Environment and Social Psychology (2024) Volume 9 Issue 10
doi: 10.59429/esp.v9i10.3069

RESEARCH ARTICLE

External green pressure, dynamic capability, and green innovation: The regulating effect of executive environmental attention

Xiaofang Lin[1], Wunhong Su[1,*]

[1]*International College, Krirk University, Bangkok, 10220,Thailand*

*** Corresponding author:** Wunhong Su, whsu@hdu.edu.cn

ABSTRACT

Aiming to investigate the mediating effect of green dynamic capability on external green pressure and green innovation, as well as the moderating effect of executive environmental attention on external green pressure and green dynamic capability, this study preferred a theory model with five hypotheses. A valid sample of 357 interviewees was investigated to test the proposed hypotheses, and structural equation modeling was utilized. In addition, external green pressures mostly have a significant impact on green innovation, the green dynamic capability as a mediator. Also, executive environmental attention moderates the relationship between external green pressure and green dynamic capabilities. The results offer unique contributions to the literature and some suggestions for practicing in manufacturing enterprises.

Keywords: green innovation; external green pressure; green dynamic capability; executive environmental attention

1. Introduction

Nowadays, firms have been increasingly scrutinized for wrongdoing, particularly concerning the environment (such as the release of toxic materials and emissions that augment global warming). Governments introduce policies that place a cost on emissions, and consumers consider a company's environmental philosophy when purchasing products and services[1]. One possible response to these mounting pressures is environmental innovation.

Since the reform and opening up, China's economy has developed rapidly. However, at the same time, it is accompanied by the abuse of natural resources and the rampant ecological and environmental problems, which have brought great pressure and challenges to the sustainable development of human society. In recent years, the traditional development model of over-reliance on resource and energy consumption and ecological environmental debt has been highly concerned by the relevant developments of the Chinese government and the public due to reasons such as large resource consumption, serious environmental pollution and industrial structure imbalance, and China's overall economic development has gradually shifted from high-speed growth to the stage of green, high-quality and sustainable development in the new era. With the increasingly strong call for environmental protection in all walks of life, manufacturing and other energy-consuming enterprises and major polluters have become the focus of public attention, and

ARTICLE INFO
Received: 3 September 2024 | Accepted: 3 October 2024 | Available online: 28 October 2024

CITATION
Lin XF, Su WH. External green pressure, dynamic capability, and green innovation: the regulating effect of executive environmental attention. *Environment and Social Psychology* 2024; 9(10): 3069. doi: 10.59429/esp.v9i10.3069

changing the development model and achieving green innovation has become an urgent need for China's manufacturing industry.

With the increasing attention of the international community to the environmental benefits, enterprises began to pursue green, sustainable innovation. Klemmer defines this kind of green sustainable innovation as environmental innovation and suggests that the purpose of environmental innovation is to reduce environmental burden and achieve ecological sustainable development[2]. In essence, it is the application or introduction of new ideas, new behaviors, new products, and new processes in the process of business development. Kemp then proposed that systematic organizational innovation and management innovation are also important measures for enterprises to achieve ecologically sustainable development[3]. Hellstrom put forward the concept of sustainable innovation, which includes innovations that are conducive to improving human life, such as those in the aspects of safety and quality of life[4]. In a word, green innovation emphasizes the specific innovation behavior of products and technology carried out by enterprises to protect the environment. Green innovation in this study includes green product innovation and green process innovation.

In this paper, we aim to investigate the mediating effect of green dynamic capability on external green pressure and green innovation. The moderating effect of executive environmental attention on external green pressure and green dynamic capability is also discussed. We predict the following opinions by consolidating hypotheses in this paper: faced with external green pressure, the manufacturing firm can turn this pressure into improving green dynamic capability so as to bring about green innovation actions, including green product innovation and green process innovation.

2. Literature review and hypotheses development

2.1. External green pressure and green innovation

Existing studies have shown that external green pressures, such as stakeholders, have always been the key drivers of enterprises' efforts to achieve corporate social responsibility and sustainable green development, such as green marketing, green supply chain management, green product innovation, and green human resource management. Based on the Stakeholder theory, governments, suppliers, customers, society, and non-governmental organizations may drive pressure on firms. It is proposed that external pressure, such as stakeholder pressure is positively correlated with green innovation[5].

The pressure of coercive environmental regulation makes enterprises choose green innovation strategies or activities. The government guides the production and operation behavior of enterprises by formulating environmental planning and environmental impact assessment, forcing enterprises to incorporate environmental factors in their strategic planning and design. By limiting production technology standards, pollutant discharge, and other constraints on enterprise behavior, enterprises have to make strategic adjustments to meet the mandatory requirements of the regulation. The government exercises the power of punishment through the implementation of environmental protection laws and regulations, increasing the cost of environmental default of enterprises[6]. Incentivized environmental regulatory pressure mainly includes government policies such as tax incentives, financial subsidies, and preferential procurement to compensate for the cost increase caused by green innovation partially and to induce enterprises to adopt green innovation strategies with its potential advantages, especially in the horizontal flow of green innovation technology, knowledge and other resources in the industry to reduce the uncertainty of green innovation.

Berrone et al. pointed out that the harsher the government's environmental regulations, the more inclined enterprises are to adopt green innovation strategies[6]. Heavy polluting enterprises are especially

inclined to increase R&D investment, upgrade production technology, and carry out green innovation activities to reduce environmental pollution. Strict environmental control is the most basic reason for enterprises to participate in environmental activities voluntarily, and it is also the primary driving force to encourage enterprises to develop environmental strategies. Government departments' investigation and punishment of environmental pollution behaviors of enterprises directly affect the level of environmental governance of enterprises[7]. Accordingly, the study develops the following hypotheses:

H1a. Coercive environmental regulatory pressure has a significant impact on green product innovation.

H1b. Coercive environmental regulatory pressure has a significant impact on green process innovation.

From the perspective of different types of environmental regulation policies, coercive environmental regulation uses the government's coercive force to manage and adjust market behavior, forcing enterprises to adopt green innovation. Market incentive environmental regulation guides enterprises to carry out green innovation with its potential advantages. Compared with the mandatory order, the market incentive environmental regulation guides market behavior through the market mechanism and economic incentives and ensures fair competition and operation of the market through the government's supervision and intervention. Incentives such as tax incentives and subsidies will reduce the R&D and other input costs of enterprises in green innovation to a certain extent and increase the rate of return. Therefore, enterprises will be more proactive and have a more significant impact on green innovation[8].

H1c. Incentivized environmental regulatory pressure has a significant impact on green product innovation.

H1d. Incentivized environmental regulatory pressure has a significant impact on green process innovation.

Market competition pressure, named imitative pressure[9], firstly by Galaskiewicz and Wasserman, is the pressure exerted by competitors on the target company, which comes from the perception of the company's social network and the behavior of its competitors in the industry. When competitors adopt green innovation strategies to develop green products, expand green markets, attract more customers, gain competitive advantages, and make profits, the impact on enterprises will prompt them to imitate their competitors' business strategies and enter the market first so as to avoid the loss of legitimacy and competitive advantage[10]. According to the research of Zhu and Geng, market competition pressure is an important driving force for domestic manufacturing enterprises to achieve energy conservation and emission reduction[11]. By quickly capturing the green innovation strategy behaviors of competitors in developing environmentally friendly products and adopting environmental protection technologies, enterprises can obtain competitive advantages by adopting the same green innovation behaviors. Therefore, when more and more enterprises in the industry adopt positive green behaviors, the likelihood of enterprises choosing green innovation strategies will increase. Therefore, the following hypothesis is proposed:

H1e. Market competition pressure has a significant impact on green product innovation.

H1f. Market competition pressure has a significant impact on green process innovation.

The pressure of social norms mainly comes from non-governmental organizations, suppliers, the public, and social media. With the improvement of people's living standards and education level, environmental awareness is also improving, and consumers and enterprises tend to choose green innovation practices. In addition, social media convey social expectations for enterprises to carry out green innovation activities and fulfill social responsibilities through the Internet, TV, we-media, and other forms. Such attention and supervision of environmental protection from the media will also increase the normative pressure faced by enterprises, prompting enterprises to choose green innovation. Specifically, with the increasing social attention to environmental issues, consumers are increasingly aware of green environmental protection. Hence, they are

more inclined to choose environmentally friendly and green products, and enterprises are more inclined to meet the needs of consumers and launch products and services that meet environmental protection standards in order to obtain market share and enhance brand image. Consumers can make consumption decisions based on in-depth knowledge of corporate environmental performance, such as media reports. As the fourth right in society independent of legislation, administration, and judiciary, news media plays an important role in information transmission, which can not only help enterprises understand the demands of stakeholders and the new trends of social technology so as to directly or indirectly affect the green strategy and green behavior of enterprises. The influence of media attention on enterprises' green innovation mainly includes "supervision and governance" and "market pressure"[12]. When enterprises perceive social pressure, corporate decision-makers consider environmental issues in consideration of corporate image and reputation[13] and choose green innovation strategies[14]. They are more inclined to design new products, develop new technologies, and use new energy. Therefore, the following hypothesis is proposed:

H1g. Social norms pressure has a significant impact on green product innovation.

H1h. Social norms pressure has a significant impact on green process innovation.

2.2. External green pressure and green dynamic capability

Dynamic capability theory (DCT), as a new research field, has attracted more and more attention in recent years. Based on DCT, dynamic capability refers to a firm's ability to identify, respond to, and implement action plans for change needs or opportunities[15]. Zahra *et al*. (2006) defined dynamic capability as the process of reconfiguring a company's resources and operational routines in a way that is envisioned and deemed appropriate by key decision-makers[16]. According to the definition of green dynamic capability and the understanding of its connotation, scholars' definition of green dynamic capability basically maintains the following points: recognizing and perceiving changes in the external environment, reconfiguring various resources, and dynamic adaptation and coordination ability. Therefore, this study uses three aspects to define green dynamic capability, namely, organizational green strategy capability, research green innovation capability, and organizational green management capability.

Dynamic capability theory holds that companies are able to respond quickly and effectively to new challenges and opportunities through development, thereby achieving long-term competitive advantage. It is an organizational ability to perceive the external environment, seize business opportunities, and restructure corporate assets[17]. It is considered an effective means to solve the turbulent environment and external pressure and can help managers expand, modify, and reconfigure existing resources. Green dynamic capability can improve the agility, effectiveness, and efficiency of enterprises in responding to environmental changes[18-19] to develop and take action on more effective corporate innovation strategies.

Stakeholders are the main source of external green pressure on enterprises and will influence the environmental behavior of enterprises through various channels[20]. Therefore, it is necessary to define both stakeholder and external green pressure simultaneously. As for stakeholders, it was first proposed and defined by Stanford University (1963), which took into account managers, employees, and customers and broke the concept of "shareholder first" at that time. In his book *Strategic Management: A Stakeholder-Starting Approach*, Freeman (1984) defined stakeholders as "all individuals and groups that can influence the achievement of an organization's objectives or are affected by the process by which an organization realizes its objectives"[21].

Most scholars believe that in order to obtain economic benefits and promote the development of a company, the support or participation of various stakeholders is essential. If enterprises want to maximize their overall interests, they cannot focus on the interests of certain subjects. Among them, these stakeholders include not only corporate shareholders, employees, creditors, customers, and other trading partners but also

the government, media, and other subjects, and even the natural environment, various non-human organisms, and other objects[22]. According to different scholars' classifications of stakeholders and related studies[21,23], different stakeholders have different influences and driving effects on green innovation strategy. External green pressures from stakeholders are generally considered to contain environmental regulatory pressure, social regulation pressure, and market competition pressure, which are related to green innovation.

The regulatory pressure mainly comes from environmental regulation, which is the main driving force of enterprises' green innovation. It can be divided into mandatory environmental regulation and market incentive environmental regulation. Mandatory orders mainly include environmental planning, environmental impact assessment, production technology standards, pollutant emission constraints, and environmental penalties, which mainly restrict enterprise behavior, increase the cost of environmental violations, and induce enterprises that want to avoid environmental penalties to take the initiative to carry out green innovation[24]. Market incentives mainly include government tax incentives, financial subsidies, preferential procurement, and other policies, which make up for the costs caused by enterprises adopting green innovation or guide the horizontal flow of green innovation knowledge and technology and other resources in the industry so as to reduce uncertainty factors for green innovation strategy. In addition, from the perspective of environmental policy tool combination, the optimal environmental policy should be reasonably designed, regulatory flexibility should be increased, and enterprises should be encouraged to carry out ecological innovation to achieve a win-win situation between environmental performance and economic performance[25].

Environmental regulatory pressure can be divided into coercive environmental regulatory pressure and incentivized environmental regulatory pressure. Companies should develop green dynamic capabilities to address environmental and social issues, reducing risks and penalties such as investor withdrawal of funds or non-compliance and legal incidents arising from business operations. Enterprises should redeploy resources and capabilities to develop green dynamic capabilities in the face of green pressure so as to fully and effectively perceive the green pressure brought by environmental regulation, market competition, and the public so as to maintain and improve their position and advantages in the dynamic market. According, the following hypothesis is proposed:

H2a. Coercive environmental regulatory pressure has a significant impact on green dynamic capability.

H2b. Incentivized environmental regulatory pressure has a significant impact on green dynamic capability.

The green pressure from competitors urges enterprises to continuously pay dynamic attention to the strategic activities of competitors in order to take timely countermeasures[26]. Similarly, green pressure from customers can force firms to identify, manage, and resolve customer claims in a timely manner[5] in order to increase market share, retain existing customers and attract new ones[27]. Simply put, enterprises need to face competitive pressures from the market and actively develop green dynamic capabilities that enable them to reintegrate, build, and deploy resources to navigate the complex and even conflicting needs of various stakeholders, address uncertainty, and reduce market risk. Therefore, enterprises need to focus on the participation of relevant market competitors by utilizing dynamic capabilities in a way that promotes cooperation and environmental learning. The greater the competitive pressure in the market, the more green dynamic capabilities can be stimulated. Therefore, it is expected that market competition pressure will encourage enterprises to develop and improve green dynamic capabilities to meet the challenges of environmental protection. Market pressure is an important resource for enterprises to obtain market information and gain competitive advantages[28]. Thus, the following hypothesis is proposed:

H2c. Market competition pressure has a significant impact on green dynamic capability.

Generally, environmental standards and norms from actors around firms can influence their environmental responses[29]. In response to environmental factors, enterprises tend to acquire and develop resources that can improve their green innovation performance[30]. The research shows that environmental NGOs and the public exert pressure on enterprises mainly through environmental litigation and public confrontation, thus affecting corporate reputation. At the same time, the media mainly influences the strategic decisions of enterprises by asking them to disclose environmental information. Companies must build their reputation and maintain legitimacy through information transparency and communication and invite external stakeholders for review[1]. In order to cope with the green pressure, enterprises should redeploy resources and capabilities, develop green dynamic capabilities so as to fully and effectively perceive the green pressure brought by non-governmental and media, and maintain and improve their status and advantages in the dynamic competitive market. Thus, the following hypothesis is proposed:

H2d. Social norms pressure has a significant impact on green dynamic capability.

2.3. Green dynamic capability and green innovation

Green dynamic capability can improve the agility, effectiveness, and efficiency of enterprises in responding to environmental changes[18-19] to develop and take action on more effective corporate innovation strategies. The green dynamic capability of an enterprise is multifaceted, including but not limited to sensing, grasping, and transforming to design and implement a business model. This capability comes from the continuous development and accumulation of the management characteristics and corporate culture of an enterprise, which usually cannot be easily replicated by competitors[31]. The improvement of green dynamic capability enables enterprises to adjust effectively to adapt to the change of a green environment, which is manifested in two aspects: first, enterprises reorganize existing resources to achieve the optimal allocation of resources; The second is to enable enterprises to seize environmental opportunities and create competitive advantages to beat competitors. The establishment of competitive advantage is positively correlated with the innovation of products and processes. The study found that the lack of clean production technology and measures to solve clean production will be the main obstacle to the high-quality development of enterprises. Hence, the ability to quickly obtain external environmental information is the key to achieving high-quality development of enterprises.

Once new market opportunities are identified, it is necessary to learn new knowledge and skills and develop new products to cater to new market opportunities[32] so as to gain competitive advantages and improve enterprise performance. It can be said that enterprises' innovation of green products and processes depends on their strong green dynamic capabilities relative to competitors, including organizational green strategy capabilities, R&D green innovation capabilities, and organizational green management capabilities [5], which can enable enterprises to coordinate resources better. Enterprises' green dynamic capabilities enhance their green innovation efforts by promoting green management practices, green strategic goals, and green research and development[33]. To sum up, the current academic research on the relationship between green dynamic capability and enterprise green innovation has confirmed the positive effect of green dynamic capability on enterprise green innovation. According to this, the following new hypothesis is developed:

H3a. Green dynamic capability has a significant impact on green product innovation.

H3b. Green dynamic capability has a significant impact on green process innovation.

2.4. The mediating role of green dynamic capability

The improvement of green dynamic capability enables enterprises to adjust effectively to adapt to the change of a green environment, which is manifested in two aspects: first, enterprises reorganize existing

resources to achieve the optimal allocation of resources; The second is to enable enterprises to seize environmental opportunities and create competitive advantages to beat competitors[34]. The establishment of competitive advantage is positively correlated with the innovation of products and processes.

As for how external pressure affects enterprise green innovation, most existing studies are based on the logic of "pressure - internal factor - behavior"[35]. Green dynamic capability includes the ability to perceive and learn external green opportunities, which helps enterprises make full use of and grasp market competition opportunities and allocate existing resources to develop new products. Once new opportunities are identified, it is necessary to learn new knowledge and skills and develop new products to cater to new market opportunities[32] in order to gain competitive advantages. In investigating Chinese manufacturing enterprises, coercive environmental regulatory pressure, and incentivized environmental regulatory pressure affect the green innovation behavior of enterprises by affecting their external knowledge reception. In summary, green dynamic capabilities play an important role in environmental regulatory pressure and green innovation. Accordingly, the study develops the following hypotheses:

H4a: Green dynamic capability mediates the relationship between coercive environmental regulatory pressure and green product innovation.

H4b: Green dynamic capability mediates the relationship between coercive environmental regulatory pressure and green process innovation.

H4c: Green dynamic capability mediates the relationship between incentivized environmental regulatory pressure and green product innovation.

H4d: Green dynamic capability mediates the relationship between incentivized environmental regulatory pressure and green process innovation.

Green dynamic capability is an organizational ability to perceive the external environmental, seize business opportunities, and restructure corporate assets[17]. It is considered an effective means to solve the turbulent environment and external pressure and can help managers expand, modify, and reconfigure existing resources. Green pressure from customers forces companies to identify, manage, and resolve customer claims in a timely manner[5] in order to increase market share and attract and retain new customers[28]. In order to effectively respond to external green pressure from the market, customers, and suppliers, enterprises will actively develop green dynamic capabilities to respond to market uncertainties and reduce risks[36].

Therefore, the following hypotheses are proposed:

H4e: Green dynamic capability mediates the relationship between market competition pressure and green product innovation.

H4f: Green dynamic capability mediates the relationship between market competition pressure and green process innovation.

With the increasing prioritization of stakeholder and social responsibility in corporate management practices[37], external green pressure can strengthen corporate support for environmental initiatives and corporate environmental commitments[26,38], promoting enterprises to explore green learning[39-40] so as to realize corporate green innovation[41-42]. Therefore, enterprises should make use of their green dynamic capabilities to meet the green pressure from the government, customers, workers, society, and other stakeholders. These pressures can have a positive impact on a firm's green dynamic capabilities[5,43-44] to encourage companies to proactively develop and renew resources and capabilities and adopt green strategic behaviors. According, the following hypotheses are developed:

H4g: Green dynamic capability mediates the relationship between social norms pressure and green product innovation.

H4h: Green dynamic capability mediates the relationship between social norms pressure and green process innovation.

2.5. The moderating effect of executive environmental attention

According to the Upper Echelons Theory, as a part of human resources, executives play a key role in the strategic decision-making of enterprise[45]. They are also "heterogeneous resources" that are not easy to be imitated and replaced by enterprises. As a unique resource of enterprises, heterogeneous resources are a major prerequisite for the strategic choice of enterprises[46]. The background characteristics, values, attitudes, and thinking patterns of corporate executives have an important impact on corporate behavior, decision-making, and economic benefits. They are also key factors in explaining the different ways that enterprises respond to external pressures under the same environment. As executives differ in their recognition and interpretation of opportunities and challenges of the external environment, their attitudes and tendency toward environmental protection issues greatly affect the results of enterprises' green innovation strategic decisions[47]. When managers make decisions in the face of complex internal and external environments, the decision-making process is not completely rational[48]. Due to the limitation of cognitive level and the influence of values, the personal characteristics of senior executives, such as educational background, age, and years of employment, have a great impact on the strategic decision-making process of enterprises. In the face of highly uncertain green behaviors, executives should not only rely on subjective thoughts to make judgments but should make a comprehensive evaluation of the future development trend based on objective facts, quickly grasp the nature of corporate green innovation, and actively promote corporate green innovation[49-50]. The green innovation activities of enterprises also depend, to a large extent, on the attention, cognition, and judgment of senior executives on this issue.

Accordingly, the study develops the following hypotheses:

H5a. Executive environmental attention positively moderates the relationship between coercive environmental regulatory pressure and green dynamic capability.

H5b. Executive environmental attention positively moderates the relationship between incentivized environmental regulatory pressure and green dynamic capability.

Executives' environmental attention can influence corporate strategic choices and actions, and managers with high environmental attention devote more time and resources to environmental issues than those with low environmental attention[51]. Human capital is close to technological innovation, which directly affects the simulation and absorption of advanced technology, self-breakthrough, and improvement of technology[52]. Under the pressure of the market, executives and enterprises will take the initiative to comply with the trend of green development and put environmental protection in a strategically important position. Managers with a high awareness of environmental risks can be aware of environmental pressure from laws and regulations, stakeholders, and the public to a large extent, seize green opportunities in the market, avoid negative public attention, and reduce the impact of enterprises on the environment in the process of operation [53].

Based on the above, the following hypothesis is proposed:

H5c. Executive environmental attention positively moderates the relationship between market competition pressure and green dynamic capability.

The media's negative reports on environmental pollution and excessive emissions of enterprises will damage the reputation of enterprises and cause enterprises to lose their competitive advantages in the market.

Therefore, media attention plays an important supervisory role as an external green supervision force, and the level of executives' attention to environmental issues will regulate the level of dynamic capability improvement of enterprises. The stronger the executives' environmental attention, the more inclined they are to identify the potential benefits and external market opportunities of green innovation[54-55], the more enterprises have a sense of responsibility and mission to carry out green innovation and are optimistic about environmental pollution, the more inclined they are to allocate internal resources more reasonably and incorporate green innovation into the strategic height[55].

Similarly, the stronger the environmental awareness and the higher the cognitive level of environmental protection, the easier it is to tap the green pressure revealed by social media, and the more inclined it is to introduce new green knowledge into the enterprise and integrate it to improve the dynamic ability of green innovation, so as to promote the green innovation behavior of the enterprise. Executives who hold a positive attitude toward environmental protection will positively affect the role of social normative pressure on the dynamic ability of green and promote the integration of green resources and the improvement of capacity. When managers treat the environment as a priority, they tend to prioritize finding and solving environmental problems[56] and guide the enterprise to seize green opportunities[57], which increases the enterprise's green dynamic ability. In this regard, the following hypothesis is proposed:

H5d. Executive environmental attention positively moderates the relationship between social norms pressure and green dynamic capability.

According to the above hypotheses, **Figure 1** is illustrated below:

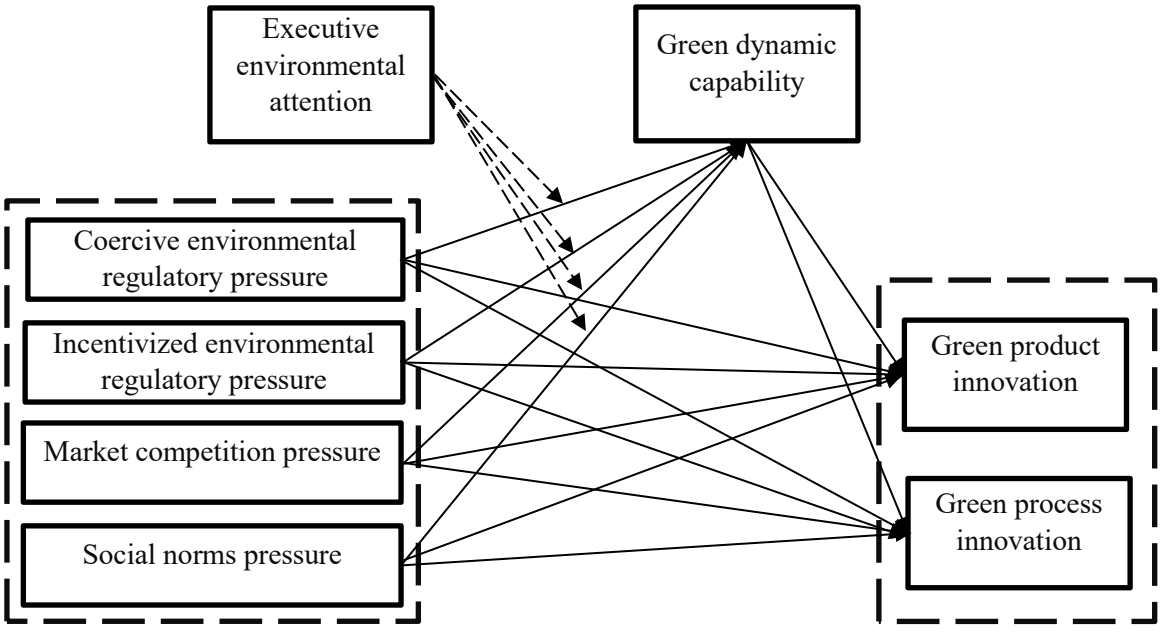


Figure 1. Conceptual work of various hypotheses in this study.

3. Research design

3.1. Research method and data collection

A questionnaire method is adopted in this study to verify the research hypotheses. The target population of this study was Chinese middle-senior managers or above in manufacturing companies. A sample size of 357, derived from the distribution of 388 questionnaires with a response rate of 92.01%, was considered sufficient for this study, confirming the validity of the subsequent investigation.

The variable measurement items in the questionnaire are all from domestic and foreign maturity scales and have been applied more. For the English scale, multiple methods such as back translation, proofreading by professional translation members, and trial work are adopted to ensure the expression of the items without ambiguity and semantic deviation. When designing the questionnaire, four senior managers from the enterprise were invited to conduct in-depth interviews, and the design and expression of the questionnaire were revised to avoid misunderstanding. Likert 7-level scale was used to improve the accuracy of data results, ranging from "1" (completely inconsistent) to "7" (fully consistent). Comprehensive details regarding the questionnaire used to measure all variables are provided in Supplementary Material 1. **Table 1.**

3.2. Common method bias

In order to avoid the common methodological bias that may occur when the questionnaire is measured from the same subjects, this study adopts statistical and procedural measures. First, when the questionnaire is designed, the subjects are informed that the survey data are only used for research purposes, and all the questionnaire data are anonymous and guaranteed not to be used for other purposes. Second, the Harman method is used for factor analysis. The results show that the contribution rate of the maximum feature root factor variance of unrotated extraction is 32.933%, which is less than the critical value of 40% and less than half of the total explanatory amount (71.293%). Therefore, there is no serious common method bias problem in this study.

3.3. Data analysis method

Structural equation modeling (SEM) with AMOS26.0 and SPSS 27.0 was used to test the hypothesized model. First, the measurement model was confirmed using confirmatory factor analysis (CFA), and then SEM analysis was performed to measure the fit and path coefficients of the hypothesized model. The chi-square (χ^2) value, degrees of freedom (df), value of χ^2/df, the goodness of fit index (GFI), adjusted goodness of fit index (AGFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA) were adopted to estimate model fit.

4. Summary of findings

4.1. Descriptive statistics analysis

This study used valid results from 357 respondents. **Tables 1 and 2** show the demographic characteristics of respondents and the firms' basic information. The respondents, in particular, had roughly a 50/50 split between males (51.8%) and females (48.2%). Besides that, 52.4% of the overall respondents were between 26 and 35 years old, and then the age groups of 36-45 years old (26.0%), 46-55 years old (14.6%), 18-25 years old (4.7%) and 56-65 years old (2.0%). The remaining 0.3% of the total respondents were over 65 years old. For education, 76.2% of the respondents had bachelor's degrees or equivalent, followed by postgraduate degrees (12.3%), diploma/advanced diploma (7.3%), no high school diploma (2.2%), and doctoral candidate (2.0%). For occupation time, 40.3% of the total respondents were 6-10 years, followed by 1-5 years (29.4%), 11-15 years (14.3%), more than 20 years (8.1%), 16-20 years (7.0%), and not more than one year (0.8%). For companies, 31.4% of the companies are more than 20 years, followed by 13-20 years (29.3%), 10-12 years (20.8%), 7-9 years (8.1%), and 1-3 years (1.4%), none is less than one year. 37.3% of the companies are located in East China, followed by South China (19.6%), North China (14.6%), Central China (10.9%), Southwest China (8.7%), Northwest China (5.3%), and Northeast China (3.6%). For enterprise-scale, four categories included micro-enterprises (5.9%), small-scale (34.7%), middle-scale (41.2%), and large-scale (18.2%). The type of industries included computers, communications, and others (27.7%) the most, followed by metalwork (14.6%), clothing and textiles (11.8%), and others.

Table 1. Demographic characteristics of respondents.

	N	%		N	%
Gender			*Age Group*		
Male	185	51.8	18–25 years	17	4.7
Female	172	48.2	26–35 years	187	52.4
Total	357	100.0	36–45 years	93	26.0
			46–55 years	52	14.6
Education			56–65 years	7	2.0
No High School Diploma	8	2.2	More than 65 years	1	0.3
Diploma/Advanced Diploma	26	7.3	Total	357	100.0
Bachelor's degree or equivalent	272	76.2			
Post Graduate degree	44	12.3	Occupation Time		
Doctoral candidate	7	2.0	Not more than one year	3	0.8
Total	357	100.0	1-5 years	105	29.4
			6-10 years	144	40.3
Occupation			11-15 years	51	14.3
Executive Director/CEO	8	2.2	16-20 years	25	7.0
Administrative or senior management	92	25.8	More than 20 years	29	8.1
Middle management	257	72.0	Total	357	100.0
Total	357	100.0			

Table 2. Basic information of firms.

	N	%		N	%
Enterprise Age			*Enterprise Scale*		
Less than one year	0	0.0	Micro-enterprises	21	5.9
1-3 years	5	1.4	Small-scale	124	34.7
4-6 years	29	8.1	Middle-scale	147	41.2
7-9 years	33	9.2	Large-scale	65	18.2
10-12 years	74	20.8	Total	357	100.0
13-20 years	104	29.3			
More than 20 years	112	31.4	*Nature of Enterprises*		
Total	357	100.0	China local company	323	90.5
			China multinational company	26	7.3
Type of industries			Foreign company	8	2.2
Clothing and textiles	42	11.8	Total	357	100.0
Petroleum, chemicals, and plastics	24	6.7			
Computers, communications, and others	99	27.7	*Location*		
Foodstuff	25	7.0	Northeast China	13	3.6
Metalwork	52	14.6	North China	52	14.6
Wood, leather, and paper	5	1.4	East China	133	37.3
Medicine	22	6.2	Central China	39	10.9
Nonmetallic mineral	6	1.7	South China	70	19.6
Automobile	9	2.5	Northwest China	19	5.3
Transportation	14	3.9	Southwest China	31	8.7
Comprehensive utilization of waste	8	2.2	Others	0	0
Other manufactures	51	14.3	Total	357	100.0
Total	357	100.0			

Notes: *1. Micro-enterprises: employees < 20 people, operating income < 3 million; Small-scale: 20 ≤ employees < 300, 3 million ≤ business income < 20 million; middle-scale: 300 ≤ employees < 1000, 20 million ≤ business income < 400 million; and large scale: Employees ≥1000, business revenue ≥ 400 million.*
2. The type of industries is classified according to the national economic industry classification standard of China (GB/T4754-2017).

4.2. Reliability and validity

In order to reflect measurement model assessment, the first step is to examine the indicator loadings. **Table 3** shows that all standardized factor loadings were above 0.652, indicating that the construct explained more than 50 percent of the indicators' variance, so all the indicators of variables remained except GMC3. All Cronbach's *a* values of variables were greater than the 0.7 threshold[58]. Suppose the latent variable

composite reliabilities are higher than 0.8, even more than 0.9, and there is a high internal consistency of indicators measuring each construct, thus confirming construct reliability. Convergent validity is always evaluated by average variance extracted (AVE), which ensures that the components used to evaluate the construct can explain the construct. AVE (≥ 0.6) and the composite reliability (>0.7) show that the variance captured by each latent variable is significantly larger than the variance because of the existence of measurement error. From the result of reliability and validity, **Table 3** shows that all Cronbach's α here are above 0.8, and AVEs are all above 0.593. Consequently, the conclusion can be drawn that all the constructs showed evidence for acceptable reliability and validity. Discriminant validity was demonstrated by showing that the average shared variance of any construct and its indicators is greater than any of the shared variance with other constructs[59]. **Table 4** lists below demonstrates this fact since the values on the diagonal are greater than any value in their corresponding rows and columns, which are the square roots of AVEs.

Table 3. Reliability and validity.

Construct	Cronbach's α	Variables	SE.	CR (t-value)	Standardized factor loadings	AVE	CR
CERP	0.897	CERP1	-	-	0.817	0.686	0.897
		CERP2	0.057	16.799(***)	0.802		
		CERP3	0.054	17.932(***)	0.844		
		CERP4	0.057	18.074(***)	0.850		
IERP	0.825	IERP1	-	-	0.794	0.612	0.825
		IERP2	0.072	13.023(***)	0.761		
		IERP3	0.076	13.190(***)	0.791		
MCP	0.851	MCP1	-	-	0.652	0.599	0.854
		MCP2	0.110	13.506(***)	0.928		
		MCP3	0.098	11.501(***)	0.701		
		MCP4	0.099	12.617(***)	0.786		
SNP	0.903	SNP1	-	-	0.729	0.615	0.905
		SNP2	0.072	13.639(***)	0.739		
		SNP3	0.074	13.905(***)	0.753		
		SNP4	0.071	14.706(***)	0.794		
		SNP5	0.071	16.483(***)	0.891		
		SNP6	0.064	14.615(***)	0.790		
OGSC	0.899	OGSC1	-	-	0.801	0.691	0.899
		OGSC2	0.058	18.135(***)	0.869		
		OGSC3	0.058	17.032(***)	0.824		
		OGSC4	0.059	17.141(***)	0.828		
DGIC	0.821	DGIC1	-	-	0.672	0.605	0.821
		DGIC2	0.144	8.711(***)	0.905		
		DGIC3	0.134	8.948(***)	0.830		
GMC	0.813	GMC1	-	-	0.750	0.593	0.813
		GMC2	0.082	12.227(***)	0.751		
		GMC4	0.087	12.363(***)	0.807		
GPDI	0.863	GDPI1	-	-	0.805	0.618	0.866
		GDPI2	0.063	16.778(***)	0.858		
		GDPI3	0.070	13.685(***)	0.706		
		GDPI4	0.062	15.084(***)	0.768		
GPCI	0.898	GPCI1	-	-	0.859	0.642	0.899
		GPCI2	0.048	17.579(***)	0.785		
		GPCI3	0.049	16.597(***)	0.755		
		GPCI4	0.053	15.950(***)	0.735		
		GPCI5	0.047	20.303(***)	0.864		
EEA	0.914	EEA1	-	-	0.820	0.682	0.914
		EEA2	0.058	17.191(***)	0.789		

Construct	Cronbach's α	Variables	SE.	CR (t-value)	Standardized factor loadings	AVE	CR
		EEA3	0.054	21.637(***)	0.927		
		EEA4	0.060	15.707(***)	0.739		
		EEA5	0.055	18.892(***)	0.842		
GDC	0.777	OGSC	-	-	0.672	0.653	0.848
		DGIC	0.164	4.848(***)	0.905		
		GMC	0.168	5.051(***)	0.830		

Table 4. *(Continued)*

Note 1: *Coercive Environmental Regulatory Pressure (CERP); Incentivized Environmental Regulatory Pressure (IERP); Market Competition Pressure (MCP); Social Norms Pressure (SNP); Organization Green Strategy Capability (OGSC); R&D Green Innovation Capability (DGIC); Organizational Green Management Capability (GMC); Organization Green Strategy Capability (OGSC); Green Product Innovation (GPDI); Green Process Innovation (GPCI); Executive Environmental Attention (EEA).*

Note 2: *"***" represents p＜0.001.*

Table 4. Discriminant validity of the constructs.

	AVE	CERP	IERP	MCP	SNP	GDC	GPDI	GPCI	EEA
CERP	0.686	0.828							
IERP	0.612	0.296	0.782						
MCP	0.599	0.243	0.230	0.774					
SNP	0.615	0.371	0.300	0.257	0.784				
GDC	0.653	0.468	0.517	0.403	0.525	0.808			
GPDI	0.618	0.426	0.486	0.428	0.314	0.666	0.786		
GPCI	0.642	0.512	0.500	0.292	0.591	0.742	0.514	0.801	
EEA	0.682	0.212	0.115	0.103	0.273	0.345	0.179	0.218	0.826

Note: *The data on the diagonal in the Table is the square root of AVE.*

Table 5. Measurement model moderation index.

	χ^2	DF	χ^2/DF	GFI	AGFI	CFI	RMSEA
CERP	6.323	2	3.162	0.991	0.954	0.995	0.078
IERP	-	-	-	-	-	-	-
MCP	6.390	2	3.195	0.991	0.954	0.993	0.079
SNP	28.537	9	3.171	0.976	0.944	0.984	0.078
OGSC	5.917	2	2.959	0.992	0.959	0.995	0.074
DGIC	-	-	-	-	-	-	-
GMC	-	-	-	-	-	-	-
GDC (two-order)	62.821	32	1.963	0.966	0.941	0.984	0.052
GPDI	6.134	2	3.067	0.991	0.956	0.994	0.076
GPCI	11.454	5	2.291	0.988	0.963	0.994	0.060
EEA	14.293	5	2.859	0.984	0.951	0.992	0.072
Reference value	-	-	＜3	＞0.8	＞0.8	＞0.8	＜0.08

Note: *Coercive Environmental Regulatory Pressure (CERP); Incentivized Environmental Regulatory Pressure (IERP); Market Competition Pressure (MCP); Social Norms Pressure (SNP); Organization Green Strategy Capability (OGSC); R&D Green Innovation Capability (DGIC); Organizational Green Management Capability (GMC); Organization Green Strategy Capability (OGSC); Green Product Innovation (GPDI); Green Process Innovation (GPCI); Executive Environmental Attention (EEA).*

As suggested by Jackson *et al.* (2009), χ^2 test, χ^2/df, GFI, AGFI, CFI, and RMSEA were selected to test the fit of the model[60]. The reference criteria are as follows: the smaller the chi-square difference of

CMIN, the better; the larger the degree of freedom, the more compact the model and the other index references are listed in **Table 5**. **Table 5** shows that the fitting of the structural model meets the requirements, and it is assumed that the fitting degree of the model and the questionnaire survey data is good.

4.3. Hypothesis assessment

The theoretical model was tested using structural equation modeling techniques (SEM) by applying AMOS 26.0. The hypothesized model provided a good fit for the data (χ^2=763.894, df=571, χ^2/df=1.338, GFI=0.899, AGFI=0.882, CFI=0.974, RMSEA=0.031).

Table 6 illustrates the direct effect estimate for direct effects. The results show that coercive environmental regulatory pressure has a positive effect on green product innovation (β=0.137, $p<0.05$) and green process innovation (β=0.166, $p<0.001$), H1a and H1b are both supported. Also, incentivized environmental regulatory pressure has a positive impact on green product innovation (β=0.183, $p<0.01$) and green process innovation (β=0.141, $p<0.01$), so H1c and H1d are both supported. It is also supported that market competition pressure has a significant effect on green product innovation (β=0.183, $p<0.001$), while the relationship between market competition pressure and green process innovation is not significant. Meanwhile, social norms pressure has a significant effect on green process innovation (β=0.251, $p<0.001$), so H1h is supported. While the relationship between social norms competition and green product innovation is not significant (p=0.465), hypothesis H1g is not supported. Furthermore, coercive environmental regulatory pressure has a greater impact on firms' green process innovation (β=0.166) than incentivized environmental regulatory pressure does on green process innovation (β=0.141), while incentivized environmental regulatory pressure has a greater impact on firms' green product innovation (β=0.183) than coercive environmental regulatory pressure does on green product innovation (β=0.137).

For the relationship between the elements of external green pressure and green dynamic capability, H2a, H2b, H2c, and H2d are all significant, with a significance level of $p<0.001$. Coercive environmental regulatory pressure, incentivized environmental regulatory pressure, market competition pressure, and social norms pressure all have a significant effect on green dynamic capability. The study also estimated the relationship between green dynamic capability and green innovation (H3a for green product innovation and H3b for green process innovation). The two hypotheses are also strongly supported with a standardized estimate of 0.479 ($p<0.001$) and 0.469 ($p<0.001$).

To explore the moderating effects of green dynamic capability, the study also explored the mediation hypothesis analysis by bootstrapping the indirect effect in line with Preacher and Hayes (2008)[61]. Using bootstrapping procedures, this study obtained bias-corrected 95% CIs and percentile 95% CIs with randomly selected 5000 samples for the estimated conditional effects of these relationships. The indirect effect of coercive environmental regulatory pressure on green product innovation (β=0.103) through green dynamic capability is significant because the confidence intervals excluded zero, and the total direct effect is also significant, so the conclusion can be drawn that the green dynamic capability partially mediates coercive environmental regulatory pressure and green product innovation, so H4a is supported. Also, green dynamic capability partially mediates coercive environmental regulatory and green process innovation (β=0.103), so H4b is also supported. Meanwhile, dynamic green capability also plays a mediating effect (β=0.101) between incentivized environmental regulatory pressure and green product innovation, supporting H4c; between incentivized environmental regulatory pressure and green process innovation (β=0.152), supporting H4d; between market competition pressure and green product innovation (β=0.096), supporting H4e; between social norms pressure and green process innovation (β=0.138), supporting H4h. However, the H4f

and H4g hypotheses are not supported, as the total and direct effects are not significant because the confidence intervals included zero.

Table 6. Direct effects estimate.

Path		Standardized	Unstandardized	SE	CR	*p*	Decision
H1a	CERP → GPDI	0.137	0.096	0.039	2.437	0.015	Supported
H1b	CERP → GPCI	0.166	0.131	0.039	3.369	***	Supported
H1c	IERP → GPDI	0.183	0.131	0.044	2.954	0.003	Supported
H1d	IERP → GPCI	0.141	0.114	0.043	2.627	0.009	Supported
H1e	MCP → GPDI	0.183	0.168	0.050	3.368	***	Supported
H1f	MCP → GPCI	-0.034	-0.035	0.048	-0.731	0.465	Not Supported
H1g	SNP → GPDI	-0.088	-0.067	0.044	-1.508	0.132	Not Supported
H1h	SNP → GPCI	0.251	0.216	0.045	4.779	***	Supported
H2a	CERP → GDC	0.214	0.150	0.041	3.607	***	Supported
H2b	IERP → GDC	0.318	0.227	0.045	5.020	***	Supported
H2c	MCP → GDC	0.201	0.184	0.052	3.528	***	Supported
H2d	SNP → GDC	0.294	0.223	0.047	4.747	***	Supported
H3a	GDC → GPDI	0.479	0.480	0.088	5.432	***	Supported
H3b	GDC → GPCI	0.469	0.530	0.089	5.984	***	Supported

Note 1: *Coercive Environmental Regulatory Pressure (CERP); Incentivized Environmental Regulatory Pressure (IERP); Market Competition Pressure (MCP); Social Norms Pressure (SNP); Green Dynamic Capability (GDC); Green Product Innovation (GPDI); Green Process Innovation (GPCI); Executive Environmental Attention (EEA).*

Note 2: *"***" represents p <0.001.*

Table 7. The total, direct, and indirect effects of the mediation model (n=5000).

Path		Effects	Point Estimate	Product of Coefficients		Bootstrapping			
						Bias-Corrected 95% CI		Percentile 95% CI	
				SE	CR	Lower	Upper	Lower	Upper
H4a	CERP → GDC → GPDI	Total	0.335	0.058	5.776	0.123	0.347	0.131	0.353
		Direct	0.137	0.057	2.404	0.026	0.249	0.026	0.250
		Indirect	0.103	0.036	2.861	0.042	0.184	0.040	0.181
H4b	CERP → GDC → GPCI	Total	0.267	0.051	5.235	0.171	0.369	0.167	0.366
		Direct	0.166	0.051	3.255	0.068	0.264	0.065	0.262
		Indirect	0.101	0.033	3.061	0.046	0.177	0.043	0.171
H4c	IERP → GDC → GPDI	Total	0.335	0.056	5.982	0.221	0.442	0.222	0.442
		Direct	0.183	0.067	2.731	0.051	0.313	0.048	0.308
		Indirect	0.152	0.042	3.619	0.082	0.246	0.082	0.245
H4d	IERP → GDC → GPCI	Total	0.290	0.047	6.170	0.198	0.383	0.197	0.382
		Direct	0.141	0.055	2.564	0.035	0.249	0.029	0.245
		Indirect	0.149	0.039	3.821	0.083	0.239	0.082	0.235
H4e	MCP → GDC → GPDI	Total	0.280	0.052	5.385	0.178	0.379	0.180	0.380
		Direct	0.183	0.053	3.453	0.075	0.285	0.076	0.287
		Indirect	0.096	0.033	2.909	0.042	0.173	0.039	0.168
H4f	MCP → GDC → GPCI	Total	0.061	0.051	1.196	-0.038	0.161	-0.040	0.160
		Direct	-0.034	0.048	-0.708	-0.130	0.059	-0.129	0.060
		Indirect	0.094	0.032	2.938	0.041	0.167	0.038	0.163
H4g	SNP → GDC → GPDI	Total	0.053	0.059	0.898	-0.068	0.168	-0.070	0.166
		Direct	-0.088	0.063	-1.397	-0.206	0.039	-0.218	0.024
		Indirect	0.141	0.043	3.279	0.070	0.237	0.069	0.236
H4h	SNP → GDC → GPCI	Total	0.389	0.052	7.481	0.291	0.492	0.292	0.494
		Direct	0.251	0.054	4.648	0.146	0.358	0.147	0.360

				0.071		0.070	0.223
Indirect	0.138	0.039			0.224		
			3.538				

Table 7. *(Continued)*

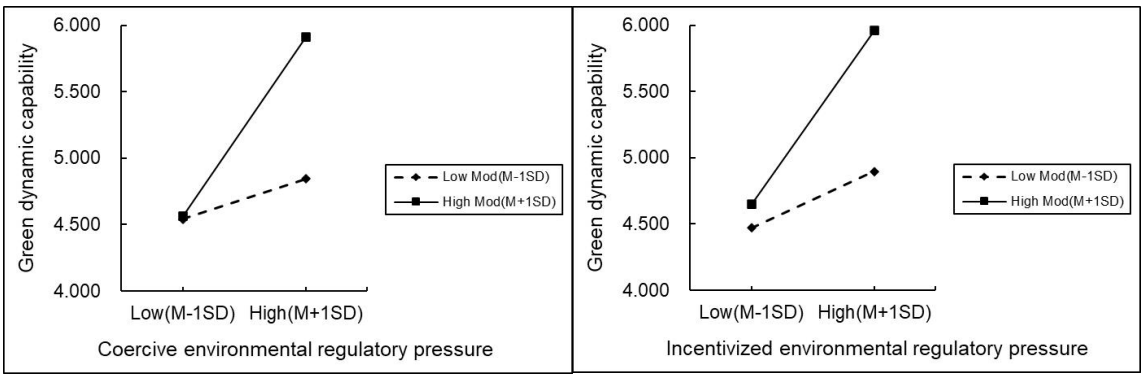
Note: *Coercive Environmental Regulatory Pressure (CERP); Incentivized Environmental Regulatory Pressure (IERP); Market Competition Pressure (MCP); Social Norms Pressure (SNP); Green Dynamic Capability (GDC); Green Product Innovation (GPDI); Green Process Innovation (GPCI); Executive Environmental Attention (EEA).*

Table 6 lists the results of the moderating effect of executive environmental attention on external green pressure and green dynamic capability. By observing the interaction term (CERP*EEA) between coercive environmental regulatory pressure and green dynamic capability, the interaction term (IERP*EEA) between incentivized environmental regulatory pressure and green dynamic capability, the interaction term (MCP*EEA) between market competition pressure and green dynamic capability, and the interaction term (SNP*EEA) between social norms pressure and green dynamic capability, the product term of the independent variable and the adjusted variant is significantly regressive. So, it means the moderating effect (β=0.136, $p<0.001$) of the executive environmental attention on the pressure of coercive environmental regulations and the green dynamic ability (H5a), the moderating effect (β=0.115, $p<0.001$) of the executive environmental attention on the pressure of incentivized environmental regulations and the green dynamic ability (H5b), the moderating effect (β=0.126, $p<0.001$)of the executive environmental attention on the relationship between market competition pressure and green dynamic capability (H5c), and the moderating effect (β=0.073, $p<0.05$) of the executive environmental attention on the relationship between social norms pressure and green dynamic capability (H5d) are all supported.

Table 8. Hypothesized moderating relationship.

Moderating		**Beta**	**Standard deviation**	**P values**	**95% Confidence interval**		**Decision**
H5a	CERP×EEA→GDC	0.136	0.028	0.000	0.080	0.191	Supported
H5b	IERP×EEA→GDC	0.115	0.027	0.000	0.063	0.167	Supported
H5c	MCP×EEA→GDC	0.126	0.028	0.000	0.072	0.181	Supported
H5d	SNP×EEA→GDC	0.073	0.029	0.011	0.017	0.129	Supported

Note: *Coercive Environmental Regulatory Pressure (CERP); Incentivized Environmental Regulatory Pressure (IERP); Market Competition Pressure (MCP); Social Norms Pressure (SNP); Executive Environmental Attention (EEA); Green Dynamic Capability (GDC).*



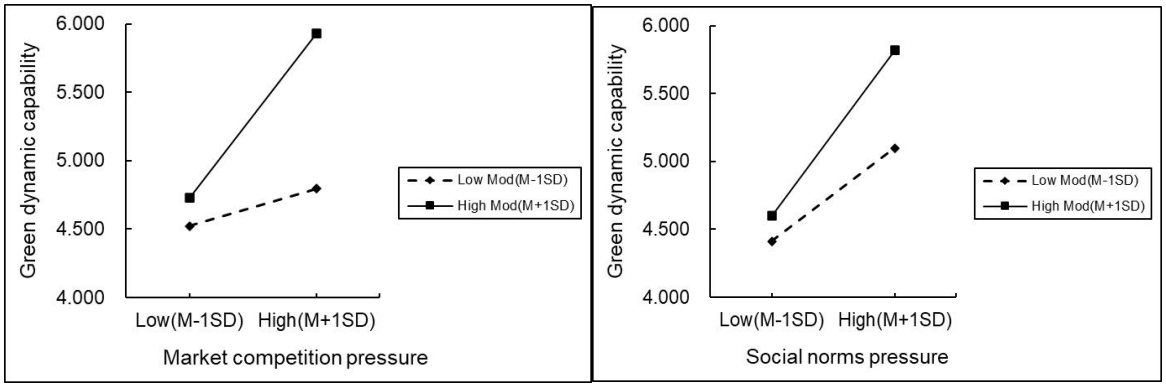


Figure 2. The moderating effect of CERP, IERP, MCP, SNP, and EEA on GDC.

5. Conclusion and discussion

5.1. Research findings

Compared with existing literature, this study explored how coercive environmental regulatory pressure, incentivized environmental regulatory pressure, market competition pressure, and social norms pressure, constituting external green pressure components, influence green dynamic capability and how green dynamic capability influences green product innovation and green process innovation. Meanwhile, the mediating effects of green dynamic capability between elements of external green pressure and green innovation were discussed. In this paper, firms' executive environmental attention, as an important element of green human capital [52], which is discussed by Luo et al. (2021), is discussed as a moderator, and some new conclusions were put forward. It was also explored that executive environmental attention moderates the relationship between the elements of external green pressure and executive environmental attention. Overall, twenty-six hypotheses were proposed, and the SEM model implemented by using the AMOS26.0 software was utilized to proceed with the analysis.

The study supports and reconfirms the results of previous studies in that institutional pressures influence green innovation[6,8,20,38,62-65]. However, the result of direct effects reveals that market competition pressure has a greater positive effect on green product innovation, and social norms pressure has a greater positive effect on green process innovation, which is consistent with the study result[66]. In contrast, there is no significant relationship between market competition pressure and green process innovation, nor between social norm pressure and green product innovation. The result also supports and echoes the findings of previous studies in that external green pressure has a critical influence on green dynamic capability[5,28,30], and green dynamic capability is an important element for firms to implement green innovation, including green product innovation and green process innovation.

In addition, the findings support the hypothesis that green dynamic capability mediates the relationship between external green pressures and green innovation. This result echoes those of the previous studies in that green dynamic capability is a vital element of enterprises' environmental innovation[34,41-42,67-68]. This finding also contributes to and advances the extant literature[48,69-72] that executive teamwork is a vital factor for firms' green innovation strategies and practices.

5.2. Theoretical implications

The results of this study have several implications that extend existing theory. First, it advances institutional theory[73-75] by increasing our understanding of how external green pressures drive and influence firms' green innovation actions. External green pressure, including coercive environmental regulatory

pressure, incentivized environmental regulatory pressure, market competition pressure, and social norms pressure, are all powerful external forces that stimulate firms to take green innovation into action. Second, based on the theory of upper echelons theory, this study discussed the moderation effects of executive environmental attention on external green pressure and green dynamic capability, which expands the research of the theory of the high ladder team in the field of enterprise innovation strategy. Third, this study introduced green dynamic capabilities, this study complemented the existing literature on how stakeholder pressures affect green innovation practices in firms, and the impact mechanism of green innovation from the micro level has deepened the theory of green innovation in the field of strategic management, and further enriched the relevant research on the green development of manufacturing enterprises. Finally, the purpose of this study is to establish a theoretical framework to explain the internal mechanism of transformation of external green pressure into green innovation actions. This theoretical framework can provide a new interpretation framework for the study of green innovation in manufacturing enterprises and can effectively make up for the existing research deficiencies in this field. This study integrates dynamic capability theory and institutional theory in the field of enterprise innovation and provides a new explanatory framework for solving the problem of enterprise green innovation and enterprise performance improvement.

5.3. Practical implications

China's manufacturing industry needs to take green innovation into strategic consideration in order to shift from the traditional extensive development mode of "high input, high consumption, and high pollution" to the pursuit of sustainable development of the environmental economy and achieve synergies through innovative cooperation and resource sharing in various links. This study is helpful for manufacturing enterprises to comprehensively clarify the relationship between corporate environmental protection and economic development and provide decision-making references for how to fulfill social responsibilities better and implement the concept of sustainable development from the perspective of corporate strategy.

In addition, green transformation and innovation development in the manufacturing industry are important ways to obtain cost and competition advantages. The manufacturing industry needs to take the road of green transformation and development. This study has important practical significance for Chinese manufacturing enterprises to take the road of green and sustainable development, and the research results will help mobilize the enthusiasm of enterprises in green product innovation and green process innovation. Green innovation is complex, requiring both external and internal factors to be organized for relationships and interrelations to be successful. This study provides a path to improve the level of enterprise green innovation. The results can also assist governments, institutions, and organizations in structuring and qualifying practices for leading to green innovation success.

Author contributions

Conceptualization, Xiaofang Lin and Wunhong Su; methodology, Wunhong Su and Xiaofang Lin; software, Wunhong Su; validation, Wunhong Su; formal analysis, Wunhong Su; investigation, Xiaofang Lin; resources, Xiaofang Lin; writing—original draft preparation, Xiaofang Lin and Wunhong Su; writing—review and editing, Wunhong Su; supervision, Wunhong Su; project administration, Xiaofang Lin; funding acquisition, Xiaofang Lin. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare no conflict of interest.

References

1. Hart SL. A natural-resource-based view of the firm (). Academy of Management Review. 1995; 20(4): 986-1014. doi: 10.5465/amr.1995.9512280033
2. Klemmer P. Innovation and the Environment. Studies of the Research Group "Innovation Effects of Environmental Policy Instruments". Analytica Verlag. Berlin.1999
3. Kemp R, Arundel A, Smith K. Survey indicators for environmental innovation. Gramisch-Partenkirchen, Germany: Conference towards environmental innovation systems. 2002
4. Hellstrom, T. Dimensions of environmentally sustainable innovation: the structure of ecoinnovation concepts. Sustainable Development. 2007; 15(3): 148-159. doi: 10.1002/sd.309
5. Singh SK, Giudice MD, Jabbour CJC, et al. Stakeholder pressure, green innovation, and performance in small and medium-sized enterprises: The role of green dynamic capabilities. Business Strategy and the Environment. 2022; 31(1): 500–514. doi: 10.1002/bse.2906
6. Berrone P, Fosfuri A, Gelabert L. Necessity as the mother of "green" inventions: institutional pressures and environmental innovations. Strategic Management Journal. 2013; 34(8): 891-909. doi: 10.1002/smj.2041
7. Xu H, Zhao XK, Jie S. Stakeholders' environmental demands and corporate environmental responsiveness. Soft Science. 2015; 29(12): 18-21. doi: 10.13956/j.ss.1001-8409.2015.12.05
8. Frondel M, Horbach J, Rennings K. What triggers environmental management and innovation? Empirical evidence for Germany. Ecological Economics. 2007; 66(1): 153-160. doi: 10.1016/j.ecolecon.2007.08.016
9. Galaskiewicz J, Wasserman, S. Mimetic processes within an interorganizational field: an empirical test. Administrative Science Quarterly. 1989; 34(3): 454-479. doi: 10.2307/2393153
10. Henisz WJ, Delios A. Uncertainty, imitation, and plant location: Japanese multinational corporations, 1990-1996. Administrative Science Quarterly. 2001; 46(3), 443-475. doi: 10.2307/3094871
11. Zhu Q, Geng Y. Drivers and barriers of extended supply chain practices for energy saving and emission reduction among Chinese manufacturers. Journal of Cleaner Production. 2013; 40: 6-12. doi: j.jclepro.2010.09.017
12. Li XP. Research on the influence of media attention on enterprise green technology innovation: Based on the executive team environmental attention perspective. Journal of Entrepreneurship in Science & Technology. 2023; 36(5): 14-21. doi: 10.1016/j.techfore.2023.122522
13. Lee MDP, Lounsbury M. Filtering institutional logics: community logic variation and differential responses to the institutional complexity of toxic waste. Organization Science. 2015; 26(3): 847-866. doi: 10.1287/orsc.2014.0959
14. Feng WN, Mu Y, Qu R. External green pressure, environmental commitment and green innovation strategy of manufacturing enterprises: The moderating role of organizational slack. Journal of Northeastern University (social Science). 2023; 25(1): 35-46. doi: 10.15936/j.cnki.1008-3758.2023.01.005
15. Eisenhardt KM, Martin JA. Dynamic capabilities: What are they? Strategy Management Journal. 2000; 21(10-11): 1105-1121. doi: 10.1002/1097-0266(200010/11)21:10/11<1105::AID-SMJ133>3.0.CO;2-E
16. Zahra SA, Sapienza HJ, Davidson P. Entrepreneurship and dynamic capabilities: A review, model, and research agenda. Journal of Management Studies. 2006; 43(4): 917-955. doi: 10.1111/j.1467-6486.2006.00616.x
17. Yang L, Tan JS, Gan C. Does independent goal interdependence impair dynamic capability? The mediating role of supplier integration and the moderating role of internal integration. Asia Pacific Journal of Marketing and Logistics. 2021; 34: 1436–1458. doi: 10.1108/APJML-02-2021-0078
18. Zhou SS, Zhou AJ, Feng J, et al. Dynamic capabilities and organizational performance: The mediating role of innovation. Journal of Management & Organization. 2019; 25(5): 731–747. doi: 10.1017/jmo.2017.20
19. Rodrigues B, Gohr C. Dynamic capabilities and critical factors for boosting sustainability-oriented innovation: Systematic literature review and a framework proposal. Engineering Management Journal. 2021; 34(4): 591–619. doi: 10.1080/10429247.2021.1960124
20. Delgado-Ceballos J, Aragon-Correa JA, Ortiz-de-Mandojana N, et al. The effect of internal barriers on the connection between stakeholder integration and proactive environmental strategies. Journal of Business Ethics. 2012; 107(3): 281-293. doi: 10.1007/s10551-011-1039-y
21. Freeman RE. Strategic management: a stakeholder approach. Cambridge University Press.1984
22. Mitchell RK, Agle BR, Wood DJ. Toward a theory of stakeholder identification and salience: defining the principle of who and what really counts. Academy of Management Review. 1997; 22(4): 853-886. doi: 10.5465/amr.1997.9711022105
23. Buysse K, Verbeke A. Proactive environmental strategies: A stakeholder management perspective. Strategic Management Journal. 2003; 24(5): 453-470. doi: 10.1002/smj.299
24. Li WH, Gu Y, Liu F, et al. The effect of command-and-control regulation on environmental technological innovation in China: a spatial econometric approach. Environmental Science and Pollution Research. 2019; 26(34): 34789-34800. doi: 10.1007/s11356-018-3678-3

25. Liao ZJ, Liu P. Market-based environmental policy instrument mixes and firms' environmental innovation: a fuzzy-set qualitative comparative analysis. Emerging Markets Finance and Trade. 2022; 58(14): 3976-3984. doi: 10.1080/1540496X.2022.2079974
26. Dai J, Montabon FL, Cantor DE. Linking rival and stakeholder pressure to green supply management: Mediating role of top management support. Transportation Research Part E: Logistics and Transportation Review. 2014; 71: 173-187. doi: 10.1016/j.tre.2014.09.002
27. Helmig B, Spraul K, Ingenhoff D. Under positive pressure: How stakeholder pressure affects corporate social responsibility implementation. Business & Society. 2016; 55(2), 151–187. doi: 10.1177/0007650313477841
28. Montabon F, Sroufe R, Narasimhan R. An examination of corporate reporting, environmental management practices, and firm performance. Journal of Operations Management. 2007; 25(5): 998-1014. doi: 10.1016/j.jom.2006.10.003
29. Wang S, Li, Zhao D. Institutional pressures and environmental management practices: The moderating effects of environmental commitment and resource availability. Business Strategy and the Environment. 2018; 27: 52-69. doi: 10.1002/bse.1983
30. Le Y. Green entrepreneurial orientation: The driving factors and its impact on firm performance. [Doctoral Dissertations, Jilin University]. 2022. doi: 10.27162/d.cnki.gjlin.2022.007125
31. Teece DJ. The foundation of enterprise performance: Dynamic and ordinary capabilities in an (economic) theory of the firm. Academy of Management Perspectives. 2014; 28(4): 328-352. doi: 10.5465/amp.2013.0116
32. Teece DJ. Explicating dynamic capabilities: The nature and micro-foundations of (sustainable) enterprise performance. Strategic Management Journal. 2007; 28(13): 1319-1350. doi: 10.1002/smj.640
33. Amui LBL, Jabbour CCJ, de Sousa Jabbour AB, et al. Sustainability as a dynamic organizational capability: A systematic review and a future agenda toward a sustainable transition. Journal of Cleaner Production. 2017; 142: 308-322. doi: 10.1016/j.jclepro.2016.07.103
34. Lin YH, Chen YS. Determinants of green competitive advantage: the role of green knowledge sharing, green dynamic capabilities, and green service innovation. Quality & Quantity. 2017; 51(4): 1663-1685. doi: 10.1007/s11135-016-0358-6
35. Majid A, Yasir M, Yasir M, et al. Nexus of institutional pressures, environmentally friendly business strategies, and environmental performance. Corporate Social Responsibility and Environmental Management. 2019; 27(2): 706-716. doi: 10.1002/csr.1837
36. Huang YM, Chen C, Lei LJ, et al. Impacts of green finance on green innovation: A spatial and nonlinear perspective. Journal of Cleaner Production. 2022; 365(10): 132548. doi: 10.1016/j.jclepro.2022.132548
37. Goyal L. Stakeholder theory: Revisiting the origins. Journal of Public Affairs. 2022; 22(3): 1-8. doi: 10.1002/pa.2559
38. Bhatia MS, Kumar S. Linking stakeholder and competitive pressure to industry 4.0 and performance: Mediating effect of environmental commitment and green innovation. Business Strategy and the Environment. 2022; 31(5): 1905-1918. doi: 10.1002/bse.2989
39. Hofman PS, Blome C, Schleper MC, et al. Supply chain collaboration and eco-innovations: An institutional perspective from China. Business Strategy and the Environment. 2020; 29(6): 2734-2754. doi: 10.1002/bse.2532
40. Cui R, Wang J. Shaping sustainable development: External environmental pressure, exploratory green learning, and radical green innovation. Corporate Social Responsibility and Environmental Management. 2022; 29(3): 481-495. doi: 10.1002/csr.2213
41. Nguyen H, Onofrei G, Yang Y, et al. Handling customer green pressures: The mediating role of process innovation among export-oriented manufacturing industries. Business Strategy and the Environment. 2023; 32(4): 2312-2326. doi: 10.1002/bse.3250
42. Wang CH. An environmental perspective extends market orientation: Green innovation sustainability. Business Strategy and the Environment. 2020; 29(8), 3123-3134. doi: 10.1002/bse.2561
43. Aboelmaged M, Hashem G. Absorptive capacity and green innovation adoption in SMEs: The mediating effects of sustainable organizational capabilities. Journal of Cleaner Production. 2019; 220: 853-863. doi: 10.1016/j.jclepro.2019.02.150
44. Singh SK, Giudice MD, Chierici R, et al. Green innovation and environmental performance: The role of green transformational leadership and green human resource management. Technological Forecasting and Social Change. 2020; 150: 119762. doi: 10.1016/j.techfore.2019.119762
45. Child J. Strategic choice in the analysis of action, structure, organizations, and environment: retrospect and prospect. Organization Studies. 1997; 18(1): 43-76. doi: 10.1177/017084069701800104
46. Andersen O, Kheam LS. Resource-based theory and international growth strategies: an exploratory study. International Business Review. 1998; 7(2): 163-184. doi: 10.1016/S0969-5931(98)00004-3
47. Zhang G, Zhang XJ. Driver factors of corporate green innovation strategy based on planning behavior theory. Journal of Business Economics. 2013; (7): 47-56. doi: 10.14134/j.cnki.cn33-1336/f.2013.07.009

48. Hambrick DC, Mason PA. Upper echelons: the organization as a reflection of its top managers. Academy of Management Review. 1984; 9(2): 193-206. doi: 10.5465/amr.1984.4277628
49. Song C, Nahm AY, Song Z. Executive technical experience and corporate innovation quality: evidence from Chinese listed manufacturing companies. Asian Journal of Technology Innovation. 2022; 31(1): 94-114. doi: 10.1080/19761597.2021.2020137
50. Shao D, Zhao S, Wang S, et al. Impact of CEOs' academic work experience on firms' innovation output and performance: evidence from Chinese listed companies. Sustainability. 2020; 12(18): 7442. doi: 10.3390/su12187442
51. Naffziger DW, Ahmed NU, Montagno RV. Perceptions of environmental consciousness in US small business: An empirical study. Sam Advanced Management Journal. 2003; 68(2): 23-32. https://www.proquest.com/scholarly-journals/perceptions-environmental-consciousness-u-s-small/docview/231256554/se-2
52. Luo Y, Wang Q, Long X, et al. Green innovation and SO_2 emissions: Dynamic threshold effect of human capital. Business Strategy and the Environment. 2023; 32(1): 499-515. doi: 10.1002/bse.3157
53. Kirchoff JF, Tate WL, Mollenkopf DA. The impact of strategic organizational orientations on green supply chain management and firm performance. International Journal of Physical Distribution & Logistics Management. 2016; 46(3): 269-292. doi: 10.1108/IJPDLM-03-2015-0055
54. Peng XR, Wei J. Stakeholders' environmental orientation and eco-innovation: The moderating role of top managers' environmental awareness. Studies in Science of Science. 2015; 33(7): 1109-1120. doi: 10.16192/j.cnki.1003-2053.2015.07.018
55. Cao HJ, Chen ZW. The driving effect of internal and external environment on green innovation strategy: The moderating role of top management's environmental awareness, Nankai Business Review. 2017; 20(6): 95-103.
56. Jiang W, Chai H, Shao J, et al. Green entrepreneurial orientation for enhancing firm performance: A dynamic capability perspective. Journal of Cleaner Production. 2018; 198: 1311-1313. doi: 10.1016/j.jclepro.2018.07.104
57. Nordin R, Hassan RA. The role of opportunities for green entrepreneurship towards investigating the practice of green entrepreneurship among SMEs in Malaysia. Review of Integrative Business and Economics Research. 2019; 8(1): 99-116.
58. Nunnnally JC. An Overview of Psychological Measurement. In: Wolman, B.B. (eds) Clinical Diagnosis of Mental Disorders. Springer, Boston, MA. 1978; doi: 10.1007/978-1-4684-2490-4_4
59. Fornell C, Larcker DF. Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research. 1981; 18(1): 39-50. doi: 10.1177/002224378101800104
60. Jackson DL, Gillaspy Jr JA, Purc-Stephenson R. Reporting practices in confirmatory factor analysis: An overview and some recommendations. Psychological Methods. 2009; 14(1): 6-23. doi: 10.1037/a0014694
61. Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. Behavior Research Methods. 2008; 40(3): 879-891. doi: 10.3758/BRM.40.3.879
62. Aragon-Correa JA, Marcus AA, Vogel D. The effects of mandatory and voluntary regulatory pressures on firms' environmental strategies: A review and recommendations for future research. Academy of Management Annals. 2020; 14(1): 339-365. doi: 10.5465/annals.2018.0014
63. Dechezlepretre A, Sato M. The impacts of environmental regulations on competitiveness. Review of Environmental Economics and Policy. 2017; 11(2): 183-206. doi: 10.1093/reep/rex013
64. Horbach J. Determinants of environmental innovation – new evidence from German panel data sources. Research Policy. 2008; 37(1): 163-173. doi: 10.1016/j.respol.2007.08.006
65. Murillo-Luna JL, Garces-Ayerbe C, Rivera-Torres P. Why do patterns of environmental response differ? A stakeholder's pressure approach. Strategic Management Journal. 2008; 29(11): 1225-1240. doi: 10.1002/smj.711
66. Zhang J, Zhu M. When can B2B firms improve product innovation capability (PIC) through customer participation (CP)? The moderating role of inter-organizational relationships? Journal of Business & Industrial Marketing. 2019; 34(1): 12-23. doi: 10.1108/JBIM-09-2016-0214
67. Huang SZ, Tian HH, Cheablam O. Promoting sustainable development: Multiple mediation effects of green value co-creation and green dynamic capability between green market pressure and firm performance. Corporate Social Responsibility and Environmental Management. 2023; 31: 1063-1078. doi: 10.1002/csr.2613
68. Liao ZJ, Liu P, Tan YY, et al. Research progress and review on driving factors of firm's environmental innovation: From the perspective of stakeholder. Environmental Pollution & Control. 2023; 45(10): 1440-1446, 1466. doi: 10.15985/j.cnki.1001-3865.2023.10.018
69. Antonia MG, Antonio D. Sustainable development barriers and pressures in SMEs: The mediating effect of management commitment to environmental practices. Business Strategy and the Environment. 2023; 33: 949-967. doi: 10.1002/bse.3537
70. Kang LQ, Liu HM, Qian JJ. Influence of top managers' long-term orientation on enterprise green innovation: Moderating role of environmental dynamics and the mediating effect of strategic learning capability. Journal of Business Economics. 2021; (10): 34-48. doi: 10.14134/j.cnki.cn33-1336/f.2021.10.003

71. Quan XF, Ke Y, Qian YT, et al. CEO foreign experience and green innovation: evidence from China. Journal of Business Ethics. 2023; 182: 535-557. doi: 10.1007/s10551-021-04977-z
72. Ren,S, Jiang KF, Tang GY. Leveraging green HRM for firm performance: The joint effects of CEO environmental belief and external pollution severity and the mediating role of employee environmental commitment. Human Resource Management, 2022; 61(1): 1-16. doi: 10.1002/hrm.22079
73. Clemens B, Douglas TJ. Does coercion drive firms to adopt 'voluntary' green initiatives? Relationships among coercion, superior firm resources, and voluntary green initiatives. Journal of Business Research. 2006; 59(4): 483-491. doi: 10.1016/j.jbusres.2005.09.016
74. Scott WR. Institutions and organizations: Ideas, interests, and identities. Sage Publications. 2013.
75. Selznick P. TVA and the grass roots: A study in the sociology of formal organization. University of California Press, Berkeley, CA.1949.
76. Yu F, Hu C, Liu M. Network density, attention allocation of TM and firm green innovation: The moderating effect of institutional pressure. Journal of Industrial Engineering/Engineering Management. 2021; 35(2): 55-66. doi: 10.13587/j.cnki.jieem.2021.02.006
77. Xu J, Guan J, Lin Y. Institutional pressures, top managers' environmental awareness and environmental innovation practices: An institutional theory and upper echelons theory perspective. Management Review. 2017; 29(9): 72-83. doi:10.14120/j.cnki.cn11-5057/f.2017.09.007
78. Hung RYY, Yang B, Lien BY, et al. Dynamic capability: Impact of process alignment and organizational learning culture on performance. Journal of World Business. 2010; 45: 285-294. doi: 10.1016/j.jwb.2009.09.003
79. Ar IM. The impact of green product innovation on firm performance and competitive capability: the moderating role of managerial environmental concern. Procedia-Social and Behavioral Sciences. 2012; 62: 854–864. doi: 10.1016/j.sbspro.2012.09.144
80. Chen J, Liu L. Customer participation, and green product innovation in SMEs: the mediating role of opportunity recognition and exploitation. Journal of Business. Research. 2020; 119: 151-162. doi: 10.1016/j.jbusres.2019.05.033
81. Xie X, Huo J, Zou, H. Green process innovation, green product innovation, and corporate financial performance: a content analysis method. Journal of Business Research. 2019; 101: 697–706. doi: 10.1016/j.jbusres.2019.01.010
82. Wang MY, Li YM, Li JQ, et al. Green process innovation, green product innovation, and its economic performance improvement paths: A survey and structural model. Journal of Environmental Management. 2021; 297: 113282. doi: 10.1016/j.jenvman.2021.113282
83. Cai W, Li G. The drivers of eco-innovation and its impact on performance: evidence from China. Journal of Cleaner Production. 2018; 176: 110–118. doi: 10.1016/j. jclepro.2017.12.109
84. Chiou TY, Chan HK, Lettice F, et al. The influence of greening the suppliers and green innovation on environmental performance and competitive advantage in Taiwan. Transportation Research Part E: Logistics and Transportation View. 2011; 47(6): 822–836. doi: 10.1016/j.tre.2011.05.016
85. 29.Wang L, Li W, Qi L. Stakeholder pressures and corporate environmental strategies: a meta-analysis. Sustainability. 2020; 12(3): 1172. doi: 10.3390/su12031172

Appendix 1. Survey Questionnaire

Code	Questions	Resources
Coercive Environmental Regulatory Pressure (CERP)		
CERP1	Relevant laws, rules, or regulations set strict emission standards for pollutants (such as concentration or total emission of pollutants).	Cao & Chen (2017)[55]
CERP2	The relevant laws and regulations stipulate strict technical standards for production.	
CERP3	For enterprises that fail to meet environmental standards, relevant laws, regulations, or rules stipulate strict pollution control deadlines, order rectification deadlines, or take compulsory measures such as closure and production suspension.	
CERP4	The Environmental protection Department has developed detailed environmental plans in accordance with relevant laws, regulations, or regulations.	
Incentivized Environmental Regulatory Pressure (IERP)		
IERP1	The local government has developed a sound tax incentive system for green innovative enterprises (tax reduction or return).	Cao & Chen (2017)[55]
IERP2	The local government provides special financial subsidies for green innovation projects.	
IERP3	Local governments provide discounted interest or preferential loans for green, innovative	

Code	Questions	Resources
	enterprises.	
Market Competition Pressure (MCP)		
MCP1	Peers and peer companies have expanded their impact with their green practices.	Yu *et al.* (2021)[76]
MCP2	The green innovation of local and peer companies has a profound impact on our company.	
MCP3	The results of green innovation are good for local and peer enterprises.	
MCP4	Most local and peer companies have carried out green innovation.	
Social Norms Pressure (SNP)		
SNP1	Customers demand that the company's products meet environmental standards.	Wang *et al*. (2017)[29]; Xu *et al.* (2017)[77]
SNP2	Suppliers require the production of enterprises to comply with environmental regulations.	
SNP3	Industry associations require companies to comply with regulations on green environmental protection.	
SNP4	Environmental non-governmental organizations attach importance to the green behavior of enterprises.	
SNP5	The public is concerned about the green behavior of enterprises.	
SNP6	The media monitors the green behavior of enterprises.	
Organization Green Strategy Capability (OGSC)		
OGSC1	My organization owns future competitive flexibility in the industry.	Hung *et al*. (2010)[78]; Singh *et al*. (2022)[5]
OGSC2	My organization can be aware of business opportunities and threat possibilities.	
OGSC3	In my organization, leaders have entrepreneurial characteristics.	
OGSC4	My organization can cohesively share employees' knowledge through visioning.	
R&D Green Innovation Capability (DGIC)		
DGIC1	My organization can evaluate strengths and weaknesses.	Hung *et al*. (2010)[78]; Singh *et al*. (2022) [5]
DGIC2	My organization can know the direction and timing for green R&D.	
DGIC3	My organization has the flexibility to develop new green products or technology.	
Organizational Green Management Capability (GMC)		
GMC1	My organization has the flexibility to understand the needs of the customers.	Hung *et al*. (2010)[78]; Singh *et al*. (2022)[5]
GMC2	My organization has the flexibility to communicate and coordinate effectively among the departments.	
GMC3	My organization helps employees balance their work and family lives.	
GMC4	My organization coordinates with the community to fulfill mutual needs.	
Green Product Innovation (GPDI)		
GPDI1	Companies choose the least polluting product materials for product development or design.	Ar (2012)[79]; Chen & Liu (2020)[80]; Xie *et al*. (2019)[81]; Wang *et al*. (2021) [82]
GPDI2	Companies choose the product materials that consume the least amount of energy and resources for product development or design.	
GPDI3	Companies use minimal materials to compose products and develop or design products.	
GPDI4	Companies will carefully consider whether the product is easy to recycle, reuse, and decompose in order to develop or design the product.	
Green Process Innovation (GPCI)		
GPCI1	The company consumes fewer resources (e.g., water, electricity) than its competitors.	Cai & Li (2018)[83]; Chiou et al. (2011)[84]; Xie et al. (2019)[81]; Wang et al. (2021)[82]
GPCI2	Companies recycle, reuse, and remanufacture materials or parts.	
GPCI3	Companies use cleaner or renewable technologies to save money (e.g., water, energy, waste)	
GPCI4	Companies have redesigned production and operational processes to improve environmental efficiency.	
GPCI5	Companies redesign and improve products or services to meet new environmental standards or directives.	

Code	Questions	Resources
Executive Environmental Attention (EEA)		
EEA1	Senior management fully supports the company's environmental actions and sustainability practices.	Wijethilake & Lama (2018)[85]
EEA2	Executives have always focused on assessing the environmental impact of their business.	
EEA3	Executives have a deep understanding of their competitors' green sustainability practices.	
EEA4	Executives understand customers' green consumption needs.	
EEA5	Executives understand the industry's green and sustainable development requirements.	