

How Does Public Environmental Concern Affect Corporate Green Innovation?

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Abstract: This study investigates the impact of the rising public environmental concern on corporate green innovation in China using a firm-level fixed effects model. It includes 41,881 Chinese A-share listed firms from 2010 to 2024. Data are obtained from the Baidu search index and the CNRDS green patent database. The results show that public environmental attention can promote corporate green innovation. Heterogeneity analyses show that this positive impact is substantially stronger for financially constrained firms. This indicates that environmental attention serves as a critical external pressure that motivates green innovation under financing constraints. Also, state-owned enterprises respond more strongly to environmental attention than non-state-owned firms.

Keywords: Public environmental concern, green innovation, Chinese A-share listed firms, firm-level fixed effects model.

1. Introduction

There is a growing concern about environmental problems among publics. As public concern of environment grows, residents are more inclined to buy more eco-friendly products, use less plastic, recycle waste and choose public transport or low carbon ways to travel. Changes of consumers and society pose pressure for companies to act green. Some firms have made commitment to pursue better environmental performance (ESG) by producing green products, saving energy, and reducing pollution. At the policy level, governments respond to growing public concern by making stricter environmental rules, giving green incentives, or controlling pollution more strictly. In China, both the government and firms have adopted green innovation to address environmental challenges. Chinese firms attempted to integrate green innovation into their development strategies. There is a rapid growth in green patent applications and cleaner production practices (Popp et al., 2020; Xie et al., 2019). Also, environmental protection taxes, emissions trading schemes, and energy-consumption controls have taken place in China to stimulate firms' green technological innovation (Porter & van der Linde, 1995; Zhang et al., 2019; Cai & Li, 2018).

However, existing studies focus more on simple behaviors such as recycling or pollution control, but pay less attention to what motivates companies to do deep green innovation, such as new eco technologies or green product designs (Rennings, 2000; Horbach, 2008; Delmas & Burbano, 2011). Therefore, it is important to study how public environmental concern together with company internal ability and external pressure can lead firms to true green innovation. This helps to understand when and why companies invest in green technology and sustainable products.

This research links public environmental concern with internal factors (e.g. technology capacity, management decision, marketing orientation) external factors (e.g. regulation, consumer demand, investor pressure) in firms. Data concerning green patents, firm green patents, firm green product sales, and environmental performance were analyzed to test how these factors affect green innovation.

2. Literature Review And Hypothesis Development

2.1. Public Concern and Cooperation Behavior

The impact of increase in public concern for the environment is demonstrated in society at three levels: individuals, firms, and government behavior.

Individuals with stronger ecological attitudes tend to have more ecological purchasing behaviors. That is, when individuals concern more on environmental issues, they are more likely to make environmentally friendly consumption choices (Chen, Wu, & Jiang, 2022). Their lifestyle will be more ecological as well. People care about environments tend to reduce the use of disposable plastics, be more active in recycling and waste sorting, and have greater use of public transportation or low carbon travel methods. Thus, environmental concern has a relatively positive effect on green consumption (Chen, Wu, & Jiang, 2022).

Also, enterprise behavior has a positive correlation with environmental concern. Such a correlation is between the public environmental concern (PEC) and environmental social governance (ESG) but not in a linear relationship. With the rise of PEC, the ESG will show an improvement but not directly increase in performance. Also, enterprise behavior may be influenced by the informal institution by a higher attention on environmental problem (Cheong et al., 2025). This will motivate firms to invest more in energy saving, emission reduction and green manufacturing. Also, they may shift toward green products and innovation. For example, cooperation may determine to develop eco-friendly products and degradable packaging, or increase the use of renewable energy and environmentally friendly materials. However, during the shift, companies may focus more on the corporate image and risk management. For instance, they will increase transparency and publication of sustainability reports.

Furthermore, Liu et al. (2023) conducted a large-scale quantitative study to investigate the relation between public's attitudes and government behavior. The researchers studied 284 prefecture-level cities in China from (2011-2020) using public environmental concern (PEC) and Urban pollution

level that is measured by web-search data. They found a negative correlation between these two objects. The government might provide subsidies to the firms to promote green energy investment and low carbon urban development. In addition, they will set more regulations or policies to reduce the waste and emission, such as waste reduction measures and energy-saving policies. Stronger regulatory enforcement will be made: more inspections or harder punishment on pollution of business, will be taken place, and the carbon tax will be higher to reduce the aggregate demand of carbon and promoting people to find substitutes that can bring benefit to the environment.

2.2. Internal and External Factors of Making Green Innovations

However, despite the above three points being closely related to impact from environmental concerns to society, there is a lack of research for the factor that drives enterprises to make green innovations. The driving factors include internal and external factors. The internal mechanism is in response to the public or market's expectation and environmental responsibility, firms will improve environmental management and internally enhance motivation for green innovation. In comparison, the external pressure means when public environmental concern rises, the institutional investors pay more attention to a firm's environmental performance, exerting pressure that indirectly promotes improvements in green innovation (Song and Wang, 2025).

In internal factors, the firms may be influenced by the marketing strategy. A green marketing orientation signals to the firm that there is growing market demand for environmentally friendly products and services. This demand promotes green products to be produced and consumed. Such a demand also aligns business incentives with sustainability by framing sustainability as part of brand, positioning, and competitive advantage. Firms can justify the cost and risk of green innovation. Also it links what the firm offers with what consumers demand (Song & Wang, 2025).

Technical reserves also influence firms' capacity to innovate environmentally. This refers to a firm's ability to design and develop new processes or products, absorb and deploy new technologies and transform knowledge into valuable innovative outputs. Technical reserves include human capital, technical infrastructure, and the capacity for continuous improvement (Valdez-Juárez et al., 2021). Moreover, CEOs sometimes influence the firm to do green innovation. CEOs as strategic decision makers are more likely to approach rather than avoid such risky but potentially rewarding investments. Drawing on "attention-based view", powerful CEOs will be more willing to focus managerial attention on long term sustainability environmental issues and green research and development instead of short term profit only. They can channel organizational resources toward green projects even if these carry risk or pay off only in the longer term. Powerful CEOs facilitate genuine green innovation rather than superficial compliance (Yang et al., 2022).

For external factors, government intervention drives green innovation through several channels. First is regulatory pressure, government environmental regulation creates formal constraints and compliance costs, such as pollution permits or adding corporation tax on the firms that polluting the environment (Su, 2025). Second is incentives. Governments offer subsidies, grants or support for

environmental protection, which will motivate firms who invest more in green innovation by the cost reduction of sending subsidies. Third is the pressure from public accountability, such as media public opinion. Government regulation combined with public transparency and media attention can increase reputational risk for non-compliant firms. To maintain reputation and validity, firms may choose to enjoy green innovation.

Customers is another factor influencing firms' decision on green innovation. The high ESG performance firms may use supply chain relationships to let those green customers indirectly transfer knowledge or set benchmarks, hence encouraging suppliers to adopt similar innovations or practices (Huang et al., 2025).

Furthermore, competitors' behavior will also influence the green innovation of the enterprise. Because the transition for the substitute from non-green product to green product will let the enterprise realize that the trend was changed, hence the entrepreneur will follow the competitor to making green innovations also to maintain the market shares of the firm in the market (Porter & van der Linde, 1995; Aghion et al., 2005). This will be reflected in the financing constraint mechanism, by the increase in ESG investors setting the environmental performance to be the important basis for the investment decisions will lead capital flows towards the shares of the firms with good environmental performance. Moreover, the competition between the firms will promote companies to do more green innovations and create a variety of green products (Xie et al., 2019; Flammer, 2015). Meanwhile, in an intrinsic driving mechanism, entrepreneurial spirit will drive entrepreneurs to make feedback for the public environmental demand, hence allowing more firms to be focused on producing green products. Also, the public concern will influence the employees in the company, especially the younger generation of employees. They are more willing to work for firms with a sense of social responsibility. This lead to a promotion of environmental protection concept flow into the company hence promote and motivate the green innovations. In addition, the brand image and reputation will be influenced to the green innovation. Enterprises that actively carry out green innovation will shape a good environmentally friendly image.

3. Data

3.1. Data Collection

This study uses a panel dataset of A-share listed non-financial firms in China from 2010 to 2024. After data cleaning and matching across datasets, the final sample consists of 41,881 firm-year observations. Firm-level financial and governance data are obtained from the China Research Data Services Platform (CNRDS). Data on public environmental attention is collected using Baidu Search Index. Stata is used for empirical analyses.

3.2. Variable Definitions

The core dependent variables measure corporate green innovation are green patent applications and green patent grants. green patent applications are measured as the natural logarithm of one plus the number of green patent applications, $\ln(1 + \text{Green Patent Applications})$. In addition, green patent grants are measured as the natural logarithm of one plus the number of green patents granted, $\ln(1 + \text{Green Patents Granted})$. The mean values of $\ln(1 + \text{Green Patent$

Applications) and $\ln(1 + \text{Green Patent Grants})$ are 0.866 and 0.586 respectively. This indicates big variation in firms' green innovation activities. The key explanatory variable is public environmental attention (Env). This variable is measured using the Baidu Search Index for environment-related keywords at the city level where the firm is located. It represents the degree of public concern and attention concerning environmental issues. The mean value of environmental attention is 0.513.

Control variables include firm size, firm age, fixed assets ratio, cash holdings ratio, leverage return on assets (ROA), book-to-market ratio, board size, independent director ratio, and CEO Duality.

4. Model

This study employs a firm-level fixed effects model to examine the impact of public environmental concern on corporate green innovation.

$$Y_{it} = \alpha + \beta_1 \text{Environment}_{it} + \theta \text{Controls}_{it} + u_i + \lambda_t + \varepsilon_{it}$$

Where represents the green innovation performance of firm i in year t . Y_{it} captures the level of public environmental concern in the city where the firm is located, which was constructed from the Baidu search index. Controls_{it} is a vector of firm-level control variables, including firm size, firm age, fixed asset ratio, cash holdings, leverage, ROA book to market ratio, board size, independent director ratio, and CEO duality (company level financial indicator). u_i denotes firm fixed effects that absorb time-invariant firm heterogeneity. It's offset during operation. λ_t denotes year fixed effects that control for macroeconomic trends and policy shocks. ε_{it} is the error term that change with factors. β_1 is the impact of each one unit increase in environmental attention on a company's green innovation. If > 0 and statistically significant, it indicates that increased public environmental attention significantly promotes corporate green innovation. This coefficient reflects firms' behavioral adjustments in response to social monitoring and environmental pressure then higher public scrutiny incentivizes firms to invest in green innovation to enhance their environmental reputation or comply with anticipated regulations. $\text{Env}_{(it)}$ is the public environmental attention in the city where firm i is located in year t , constructed using the Baidu Search Index. Higher values indicate greater public environmental awareness.

5. Results

Table 1 presents the baseline regression results for the impact of public environmental attention (Env) on corporate green innovation. Columns (1) and (2) use green patent applications $\ln(1 + \text{Green Patent Applications})$ as the dependent variable, while columns (3) and (4) use green patent grants $\ln(1 + \text{Green Patents Granted})$. Columns (1) and (3) include only firm and year fixed effects, whereas columns (2) and (4) incorporate the full set of control variables. After controlling for firm characteristics, public environmental attention has a significant positive impact on green patent applications. As shown in column (2), the coefficient for Env is 0.040, significant at the 1% level. This implies that a one-unit increase in public environmental attention leads to an approximately 4.0 percentage point increase in corporate green patent applications. Similarly, environmental attention

also promotes the final grant of green patents. Column (4) shows that the coefficient for Env is 0.034, significant at the 1% level, indicating that a one-unit increase in attention raises green patent grants by approximately 3.4 percentage points. Comparing columns (1) and (2) (or columns (3) and (4)), it is evident that after adding control variables, the coefficient and significance of the core explanatory variable Env remain robust, while the model's goodness-of-fit (r^2_a) improves, confirming the reliability of the baseline results.

Table 1. Baseline

	(1)	(2)	(3)	(4)
	$\ln(1 + \text{GP})_a$		$\ln(1 + \text{GP})_g$	
Env	0.036*** (0.013)	0.040*** (0.012)	0.030*** (0.011)	0.034*** (0.011)
_cons	0.847*** (0.007)	-3.712*** (0.280)	0.571*** (0.006)	-2.983*** (0.256)
Control		Yes		Yes
Firm	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	41881	41881	41881	41881
r^2_a	0.711	0.726	0.689	0.703

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2. Heterogeneity SA

	(1)	(2)	(3)	(4)
	$\ln(1 + \text{GP})_a$		$\ln(1 + \text{GP})_g$	
Env	0.051** (0.021)	0.031** (0.016)	0.045** (0.018)	0.024* (0.014)
_cons	-3.949*** (0.365)	-3.671*** (0.306)	-3.184*** (0.349)	-2.915*** (0.271)
Control	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	15992	24664	15992	24664
r^2_a	0.717	0.729	0.692	0.706

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2 divides the full sample into a financially constrained group higher SA index, columns (1) and (3) and a less financially constrained group lower SA index, columns (2) and (4) based on the SA index. In the financially constrained subgroup, the coefficients of Env on Green Patent Applications and Green Patents Granted are 0.051 and 0.045, respectively, both significant at the 5% level. In the less financially constrained subgroup, the coefficients of Env are 0.031 for Green Patent Applications, significant at 5% and 0.024 for Green Patents Granted, significant at 10%. The promoting effect of environmental attention on green innovation is more pronounced in financially constrained firms ($0.051 > 0.031$; $0.045 > 0.024$). This suggests that firms facing greater financing pressures may view green innovation as a critical strategic tool to respond to social pressure, improve their external image, and potentially gain policy or market support.

Table 3. Heterogeneity WW

	(1)	(2)	(3)	(4)
	Ln(1 + GP) _a		Ln(1 + GP) _g	
Env	0.063*** (0.020)	0.024 (0.017)	0.061*** (0.018)	0.022 (0.014)
_cons	-3.972*** (0.347)	-3.575*** (0.322)	-3.242*** (0.330)	-2.851*** (0.286)
Control	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	16026	24610	16026	24610
r2 _a	0.719	0.726	0.695	0.701

Standard errors in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

Table 3 uses the WW index for robustness testing, and the conclusions align with those in Table 2. In the financially constrained subgroup high WW group, the coefficient of Env on Green Patent Applications is as high as 0.063 significant at 1%. In the less financially constrained subgroup low WW group, the coefficient of Env on Green Patent Applications is 0.024, and its effect on Green Patents Granted is statistically insignificant. So using different indicators confirms that financial constraints amplify the driving effect of environmental attention on green innovation, reflecting firms' strategic responses under pressure.

Table 4. Heterogeneity

	(1)	(2)	(3)	(4)
	Ln(1 + GP) _a		Ln(1 + GP) _g	
Env	0.054** (0.023)	0.021 (0.014)	0.037* (0.020)	0.021* (0.012)
_cons	-4.292*** (0.525)	-3.928*** (0.344)	-3.695*** (0.492)	-3.186*** (0.317)
Control	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	13656	27916	13656	27916
r2 _a	0.787	0.681	0.768	0.646

Standard errors in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

Table 4 groups the sample by firm ownership type. In the state-owned enterprise (SOE) group, the coefficients of Env on Green Patent Applications and Green Patents Granted are 0.054 significant at 5% and 0.037 significant at 10%, respectively. In the non-state-owned enterprise group, the effect of Env on Green Patent Applications is insignificant (coefficient 0.021), while its effect on Green Patents Granted is only marginally significant at the 10% level (coefficient 0.021). SOEs respond significantly more strongly to environmental attention than non-SOEs. This aligns with the institutional characteristics of SOEs, which bear greater social responsibilities and are more sensitive to public opinion and policy directives from the government and the public. Their green innovation behavior exhibits a strong Political-Social responsiveness.

6. Discussion

The study has several important implications for management and practice. For managers, public

environmental issues should be seen as a long-term strategic factor rather than as a short-term external pressure (Flammer, 2015). Companies must actively integrate environmental objectives into their strategies and invest in green technologies and sustainable products (Bolton & Kacperczyk, 2021; Pankratz & Zeisberger, 2021). This allows companies to transform their environmental responsibility into competitive advantage and brand value.

For governments and regulators, public environmental concerns can serve as an effective informal governance mechanism. Governments can promote green innovation in companies without relying on strict administrative regulation (Zhang et al., 2019). Instead, they can take measures such as increasing the level of disclosure of environmental information and encouraging public participation and media monitoring.

Furthermore, for investors and financial institutions, green innovation is not only a matter of social responsibility, but also a strategic choice related to the sustainable development of companies. Integrating environmental performance and green innovation capabilities into investment decisions can help identify companies that have high long-term growth potential. Regarding corporate governance, the most significant effects observed for enterprises with financial constraints and state-owned enterprises show that the internal governance structure and management attention to environmental issues are paramount. Improving the quality of governance can help companies respond more effectively to societal expectations and environmental pressures.

Despite its contribution, this study has several limitations. First, the degree of public concern about the environment is measured by the baidu research index. While this measure is objective and timely, it may not fully capture the depth or emotional intensity of the public's environmental attitudes. Further research could use methods such as survey and interview to gain in-depth data concerning public attitudes. Secondly, despite the use of firm fixed effects and year fixed effects, there may be underlying endogenous problems. For instance, inverse causality or missing variables cannot be completely excluded. Future research could use instrumental variable methods or near-natural experiments to improve the accuracy of cause-and-effect identification. In addition, this study focuses on the average effects at the company level and does not sufficiently examine the differences between different sectors or types of green innovation, which may limit the depth of the conclusions.

7. Conclusion

This article examines the impact of environmental public awareness on green innovation in enterprises and explores the heterogeneity of enterprises. The results revealed that public awareness of the environment has greatly stimulated green innovation in companies, especially for companies with financial constraints. In addition, company ownership also plays an important role. SOEs respond more strongly to public environmental concerns than non-SOEs. This study shifts attention from traditional regulatory drivers of green innovation toward public environmental concern. By integrating social pressure, financing constraints, and ownership characteristics into a unified analytical framework, the findings enhance understanding of when and why firms engage in substantive green innovation.

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