft), we identify heavy-polluting firms with defining them as 1 and others as 0. Prior studies

argued that the development of some environmental activities more relies on heavy-polluting firms, e.g. preventing environmental accidents (Li and Lu, 2016; Maung et al., 2016), which indicates the potential differences of whole process of pollution reduction in heavy-polluting and non-heavy-polluting firms.

Additionally, some studies on GO designed financial performance (e.g., total asset, ROA, or ROE) as the control variable (Chang et al., 2015; Song et al., 2017). Generally, the size of total asset can largely determine whether firms are competent to engage in GO, and firms with larger-size total asset can more easily get access to resources that can help to GO (Buysse and Verbeke, 2003). In this case, the potential moderating effect of contextual factors will be better presented. However, we have not selected financial indicators as a control variable because it often presents a feature of time volatility, but EMs' perception of GO is relatively robust, especially in state-owned or large firms. Accordingly, EMs will be less likely to change their initial motivation and subsequent behaviors with the change of last year's financial indicators. Except control variables, we measure all other variables by the 7-point scale (Table A1). Table 1 displays the overview of control variables.

Table 1. The overview of respondents and their firms' profiles (N=155)

Variables	Sub-category	Frequency	Percentage (%)	
Gender	Male	82	52.90	
	Female	73	47.10	
Age	No more than 35 years old	45	29.03	
	36 to 45 years old	49	31.61	
	46 to 55 years old	46	29.68	
	Over 55 years old	15	9.68	
Educational level	GCSE/A-Level	11	7.10	
	Bachelor	83	53.55	
	Master	58	37.42	
	Ph.D.	3	1.94	
Ownership property	Non-state-owned	88	56.77	
	State-owned	67	43.12	
Pollution level	Non-heavy-polluting	123	79.35	
	Heavy-polluting	32	20.65	
Variables	Minimum	Maximum	Mean	s.d.
Working age	1	40	10.47	8.73
Establishment age	3	100	29.79	22.04
Shareholding proportion of the largest shareholder	15.00	100.00	70.95	22.74
Number of employee	10	174000	6636.50	20120.23

Table 1 presents that the distribution of respondents' gender is uniform with the age of more than 90% under 55 years, and most of them have a bachelor degree. Additionally, the average working age of respondents in the present position is relatively long (more than 10 years), which implies that they can well understand firms' GO. The distribution of firms' ownership property is also uniform as a whole.

Further, our sample covers 19 industries, which indicates that empirical results will be able to provide a generic view of GO across sectors. However, 79.35% of our sample belongs to the light industry because EMs of some heavy-polluting firms are not willing to publish GO issues. The average establishment age of our sample is relatively long (nearly 30 years) with the average number of employee more than 6000, which indicates that most firms are at a mature development stage. The standard deviation of variables reflects a large difference in EMs and their firms' profiles, also supporting the randomness of sample selection. Given the distribution discreteness of control variables, we centralize and then standardize all data to decrease the multiple collinearity among variables.

4. Empirical results

4.1. Preliminary test

First, we develop the reliability test for measurement scales through the exploratory factor analysis as Table A1. It presents that the Cronbach α coefficients of all dimensions are higher than 0.70, and further test presents that the α coefficients of all items, odd-number items, and even-number items are 0.96, 0.93, and 0.92, respectively, which supports the high reliability of measurement scale. There is no item whose CITC value less than 0.50, thereby remaining all items. Further, we develop the single dimension test (KMO) and Bartlett's test on each dimension with findings that KMO value for all items is 0.92, and such value for each dimension is also at a high level with the minimum 0.64. The KMO test presents that all items of each dimension can be classified into one factor with the lowest interpretation 63.45%, which indicates that all dimensions have a uni-dimensional feature. Additionally, results of Bartlett's test are all statistically significant, which verifies a strong correlation among variables together with KMO test.

Based on the reliability test, we further develop the validity test for the full conceptual model through the confirmatory factor analysis. Using the AMOS 22.0 software, we obtain following critical parameters: Chi square (χ^2)=653.64; df =328; χ^2/df =1.99 (less than 3); RMSEA=0.08; RMR=0.10; IFI=0.92; TLI=0.90; CFI=0.92. These parameters support that our data has a higher goodness of fit with the designed model. Further, we develop the discrimination validity test based on the root-mean-square of Average Variance Extracted (AVE) as results in Table 2. Ideally, the AVE square root of target variable is larger than its all correlation coefficients with other variables. The large correlation coefficients indicate a close relation among critical elements during EMs' motivation evolving into PPRB's performance.

Table 2. The correlation analysis and discriminant validity test

Variables	1	2	3	4	5	6	7	8	9	10
IRSE	<u>0.94</u>									
ERSE	0.81***	<u>0.93</u>								
FRES	0.71***	0.75***	<u>0.92</u>							
FRCO	0.73***	0.68***	0.69***	<u>0.84</u>						
IAR	0.61***	0.69***	0.67***	0.57***	<u>0.93</u>					
IES	0.54***	0.58***	0.60***	0.49***	0.59***	<u>0.84</u>				
PPRB	0.63***	0.63***	0.55***	0.58***	0.49***	0.30***	<u>0.94</u>			
OP	0.56***	0.59***	0.51***	0.52***	0.57***	0.48***	0.58***	<u>0.92</u>		
SC	0.59***	0.62***	0.60***	0.62***	0.64***	0.69***	0.50***	0.66***	<u>0.93</u>	
EP	0.54***	0.56***	0.63***	0.67***	0.56***	0.71***	0.41***	0.51***	0.73***	<u>0.91</u>

Note: IRSE (in-role self-efficacy), ERSE (extra-role self-efficacy), FRES (felt responsibility establishment), FRCO (felt responsibility coordination), IAR (internal available resources), IES (incentives from external stakeholders), PPRB (proactive pollution reduction behavior), OP (operational performance), SC (strategic competitiveness), EP (environmental performance).

*** $p \leq 0.01$ (Two-tailed). The black bold figures with the underline are the AVE square root corresponding to each variable, and other figures are correlation coefficients among variables (Spearman coefficients).

4.2. The impact of psychological motivation on PPRB under the moderating effect of contextual factors

4.2.1. The impact of psychological motivation on PPRB

Table 3 displays the impact of EMs' RBSE and FR on PPRB under the moderating effect of contextual factors. This paper separately examines how each motivation affects PPRB based on following reasons. First, there is a significant correlation among psychological motivations with the larger coefficients (the minimum is 0.68 as Table 2). Therefore, arranging RBSE and FR into one group of independent variable may trigger a large deviation between their estimated and true impacts on PPRB. Second, our analysis on definitions of RBSE and FR indicates that in reality, individual is likely to simultaneously hold these two motivations that exist the inherent link and mutual independence in the same thing. Additionally, Fuller et al. (2006) developed a similar test to examine the impact of each antecedent on FR rather than integrating all into one measuring model. This design can help to present the independent effect of each antecedent and avoid their effect being underestimated because of the participation of other antecedents. Further, the value of *Adjusted R²* presents following two facts. First, with the increase of the number of variables in models, the change of dependent variable will be better explained. Second, the *Adjusted R²* of Model 2 to Model 7 is significantly larger than that of Model 1, which indicates that EMs' motivation and related contextual factors can better explain the change of PPRB compared with their basic profiles.

Table 3. The impact of psychological motivation on PPRB under the moderating effect of contextual factors

Variables	Control variables	RBSE		FR			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Intercept	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gender	0.24*** (1.17)	0.17*** (1.19)	0.16*** (1.19)	0.17*** (1.22)	0.17*** (1.19)	0.17** (1.19)	0.19*** (1.23)

Age	-0.08 (1.23)	-0.07 (1.24)	-0.08 (1.32)	-0.07 (1.33)	-0.13* (1.42)	-0.12 (1.49)	-0.12 (1.56)
Educational level	0.10 (1.54)	0.06 (1.55)	0.06 (1.55)	0.07 (1.60)	0.04 (1.58)	0.05 (1.58)	0.03 (1.67)
Working age	0.26*** (1.72)	0.19** (1.73)	0.20*** (1.77)	0.20*** (1.81)	0.27*** (1.77)	0.26*** (1.78)	0.26*** (1.79)
Established age	-0.09 (1.48)	-0.08 (1.49)	-0.10 (1.54)	-0.10 (1.57)	-0.13* (1.51)	-0.14* (1.53)	-0.13* (1.54)
Ownership property	-0.21** (1.44)	-0.22*** (1.45)	-0.22*** (1.45)	-0.20*** (1.54)	-0.13* (1.46)	-0.15** (1.50)	-0.13* (1.56)
Shareholding proportion	0.00 (1.26)	0.02 (1.29)	0.01 (1.30)	-0.01 (1.33)	0.00 (1.29)	0.00 (1.30)	0.01 (1.32)
Number of employee	0.23*** (1.16)	0.11* (1.21)	0.13** (1.29)	0.15** (1.40)	0.12* (1.23)	0.15** (1.32)	0.15** (1.55)
Pollution level	-0.01 (1.07)	0.02 (1.08)	0.01 (1.09)	-0.02 (1.12)	-0.02 (1.07)	-0.02 (1.08)	-0.05 (1.16)
IRSE		0.44*** (3.07)	0.42*** (3.16)	0.31*** (4.25)			
ERSE		0.18* (3.16)	0.11 (3.75)	0.21* (4.67)			
FRES					0.31*** (2.37)	0.23** (3.11)	0.23** (3.42)
FRCO					0.30*** (2.23)	0.27*** (2.37)	0.28*** (2.60)
IAR			0.12 (2.20)	0.13 (2.26)		0.15 (2.25)	0.12 (2.31)
IES			0.01 (1.74)	0.02 (2.15)		-0.01 (1.81)	0.05 (2.02)
IRSE×IAR				-0.19 (6.67)			
ERSE×IAR				0.28** (6.11)			
IRSE×IES				-0.05 (4.34)			
ERSE×IES				0.04 (4.37)			
FRES×IAR							-0.06 (3.22)
FRCO×IAR							0.12 (3.34)
FRES×IES							0.19* (3.16)
FRCO×IES							-0.19* (2.69)
<i>F-value</i>	4.13***	14.93***	12.89***	10.56***	12.57***	10.93***	8.85***
<i>Adjusted R²</i>	0.16	0.50	0.50	0.51	0.45	0.46	0.46
<i>Durbin-Watson</i>	2.20	2.26	2.26	2.29	2.30	2.30	2.36

Note: * $p \leq 0.10$ (Two-tailed), ** $p \leq 0.05$ (Two-tailed), *** $p \leq 0.01$ (Two-tailed). The value of VIF is in parentheses.

When only considering the impact of control variables, EMs will more focus on pollution reduction if they are female, taking charge of environmental issues for longer time, working in non-state-owned firm, or their firm with more employees. The separate test for control variables describes following facts. First, female EMs with rich experience in GO are more likely to engage in environmental issues because their gentle character makes them more sensitive to the role of firm in the society and excel at capturing information that can help to enhance firms' social value compared with the male (Marian et al., 2017). Second, the non-state-owned manufacturer is facing more uncertain market risks but with less available resources than the state-owned, but this case is being improved in China. As Chinese government is attaching great importance to GO, more and more large-size non-state-owned firms will not pursue business profit at the cost of damaging social value because their resources can support related social activities. More importantly, neglecting such social action will make them rapidly suffer from a loss of competitive edge (Fryxell and Lo, 2001; Lu, 2009).

With respect to the effect of RBSE, both IRSE (0.44) and ERSE (0.18) significantly positively affect PPRB (see Table 3), which verifies H1a and H1b. Empirical results of model 2 present that EMs are more confident in engaging in the short-run environmental plan. Currently, EMs of Chinese manufacturing

firms (including multiple ownership properties) are in the early stage of establishing the perception on environmental strategies, e.g. organizing broad cooperation with major stakeholders with presenting a gradually stronger confidence as well. However, this forward-looking confidence is behind the focus on the short-run environmental by now. For Chinese manufacturing industry, stronger insights are needed to target at the strategic level because in the long-run, only the environmental management is valued as a kind of strategy, the natural environment around firms will be sustainably improved.

With respect to the effect of FR, both FRES (0.31) and FRCO (0.30) significantly improve PPRB, which verifies H2a and H2b. Empirical results of model 5 present that EMs are generally establishing a robust FR for engaging in pollution reduction without at the cost of neglecting other performance. Although EMs agree that environmental management can help to improve firms' competitiveness, they have also realized that this management may disorder firms' other operation systems. That is, with the gradual maturity of environmental management in Chinese manufacturing firms, EMs may try to coordinate the relation between environmental and other issues. It also releases a positive signal that most EMs agree on the importance of achieving the win-win of EP and other performance. Although some recent literature, e.g. [Zhang et al. \(2012\)](#) and [Walker et al. \(2014\)](#), pointed out that the current environmental management status of Chinese manufacturers is still hard to coordinate EP and operational performance, our analysis on EMs' FR can at least present EMs' willingness to simultaneously improve EP and other performance from the angle of psychological motivation. Further, EMs' relatively strong FRCO is more likely to enhance the strategic significance of PPRB.

Combining measuring items in Table A1, the positive effect of all motivations indicate that Chinese EMs are gradually establishing the systematic perception that targets at short-run environmental plans, long-run strategies, firms' reputation, operation risks, and defects of GO system when responding to GO issues. At least, they can understand the significance of reducing pollutants with the belief that their capability can improve GO system, which is also a remarkable progress compared with the prior vague environmental perception in China ([Fryxell and Lo, 2001](#)). However, the positive effect of ERSE is quite smaller than that of IRSE, which indicates that EMs are not fully confident in broadly engaging in GO. In the long-run, it will trigger the lag of GO strategies, and EMs' green actions will be also hard to break through the established boundary of environmental regulations. [Bansal and Roth \(2000\)](#) that focused on EMs' sense of environmental mission further proposed that a critical issue within GO is not only their

attitude, but also a kind of belief. When EMs are asked why they need to undertake the environmental responsibility, their response is usually that I am doing a right thing. In this case, how to promote EMs to robustly hold such confidence even the belief is one important direction that Chinese policymakers need to consider in the future.

4.2.2. The moderating effect of contextual factors

Judged by model 4 and model 7 in Table 3, H3a is verified. Although IAR cannot positively moderate all kinds of psychological motivations, its moderating effect is more positive than that of IES as a whole. Accordingly, H3b is verified. Table 3 presents that IAR can significantly help to improve the impact of ERSE (0.28) on PPRB, and IES can significantly improve the impact of FRES (0.19) but impede FRCO (-0.19) to improve PPRB. These findings describe the following picture. IAR can help to improve the value of EMs' long-run confidence in PPRB. Generally, IAR can more directly promote the development of GO than the effect of EC, which indicates that enriching manufacturers' GO more relies on incentives from internal capabilities. As stated by the Resource-based View, both production factors and incentive policies can promote firms' sustainable development, and the comprehensive impact of IAR on firms is usually more robust than that of external resources (Bansal, 2005). Through analyzing the definitions of RBSE and FR, self-confidence that is emphasized by RBSE largely reflects individual interest, but such interest does not necessarily lead to FR. In contrast, the sense of mission emphasized by FR contains less individual interest. Accordingly, the evolution from RBSE and FR to actual proactive behavior may be driven by different contextual factors.

With respect to the effect of IAR, the long establishment age of sample firms (29.79 years averagely) and large number of employees (6635.50 persons averagely) indicate that sample firms are in a mature development stage as a whole. Accordingly, these firms need large-size internal resources when dealing with environmental issues, and the supply of such resources should be sustainable. However, the size of IAR in sample firms has not reached a high level, especially lack of professional human resources in the environmental department (the average of item CQ2 in Table A1 is 5.09). This case indicates that the development of environmental management team in Chinese manufacturing firms is still not mature currently, and top managers lack a clear understanding of the importance of EMs' role. Accordingly, current IAR cannot fully meet the need of EMs to develop short-run environmental plans, and thus it is also hard to encourage their short-run confidence to work in pollution reduction. In contrast, empirical

results in Table 3 present that a series of IAR can help EMs to expand the coverage of their confidence with more practices targeting at future GO. Accordingly, sufficient internal resources that helpful to GO will be more likely to enhance the value of EMs' ERSE than IRSE. However, IAR has not improved the impact of EMs' FR on their PPRB with a possible reason based on our prior analysis on definitions of RBSE and FR. FR emphasizes that fulfilling something is individual responsibility that can present a stronger sense of urgency rather than only perceptions at the level of interest. Accordingly, compared with self-efficacy, FR more robustly presents one's determination to accomplish something (Crant, 2000; Fuller et al., 2006). As environmental management is not directly related to business operations, critical contextual factors that can promote EMs' FR to improve their PPRB should make EMs realize that their FR to environmental issues will contribute to a broader social group rather than only to their firms. That is, this stronger motivation is usually more reflected in firms' feedback to social support, which implies that this kind of contextual factor should be closely related to IES. Bateman and O'Connor (2016) that linked individual responsibility to climate issues further confirmed that improving the effect of such FR requires joint incentives from major external stakeholders. Accordingly, only relying on IAR will not encourage EMs' FR to present a positive effect in reducing pollutants.

With respect to the effect of IES, Aragón-Correa and Rubio-López (2007) pointed out the important IES that EMs need to face during organizing GO is responding to stakeholders' requirements. Currently, major stakeholders are more sensitive to firms' GO based on the global outlook (Miroshnychenko et al., 2017), and such external focus will more significantly affect EMs' environmental responsibility than the RBSE, which also corresponds to the effect of IAR analyzed in the last paragraph. Currently, more and more stakeholders can acquire Chinese manufacturers' operation because of increasingly transparent information and extension of industrial chains, and such closer link between firms and the public can strengthen the impact of EMs' FR on PPRB. For instance, our respondents argued that their suppliers (the average of item DQ1 in Table A1 is 5.59) and consumers (the average of item DQ2 in Table A1 is 5.77) can relatively well encourage firms' pollution reduction process. However, Chinese manufacturing industry is still at the stage of diminishing industrial capacities, and some manufacturers are facing the dilemma of how to sustainably develop GO. Therefore, how to coordinate attentions to environmental and business responsibilities is often a challenge for EMs (Zeng et al., 2011). For non-state-owned and small-and medium-size firms, external stakeholders may impose more pressures rather than incentives

for GO. For instance, Zeng et al. (2011) found that environmental association and media usually more promote large-size firms' GO than small-and medium-size firms because of a closer political relation between large-size firms and government. It implies that IES cannot effectively improve the impact of EMs' FRCO on PPRB, even generating a negative moderating effect. In contrast, state-owned firms that benefit from the close political connection with government are more likely to achieve dual competitive edges of EP and business performance (Maung et al., 2016). Accordingly, Chinese government should strengthen the guidance to GO of non-state-owned manufacturers and that located in underdeveloped regions to decrease the negative impact of dynamic external contexts on their internal GO.

4.3. The performance of PPRB

Following the conceptual model of Fig.1, this paper will examine how antecedents of PPRB and PPRB respectively affect the performance level. As the limited space, Table 4 only presents the variables that have a statistically significant impact on each performance. Overall, PPRB can significantly improve all kinds of performance, thereby verifying H4a, H4b, and H4c. Further, a number of antecedents of PPRB can also significantly improve firm performance, which verifies H5a, H5b, and H5c. Following, we will focus on how EMs' PPRB affects each kind of firm performance.

Table 4. The test for performance of PPRB

Variables	Model 1 (OP)	Variables	Model 2 (SC)	Variables	Model 3 (EP)
Educational level	-0.18** (1.79)	FRCO	0.21** (3.86)	FRES	0.24** (4.33)
ERSE	0.28** (5.46)	IAR	0.29*** (2.53)	FRCO	0.42*** (3.86)
IAR	0.21** (2.53)	IES	0.35*** (2.49)	IES	0.49*** (2.49)
IES	0.16* (2.49)	FRCO×IAR	-0.34*** (4.55)	FRCO×IES	-0.19** (2.98)
FRES×IAR	0.23* (4.75)	FRES×IES	0.27** (4.85)	PPRB	0.07*** (2.41)
FRCO×IAR	-0.34*** (4.55)	PPRB	0.14* (2.41)		
PPRB	0.31*** (2.41)				
N	155	N	155	N	155
F-value	6.11***	F-value	11.22***	F-value	11.60***
Adjusted R ²	0.44	Adjusted R ²	0.61	Adjusted R ²	0.62
Durbin-Watson	1.86	Durbin-Watson	1.71	Durbin-Watson	2.19

Note: *p≤0.10 (Two-tailed), **p≤0.05 (Two-tailed), ***p≤0.01 (Two-tailed). The value of VIF is in parentheses.

4.3.1. Operational performance

With respect to OP, Wang and Feng (2015) described that the current economic mode in China still presents a feature of high energy consumption with high pollutants discharge, but energy use efficiency is presenting an improving trend. Specific to the firm level, Wu et al. (2015) pointed out that the whole process of manufacturing production in China highly relies on fossil fuels, which requires a large amount of supportive resources to be invested to control pollutants discharge. Overall, PPRB improves

firms' OP (0.31), which presents that GO can provide manufacturers favorable production environment and improve operation efficiency through decreasing implicit environmental protection cost (Walker et al., 2014).

However, there are two cases that need to be focused on. First, empirical results present that PPRB's impact on OP (0.31) is more positive than that on SC (0.14) and EP (0.07), but the descriptive statistics in Table A1 presents that EMs do not agree with the obvious improvement of their PPRB to OP whose average is only 4.95. Through analyzing the regression coefficient in Table 4, we find that the positive impact of antecedents of PPRB on OP is weaker than that on SC and EP with the following possible reason. As both PPRB and OP are at a lower level and their averages are close, the change of OP related to environmental issues in Chinese manufacturing firms may be more rely on the related GO behaviors rather than behavioral antecedents. Second, Table A1 presents that the average of item FQ3 (4.52) is significantly lower than that of FQ1 (5.12) and FQ2 (5.19), which indicates that the positive impact of PPRB on financial performance is still limited. That is, for firms' daily operations, PPRB often more directly improve GO, but weakly improve financial indicators. With more elements participating in firms' operation, the relation between GO and financial performance also presents a complexity. Prior studies indicated that their relation is evolved from the unidirectional or non-causality to bidirectional causality (Earnhart and Lizal, 2006; Sueyoshi and Goto, 2010). Based on prior experience, when firms encounter a severe economic crisis, they may not always focus on public issues. Conversely, developing social activities may not necessarily bring expected financial performance. Actually, the impact of GO on financial performance is always affected by shares distribution, production mode, available resources, financing channels, major shareholders' green perception, and political intervention (Melnyk et al., 2003; Hatakeda et al., 2012). Accordingly, top managers and government need to address how to minimize the damage of GO brings to business performance.

4.3.2. Strategic competitiveness

Early theoretical studies pointed out that proactive environmental strategy effectively links SC and ecological issues, and a mainstream angle on environmental management also indicated that besides cost savings, EMs also need to consider how to obtain multiple competitive edges through developing environmental strategies (Sharma and Vredenburg, 1998). The positive impact of PPRB on SC (0.14) indicates that GO will more broadly affect manufacturers' prospects, and once this action is proved to

positively affect firms' future value, EMs may be motivated to place environmental issues in a strategic priority (Brickson, 2007; Basu and Palazzo, 2008). Comparing the regression coefficients that explain OP and SC in Table 4, it can be found that antecedents of PPRB can more contribute to the improvement of SC than PPRB itself. From this, we can infer that if one kind of PPRB's performance is committed to achieve a high level, it needs a more balanced driving force from both antecedents of PPRB and PPRB itself. This case supports the process of EMs' psychological motivation evolving into final behavioral performance is in a progressive status, and there is a close relation among each link. In view of possible influence channels of PPRB to each kind of SC (items GQ1, GQ2, and GQ3), the specific analysis based on China's context is as follows.

First, pollution reduction can help Chinese manufacturers to expand the sales volume of low-carbon product/service, which is an important business opportunity. Prior studies, presented that the overall perception of Chinese consumers to green production is still vague, but they will not hold conflicting or even repugnant feelings. Instead, they are willing to better understand new products and then attempt to purchase (Ramasamy and Yeung, 2009). After that, Li et al. (2016) surveyed four large cities in China (Beijing, Shanghai, Wuhan, and Shenzhen) and presented that although individual differences (e.g. age, residential location, and information sources) can affect consumers' green perception, more consumers are willing to pay a higher price for low-carbon product/service because of better marketing channels, service standards, and green brands. Accordingly, we infer that Chinese manufacturers will be willing to establish a positive relation with consumers because this way can bring new business opportunities.

Second, expanding financing channels may decrease future operation risks and strengthen investors' confidence in manufacturers' success. Table A1 presents that compared with improving business opportunities and firms' reputation, respondents less agreed that PPRB can help to expand financing channels. From investors' angle, Wang et al. (2011) explained this case. Through the natural experiment method, they surveyed the melamine contamination incident in China and found that after this event that undermines the social environment, investment willingness of individual and financial institutions has experienced a significant drop, which makes the firm hard to reverse the destroyed social image in the coming period. That is, prior bad behaviors will restrict the growth of subsequent CSR performance and further trigger a negative reaction of financial investors. Based on our empirical results, we infer that most Chinese EMs have realized the possible damage of neglecting GO, but as the lower PPRB, GO

may less and slowly helps to expand future financing channels.

Finally, an excellent reputation describes that firms are broadly respected by the public (Weiss et al., 1999). Zou et al. (2015) and Lin et al. (2016) presented that inactive GO behaviors will severely damage the reputation of Chinese manufacturers, and media is an important institution that has a function to reveal the lower level of GO. Generally, most public groups are not easy to directly learn about the manufacturers' GO status, but some of them are really interested in it. In contrast, Chinese government is more eager to acquire new progresses of manufacturers' GO, thereby optimizing the environmental regulation in time. In this context, media can oversee as well as visualize the whole process of GO. If manufacturers are exposed to not proactively engage in GO, consumers may decrease the purchase of their product/service because of their violations for social trust, which will also trigger a damage of their reputation. Currently, the broader role of media in China create a favorable context for the sustainability of manufacturers. Table A1 also supports that PPRB can better improve firms' reputation than create business opportunities or expand financial channels.

4.3.3. Environmental performance

Generally, PPRB can more directly and strongly improve EP than firms' other performance because this behavior belongs to the domain of environmental management. Table A1 presents that compared with OP (4.95) and SC (5.27), the level of EP is significantly higher (5.66). However, Table 4 presents that the impact of PPRB on EP (0.07) is less positive than that on OP and SC, but the impact of antecedents of PPRB on EP is more positive. This case further supports that if one kind of PPRB's performance is planned to be a high level, elements belonging to behavioral antecedents are required to play a stronger driving force rather than only rely on the support of behavior itself. For the status quo of China that is facing the environmental crisis, as long as these EMs attach importance to GO, it will reverse the current unfavorable situation. However, such action will be inevitably at the cost of large-size environmental investment. Accordingly, how to decrease the economic cost is also a critical issue to be addressed.

5. Research implications

5.1. Implications for the theoretical understanding of GO

Above empirical analysis improves our understanding on the antecedent of GO behavior mainly from the angle of examining the driving effect of EMs' psychological motivation and the moderating effect of critical contextual factors. The environmental management literature generally lacks the observation of

EMs' psychology level, which leaves an important question unanswered, i.e. when and how the top management of manufacturing firms will develop proactive strategy for GO (Bansal and Roth, 2000; González-Benito and González-Benito, 2006). To answer that question, we have to focus on antecedents of this behavior. Through further refining the managerial motivation to PEMB within a robust theoretical framework, this paper expands the theoretical boundary of GO in following aspects. First, compared with the traditional norm that proactive behavior always appear in business production or operation activities, GO is also presenting the strategic requirement that should be an essential part of the responsibility of the top management. For instance, it requires EMs to establish a robust and supportive motivation. EMs' perceptions of GO should be given a high priority in environment-related strategic decisions. In general, how to improve GO in the manufacturing industry through individual environmental psychology is worth broadly discussing. Accordingly, identifying more psychological motivations within a robust theoretical framework needs to be practiced. Second, even in difficult situations, EMs may still have strong desires to improve the status quo for achieving specific operation goals (Bindl et al., 2012). This paper arranges the contextual factor as a moderating variable to support the following logic. After establishing initial motivations to achieve a certain level of proactive behavior, the process of practicing targeted behavior may still be affected by objective contexts where individual is in. That is, EMs' positive motivation may not necessarily lead to their actual behaviors. Prior studies, regardless of the conceptual framework of proactive behavior theory (Crant, 2000; Parker et al., 2006; Parker et al., 2010), or antecedents of GO (Gavronski et al., 2012; Walker et al., 2014), generally neglected how critical contextual factors can potentially affect the actual outcome of individual psychological motivation in subsequent proactive behavior. Linking psychology level and behavior through the intermediary of contextual factor can help to clarify the complex interaction among these three links, as well as explaining which link can better promote the proceeding of GO. Third, empirical results reveal that the impact of EMs' psychological motivation on their PPRB is much stronger and more consistent than the effect of IAR and IES. This finding emphasizes the significance of positive motivations. It also suggests a need to integrate psychological motivation and contextual factors into one theoretical framework for GO. Accordingly, GO improvement requires manufacturers to synergize EMs' motivation and critical contextual factors in a consistent manner. Briefly, we identify the specific psychological motivation that can strongly affect EMs' PPRB. Etzion (2007) articulated a need for linking

business organization and the natural environment based on the merit of sustainable operations, which is also followed by this paper to call for future research to integrate person-environment elements within manufacturing firms.

5.2. Practical implications for GO

Through integrating the empirical results and data distribution of measuring items in Table A1, we identify that during promoting EMs' PPRB, the effect of following elements still have limitations. First, the level of all kinds of motivations is concentrated in 5 to 6 score. That means, EMs do not have a very strong sense of self-confidence and responsibility for engaging in pollution reduction. Given the relatively lower PPRB in practice, a strong psychological motivation should be considered as an important premise for improving PPRB. Second, the moderating effect of IAR and IES has not presented a very positive status, even with the negative effect. According to Crant (2000) and Parker et al. (2010), contextual factors often present a more dynamic and complex feature than individual psychology because these factors are more hard to be controlled in practice. Based above limitations on antecedents of PPRB, we discuss how to improve the effect of these antecedents for better PPRB.

5.2.1. Improving EMs' psychological motivation

Gifford (2007) and Winkel et al. (2009) suggested that in the future, more attention should be paid to individual self-selection to environmental issues because this cognition is the fundamental driving force for promoting the sustainable development of society. However, a major challenge is that some EMs do not full understand what is the real environmental or ecological knowledge. For Chinese manufacturing firms, their EMs have not presented a strong psychological motivation to pollution reduction issues. This can be attributed to EMs' relatively weak environmental knowledge system. In practice, the limitation of this knowledge system will impede the formation of EMs' psychological motivation and hinder other stakeholders to work together for GO.

The psychological motivation items in our research require EMs to develop at least three levels of knowledge system. First, items A1Q3 and B2Q3 require EMs to differentiate the impact mechanisms between their PPRB and other operations areas, thereby effectively linking multiple operation systems in a firm. This will help EMs and other top managers to establish a consensus on a firm's overall strategic plan. Second, items A1Q1 and A1Q2 require EMs to understand the development status of a firm's pollution reduction at different stages as well as the merits (and demerits) of current pollution

reduction plans. This requires EMs to understand the operations model and improvement path of a firm's pollution reduction (or cleaner production) initiatives, which is also based on an overall understanding of a firm's production plans. Third, items A2Q3 and B1Q3 require EMs to understand environmental policies and laws, and accordingly grasp the overall trend of macro-environmental regulation, thereby taking targeted environmental actions.

5.2.2. Improving firms' environmental management capability

In the field of firms' GO, improving IAR can be described as a kind of environmental management capability (EMC) judged by prior studies. Lee and Klassen (2008), Wong et al. (2012), and Wong (2013) defined EMC as a kind of organizational capability that aims to decrease the negative impact of daily operations on the natural environment with climate-friendly ways. The limited positive effect of IAR reflects the problem of Chinese manufacturers, including insufficient internal resources for GO and an unclear strategic orientation for resource deployment.

Compared with IES, EMs can more easily manage internal resources, but Table A1 presents that the average of IAR (5.24) is actually lower than that of IES (5.56). According to Song et al. (2017), EMC of Chinese A-shares listed firms is still weak as a whole relative to the size of their size and environmental responsibility they need to undertake. Accordingly, a possible path to address this problem is helping manufacturers to obtain resources that can be deployed for GO. The economies of scale will then take the effect when firms have stronger EMC to increase the volume of low-carbon product/service. In aspect of policy development, manufacturers need a favorable business environment where GO practice can be efficiently introduced. For this goal, Chinese government should encourage manufacturers to introduce GO initiatives through providing environmental credits and financial support. This is in line with suggestions of Zeng et al. (2011) that both heavy-polluting and non-heavy-polluting firms are hard to achieve remarkable progress in GO because of the lack of policy support in China.

Additionally, Table 3 and Table 4 jointly present that lack of IAR will delay the positive evolvement from EMs' initial motivation to multiple firm performance. In this case, another policy instrument that can promote GO practice is developing green government procurement. Enlightened by Geng and Doberstein (2008), this procurement mode is gaining popularity in developing countries because the low-carbon consumption led by public sectors can improve manufacturers' production structure and increase public awareness for GO. Further, such sustainable low-carbon behavior at the government

level will imply more strategic information on GO for firms, thereby improving the item CQ3.

Although the reform of green production led by Chinese government can help to strengthen PPRB, EMs' environmental perception is more helpful to obtain IAR compared with the support from external stakeholders. EMs need to identify the significance of GO to firms' operation. This positive perception will bring competitive edges in the long-run. As suggested by [Lee and Klassen \(2008\)](#) and [Yang et al. \(2011\)](#), GO requires all members' participation as well as the establishment of dedicated environmental department. Table A1 presents a lower level of item CQ2 (5.09) and EQ2 (4.75). To improve it, EMs need to strengthen professional training in environmental issues for all members with essential incentives to enhance members' proactivity, which also helps to improve EMC.

5.2.3. Improving incentives from external stakeholders

Table A1 presents higher IES compared with IAR, but Table 3 supports that the moderating effect of IAR is more positive than that of IES, which implies that IES can play the stable effect only if its level reaches a higher level compared with now. That is, external stakeholders need to create more favorable contexts. From this point of view, Industrial Symbiosis programs that are broadly practiced in Western countries should be suggested. EMs' initial motivation can be reinforced when a broader range of major stakeholders are involved in GO decisions. The development of Industrial Symbiosis programs is still at the initial stage in China. Experiences from Western countries on coordinating the role of firms and their stakeholders can enrich GO practices for promoting the "new normal" of economy in China. Towards this direction, [Zhang and Wang \(2014\)](#) suggested Chinese manufacturers to cooperatively reducing their pollutants spanning across their value chains, and the essence of this mode is a kind of market selection that breaks the traditional situation where resources flow is dominated by policy regulations. Currently, lack of infrastructure and institutional safeguard mechanism are main obstacles for establishing such cooperative mode. Our analysis reveals that EMs are generally confident in cooperating with external stakeholders on GO issues (as the average of item A2Q2), which provides an encouraging view for GO improvement among Chinese manufacturers.

6. Conclusion

This paper surveys 155 EMs of manufacturing firms in the context of rapid economic growth and severe environmental pollution in China. Within a conceptual framework underpinned by the proactive behaviour, we examine how EMs' psychological motivation (RBSE and FR) affect their PPRB under the

moderating effect of IAR and IES. Integrating prior analysis on RBSE and FR as well as EMs' possible psychological status in environmental management, we divide RBSE into IRSE and ERSE, and FR into FRES and FRCO. Our empirical findings confirm that both EMs' RBSE and FR can significantly improve their PPRB, but IAR only positively moderates the impact of ERSE on PPRB, and IES only positively moderates the impact of FRES on PPRB. These findings suggest a strong effect of EMs' initial motivation in environmental management, but the moderating effect of critical contextual factors is less positive. Additionally, PPRB can improve firms' OP, SC, and EP, but higher performance comes from the promotion of antecedents of PPRB rather than PPRB itself. This further confirms the necessity of EMs' strong motivation and providing a favourable context for GO.

The limitation of this paper suggests following promising directions for future research. Overall, the total respondents need to be expanded with including more heavy-polluting firms. We encountered a number of major difficulties in the data collection. Some respondents are reluctant to respond because our research theme is seen as sensitive and related to CSR. A number of respondents also explicitly said that a few questions are too close to their business secrets, e.g. the shareholding proportion of the largest shareholder. We have to view these incomplete questionnaires as the valid. Further, because of multiple job positions of respondents, we have spent a lot of time to communicate with each firm to identify the most appropriate respondent. We hope that our experience from this paper can help researchers to find a way for dealing with these difficulties in the future. Additionally, we attempt to investigate the whole process of EMs' PPRB. However, introducing too many items may trigger respondents' repugnance to provide credible data. We are conscious of this possible risk and thus appropriately reduce the number of items, but this design may make it hard for items of PPRB to involve all aspects of this behavior. For instance, [Liu et al. \(2017\)](#) suggested EMs' spill over role across the whole industry. Enlightened by this broader investigation angle, more context-specific behaviors should be further studied in the future.

Acknowledgement

We thank the funding sponsored by the National Natural Science Foundation of China [grant number: 71774039].

Appendix

Table A1. The overview of measuring items with reliability and validity tests

Measuring items (Scale: 1=strongly disagree; 2=disagree; 3= relatively disagree; 4= neutrality; 5= relatively agree; 6=agree; 7=strongly agree)	Mean	s.d.	Estimate	CITC
In-role self-efficacy (Cronbach $\alpha=0.87$; KMO=0.72; AVE=0.88)	5.44	0.95		
A1Q1. I feel confident to propose innovative ideas for firm's pollution reduction plans.	5.37	1.06	0.84	0.72
A1Q2. I feel confident to optimize firm's pollution reduction plans in time.	5.34	1.09	0.93	0.74
A1Q3. I feel confident to improve firm's reputation through pollution reduction.	5.61	1.03	0.74	0.71
Extra-role self-efficacy (Cronbach $\alpha=0.84$; KMO=0.64; AVE=0.87)	5.29	0.97		
A2Q1. I feel confident to formulate firm's pollution reduction strategies.	5.41	1.08	0.80	0.68
A2Q2. I feel confident to organize cooperative pollution reduction programs with firm's major stakeholders.	5.37	1.07	0.89	0.75
A2Q3. I feel confident to fulfill firm's pollution reduction tasks that exceed environmental policies or laws require.	5.10	1.20	0.80	0.68
Felt responsibility establishment (Cronbach $\alpha=0.83$; KMO=0.68; AVE=0.84)	5.52	0.88		
B1Q1. It is my responsibility to correct defects existing in firm's pollution reduction plans.	5.62	0.87	0.83	0.70
B1Q2. It is my responsibility to overcome difficulties during firm's pollution reduction.	5.43	1.03	0.87	0.74
B1Q3. It is my responsibility to comply with environmental policies and laws even if other firms benefit from violating them.	5.53	1.17	0.68	0.61
Felt responsibility coordination (Cronbach $\alpha=0.71$; KMO=0.67; AVE=0.70)	5.58	0.75		
B2Q1. It is my responsibility to give a high priority to pollution reduction.	5.34	1.05	0.77	0.73
B2Q2. It is my responsibility to prevent the dysfunction of firm's daily operations because of organizing pollution reduction.	5.69	0.86	0.61	0.60
B2Q3. It is my responsibility to coordinate environmental performance and other performance.	5.71	0.93	0.60	0.53
Internal available resource (Cronbach $\alpha=0.86$; KMO=0.72; AVE=0.86)	5.24	0.99		
CQ1. I can obtain technology resources that can help to reduce pollutants.	5.30	1.13	0.86	0.69
CQ2. I can obtain human resources that can help to reduce pollutants.	5.09	1.20	0.77	0.64
CQ3. I can obtain the information that can help to formulate firm's pollution reduction strategies.	5.32	1.03	0.84	0.73
Incentives from external stakeholders (Cronbach $\alpha=0.78$; KMO=0.65; AVE=0.70)	5.56	0.93		
DQ1. Our firm has signed green purchase agreements with more and more suppliers	5.59	1.17	0.80	0.55
DQ2. The low-carbon consumption willingness of consumers is enhancing.	5.77	1.16	0.84	0.50
DQ3. The media can help to optimize firm's pollution reduction plans.	5.32	0.99	0.90	0.66
Proactive pollution reduction behavior (Cronbach $\alpha=0.89$; KMO=0.74; AVE=0.88)	4.94	1.15		
EQ1. I identify opportunities that are favorable to reduce pollutants and make full use of them.	5.06	1.18	0.80	0.66
EQ2. I organize the knowledge training to improve all firm members' pollution reduction perceptions.	4.75	1.47	0.84	0.54
EQ3. I organize the innovation of pollution reduction plans to decrease firm's operation risks.	5.01	1.15	0.90	0.65
Operational performance (Cronbach $\alpha=0.85$; KMO=0.71; AVE=0.85)	4.95	1.08		
FQ1. My pollution reduction behavior helps to improve the productivity of low-carbon products.	5.12	1.13	0.71	0.64
FQ2. My pollution reduction behavior helps to decrease the cost of energy consumption.	5.19	1.25	0.84	0.59
FQ3. My pollution reduction behavior helps to enhance firm's net profit.	4.52	1.32	0.87	0.60
Strategic competitiveness (Cronbach $\alpha=0.85$; KMO=0.71; AVE=0.86)	5.27	1.04		
GQ1. My pollution reduction behavior helps to create new business opportunities.	5.26	1.26	0.87	0.73
GQ2. My pollution reduction behavior helps to expand firm's financing channels.	4.88	1.24	0.79	0.66
GQ3. My pollution reduction behavior helps to improve firm's reputation.	5.67	1.05	0.78	0.71
Environmental performance (Cronbach $\alpha=0.85$; KMO=0.72; AVE=0.83)	5.66	0.85		
HQ1. My pollution reduction behavior helps to decrease firm's pollutants discharge.	5.50	0.95	0.78	0.69
HQ2. My pollution reduction behavior helps to decrease the frequency of environmental accidents.	5.75	1.05	0.82	0.63
HQ3. My pollution reduction behavior helps to improve the natural environment of firm's surrounding communities.	5.73	0.96	0.75	0.65

Table A2. The list of abbreviations

Full name	Abbreviation
green operations	GO
environmental manager	EM
corporate social responsibility	CSR
environmental management capability	EMC
role breadth self-efficacy	RBSE
in-role self-efficacy	IRSE
extra-role self-efficacy	ERSE
felt responsibility	FR
felt responsibility establishment	FRES
felt responsibility coordination	FRCO
internal available resources	IAR
incentives from external stakeholders	IES
proactive pollution reduction behavior	PPRB
operational performance	OP
strategic competitiveness	SC
environmental performance	EP

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