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Research Article

Green Innovation, Green Dynamic Capability, and Enterprise Performance: Evidence from Heavy Polluting Manufacturing Enterprises in China

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Green innovation is widely regarded as a beneficial strategy for manufacturing enterprises to accelerate green transformation. Drawing the natural resource-based view with dynamic capabilities, this study proposes a model linking green innovation, green dynamic capability, and firm performance. Using survey data from 236 heavy polluting manufacturing firms in China, this study investigates the impact of green innovation on firm performance. The results show that green innovation is positively correlated with both enterprise performance and green dynamic capability, whereas green dynamic capability also has a significant impact on enterprise performance. Furthermore, the survey found that the green resource integration ability, organizational learning capability, and environmental insight capability of green dynamic capability play a moderating effect on the relationship between green innovation and enterprise performance. Additionally, we provide useful enlightenment for policymakers and business managers to stimulate green innovation in enterprises. Our research not only assists managers to better grasp the effects of green innovation practices but also provides some important implications for policymakers.

1. Introduction

Recently within the excessive use of natural resources and serious environmental pollution, topics related to green development and environmental governance have been raising numerous concerns for academics, governments, and consumers. As the main consumers of resources and producers of environmental pollution, heavy pollution manufacturing enterprises face a major challenge—how to achieve a "win-win" situation between economic growth and environmental protection. Green innovation has been increasingly regarded by enterprises as an important pathway to obtain competitive advantages [1–3]. As a special enterprise innovation activity, green innovation can help reduce environmental costs and improves environmental quality. Under this background, it is of great significance to study the impact of green innovation on the enterprise performance of heavily polluting manufacturing enterprises.

Reviewing the latest research related to this article, we found that, the existing literature has comprehensively investigated the influence mechanism of green innovation on enterprise performance [4]. The empirical research on the impact of green innovation on enterprise performance has not yet reached a consensus, and the relationship between green innovation and enterprise performance presents inconclusive results. Previous research has offered three possible directions for the correlation between green innovation and enterprise performance: positive, negative, or neutral. The studies found that green innovation was positively related to enterprise performance [5–7]. Huang and Li [8] believed that green innovation is an important strategy for preventing environmental pollution. However, green innovation would increase the costs of enterprises and reduce enterprise performance. Due to the restrictions of multiple factors, such as enterprise managers' weak consciousness of environmental protection, and the dependence on traditional

development model, many heavy pollution manufacturing enterprises seek for short-term economic benefits. The inconsistent conclusions in the above literature suggest that more efforts should be made to promote the green innovation activities of enterprises. "Does green innovation of enterprises effectively improve enterprise performance?" Thus, our study strives to answer the question. It is an important economic consequence of the green innovation of enterprises. We believe that the research on the impact of green innovation on enterprise performance needs to be strengthened.

In addition, green innovation is comprised of green product innovation and green process innovation, and different types of green innovation often have different comparative advantages. For example, green product innovation can differentiate products and services of enterprises and enhance customer value for sustainable development, thus bringing green competitive advantages to enterprises. However, green process innovation can make enterprises have leading technical superiority advantages, reduce environmental costs, and gain commercial value. In view of this, the current study is intended to investigate whether there are differences in the effects of different types of green innovation on enterprise performance. Our research divides enterprise performance into two levels: financial performance and market performance. This study's purpose is to provide some evidence of the influence of green innovation on financial and market performance.

Another research issue of this study is to identify the internal mechanism through which green innovation affects enterprise performance. With the environment becoming increasingly complex and rapidly changing, dynamic capability has become a competitive strategy for companies to gain competitive advantages [9, 10]. Moreover, the cultivation and improvement of green power capability play a decisive role in the green transformation of manufacturing enterprises. How to improve the impact of green innovation on enterprise performance by improving green dynamic capability is of great significance to guiding the practice of manufacturing enterprises. Although many scholars have studied dynamic capability [11, 12], studies that focus on green dynamic capability are rare. Scholars have not reached a consensus on its connotation and measurement. Many enterprises do not attach adequate importance to the formation and cultivation of green dynamic capability. In addition, only a few studies have incorporated green dynamic capability into green innovation and enterprise performance.

This study mainly discusses two important issues: First, how does green innovation affect enterprise performance? Second, does green dynamic capability play a mediating role in the mechanism of how green innovation influence enterprise performance in the heavy pollution manufacturing industry?

Compared with the existing research, the contributions of our study are mainly reflected in two aspects. First, this study theoretically analyzed the impact of green innovation on enterprise performance from the perspective of green dynamic capability. It is a useful supplement to the theory of green innovation and green dynamic capability. It enlightens business managers on how to implement green innovation strategy. Second, this study has important practical significance for guiding heavy pollution manufacturing enterprises in China to effectively cultivate green innovation capability, improve environmental images, and enhance green competitiveness.

The rest of the article is organized as follows: In Section 2, the relevant conceptions of green innovation, green dynamic capability, and corporate financial performance are introduced, and several research hypotheses are proposed. In Section 3, we provide a detailed description of the data collection and variable measurement. Section 4 mainly discuss the empirical results, using a unique dataset of 236 heavy polluting manufacturing firms in China. Finally, the research limitations of the study and policy recommendations are given in Section 5.

2. Literature Review and Hypothesis Development

2.1. Green Innovation and Corporate Financial Performance. "Green innovation" was first proposed by Fussler & James [13], and it has gained popularity in academic circles since 2005. Scholars have explored it from multiple perspectives, such as the concept, driving factors, and performance of green innovation. Green innovation is often referred to as "sustainable innovation," "ecological innovation," or "environmental innovation," and is usually associated with "green development," "sustainable development," and "environmental issues." Green innovation as an innovation activity of product and process significantly reduces the impact of business activities on the environment and brings value to customers and enterprises. Unlike traditional innovation, green innovation lays more emphasis on using new technologies and ideas to efficiently utilize resources, effectively reduce pollution, and achieve high economic performance. Green innovation aims to produce good environmental benefits but not just to reduce environmental pressure.

Green innovation is a key factor for enterprises to improve environmental performance, achieve sustainable development, comprehensively reduce environmental costs, and seize competitive advantages. Therefore, how to promote the green innovation practice of enterprises and explore the influence mechanism of green innovation on enterprise performance has become an important topic that has attracted the concerns of scholars, entrepreneurs, and policymakers. There have been lots of studies in which green innovation is divided into green product innovation and green process innovation. Green product innovation emphasizes the integration of the environmental protection concept into raw material selection, product design, product packaging, and other links to reduce the negative impact of the whole product life cycle on the environment [14]. Green process innovation aims at reducing harmful substance generation, reducing pollutant emission, and improving energy utilization efficiency by improving existing production processes or developing new processes [5]. Scholars

have discussed the action mechanism of green process innovation and green product innovation, including the effect of green process innovation on the financial performance of enterprises and the effect of green product innovation on competitive advantage of enterprises based on the resource-based view. The two dimensions of green innovation have different pathways in influencing the improvement in enterprise performance. Green product innovation emphasizes that using environmentally friendly materials can reduce the energy consumption of products and build a more perfect recycling and treatment system, thus reducing the adverse effects of products on the environment in the whole life cycle [6]. More importantly, the outstanding environmental protection characteristics of green products help enterprises establish differentiated competitive advantages [3], including improving stakeholders' trust in the environmental behaviors of enterprises. In particular, the differentiated product advantages of green product innovation can help enterprises obtain environmental premium, thus improving their market performance. Enterprises leading in the implementation of green product innovation can sell environmentally friendly technologies or services to improve their image and even create new markets to gain competitive advantages [15]. Therefore, implementing green product innovation can help obtain valuable, scarce, incomparable, and irreplaceable resources. Moreover, enterprises can gain more profits and markets than their competitors, which will improve their financial performance. Regarding green process innovation, through pathways, such as the use of alternative energy sources, improved processes, and recycling of resources, the innovation strategy can effectively increase the energy utilization efficiency, reduce waste generation rate, and ensure that the manufacturing process of enterprises conforms to environmental regulations to avoid the environment pollution penalty and improve the financial performance of enterprises [5]. Moreover, green process innovation can improve production efficiency by improving technology and can minimize cost by reducing resource use. In addition, as a cutting-edge technological innovation, green process innovation can lead to technological advantages and improve the environmental governance and market performance of enterprises [16]. Therefore, the following hypotheses are proposed:

H1a: Green product innovation has a positive impact on the financial performance of enterprises.

H1b: Green product innovation has a positive impact on the market performance of enterprises.

H1c: Green process innovation has a positive impact on the financial performance of enterprises.

H1d: Green process innovation has a positive impact on the market performance of enterprises.

2.2. Green Innovation and Green Dynamic Capability. To adapt to the dynamic external environment, enterprises must have the necessary internal capability. Teece et al. [11] formally put forwarded the concept of "dynamic capability," pointing out that dynamic capability is the ability of enterprises to continuously seek and utilize opportunities in the rapidly changing external environment by integrating, establishing, merging, and reconstructing internal and external resources and capacities. As part of dynamic capability, green dynamic capability is the deepening and continuation of the concept of dynamic capability. Green dynamic capability is the high-level capability of enterprises to achieve sustainable and green development in the ever-changing market environment. In the process of green innovation, resource-based enterprises combine valuable, unique, integrated, and dynamic capabilities. Such capability combination is referred to as green dynamic capability. It is these capabilities that become an endogenous power of enterprises to establish their competitive advantages [17, 18]. Green dynamic capability emphasizes the integration, construction, and reallocation of internal and external resources related to environmental protection. Moreover, it can collect, identify, and predict external information, such as green technological change, green demand, and various policies related to the green development of enterprises [14, 19]. Due to the greater disparities in dividing the dimensions of green dynamic capability, scholars have not reached a consensus on the connotation of green dynamic capability. Based on the research hypotheses and referring to the classic study of Teece [11], in this study, green dynamic capability is divided into green resource integration capability, organizational learning capability, and environmental insight capability.

2.2.1. Green Innovation and Resource Integration Capability. Resource integration capability includes the integration of internal and external resources. The former mainly involves exchanging and integrating internal environment knowledge and capability, thereby emphasizing the value of cooperation between departments of environmental units and the capability to incorporate sustainability knowledge and capabilities into the operation of enterprises [20]. The latter emphasizes the ability of enterprises to absorb knowledge from external sources, including external stakeholders (e.g., customers, suppliers, shareholders, research institutions, and the government). In general, green innovation emphasizes that enterprises should cooperate more with their customers, suppliers, and universities instead of just relying on internal resources to develop new green products or technologies [21]. Green product innovation requires enterprises to attach importance to communication and cooperation with internal and external partners in research and development. In the process of implementing green product innovation, employees and suppliers should be inspired to actively participate in product design and management activities to improve the resource integration capability of enterprises. Green process innovation requires enterprises to attach importance to establishing a symbiotic and win-win relationship with internal and external stakeholders, such as encouraging employees and customers to get involved in activities, such as production process design, to improve the resource integration capability of enterprises. Green product innovation and green process innovation gradually enhance

the resource integration capability of enterprises. Therefore, the following hypotheses are proposed:

H2a: Green product innovation has a positive impact on green resource integration capability.

H2b: Green process innovation has a positive impact on green resource integration capability.

2.2.2. Green Innovation and Organizational Learning Capability. In the current complex and ever-changing market, dynamic capability improves with the green innovation of enterprises. Therefore, green innovation requires enterprises to actively create, transfer, and learn new knowledge and promote it through institutionalization. This is conducive to changing the original business model and organizational strategy of enterprises, overcoming organization inertia, and improving their competitiveness. Green innovation gradually enhances the organizational learning capability of enterprises. Therefore, the following hypotheses are proposed:

H2c. Green product innovation has a positive impact on organizational learning capability.

H2d. Green process innovation has a positive impact on organizational learning capability.

2.2.3. Green Innovation and Environmental Insight Capability. As the sustainable development strategy of enterprises, green innovation requires enterprises to pay attention to environmental and social issues and understand supporting policies related to green development, the green demand of customers, and changes in green technologies in a timely manner. Enterprises should accumulate experience unceasingly, adapt to the external environment, and reduce pollution of the natural environment, thereby achieving green development. Therefore, green innovation will promote the environmental insight capability of enterprises and help them establish core competitive advantages. Therefore, the following hypotheses are proposed:

H2e. Green product innovation has a positive impact on environmental insight capability.

H2f. Green process innovation has a positive impact on environmental insight capability.

2.3. Green Dynamic Capability and Enterprise Performance. As a high-level capability of enterprises to achieve green development, green dynamic capability is an important source of enterprises' competitive advantages, playing an important role in improving enterprise performance. Enterprises should actively update their knowledge and constantly integrate resources to adapt to the ever-changing business environment.

2.3.1. Green Resource Integration Capability and Enterprise Performance. In the current fiercely competitive market, it is crucial for enterprises to have the ability to integrate green resources. Enterprises must also cope with opportunities and threats, integrate green resources, and create new value for customers to improve enterprise performance. Having strong resource integration capability helps enterprises obtain scarce resources, implement internal and external innovation activities, improve business efficiency, reduce costs, and improve product quality, enabling enterprises to obtain competitive advantages in market competition and improve their performance. Therefore, the following hypotheses are proposed:

H3a. Green resource integration capability has a positive impact on market performance.

H3b. Green resource integration capability has a positive impact on financial performance.

2.3.2. Organizational Learning Capability and Enterprise Performance. Enterprises obtain green knowledge by establishing interorganizational cooperative networks with their customers and suppliers, making employees actively participate in environmental protection practices and making full use of external knowledge sources to share green knowledge through organizational learning. Moreover, through relevant training, they should apply the green knowledge they have obtained in environmental protection innovation to create new knowledge, thus providing inexhaustible knowledge power to improve organizational financial performance. Enterprises with stronger organizational learning capability can quickly respond to the market and form barriers, which will help them gain competitive advantages and improve enterprise performance. Therefore, the following hypotheses are proposed:

H3c. Organizational learning capability has a positive impact on the market performance of enterprises.

H3d. Organizational learning capability has a positive impact on the financial performance of enterprises.

2.3.3. Environmental Insight Capability and Enterprise Performance. With the increasingly complex market and industrial environment, there is intensified competition among enterprises, and enterprises need to have timely insight into the environment, be alert, and predict the market information in the external environment to identify favorable market opportunities and respond effectively. Environmental insight capability refers to the process of collecting and using market environment information, which is also the ability of enterprises to effectively identify opportunities and threats, representing the sensitivity of enterprises to environmental changes. Enterprises with stronger environmental insight capability can more accurately grasp policies about green development, green technology change, industry development trend, and the green demand of customers; rapidly respond to changes in the market environment; and quickly discover new opportunities brought by environmental changes in order to adapt to market changes, which will help them gain competitive advantages and improve enterprise performance. Therefore, the following hypotheses are proposed:

H3e. Environmental insight capability has a positive impact on the market performance of enterprises.

H3f. Environmental insight capability has a positive impact on the financial performance of enterprises.

2.4. The Mediating Role of Green Dynamic Capability. In the current rapidly changing business environment, it is difficult for enterprises to effectively carry out green innovation activities by relying on static resources alone. To cope with the fiercely competitive market environment, enterprises must have the dynamic capability to adjust their resources according to changes in the environment to quickly and effectively develop new products and new technologies; improve technologies; and absorb, transform, and commercialize new knowledge to obtain sustainable competitive advantages, thereby improving enterprise performance. Therefore, dynamic capability is vital for enterprises. During green product and process innovation, the green dynamic capability of enterprises is cultivated; the capability to integrate internal and external resources is strengthened, and environmental insight capability is enhanced, thereby improving enterprise performance.

If because of an external environment with high uncertainty the existing capability of enterprises no longer satisfies the needs of green development, enterprises should quickly reconstruct the green innovation management system, integrate internal and external green resources through green resource integration capability, and optimize green innovation schemes to better meet market demand and improve enterprise performance. Thus, green resource integration capability acts as a bridge between green product innovation and competitive advantage. In summary, green dynamic capability plays a mediating role in the relationship between green innovation and enterprise performance. Therefore, the following hypotheses are proposed:

H4a: Green resource integration capability plays a mediating role in the impact of green innovation on enterprise performance.

H4a1: Green resource integration capability plays a mediating role in the impact of green product innovation on market performance.

H4a2: Green resource integration capability plays a mediating role in the impact of green product innovation on financial performance.

H4b1: Green resource integration capability plays a mediating role in the impact of green process innovation on market performance.

H4b2: Green resource integration capability plays a mediating role in the impact of green process innovation on financial performance.

In the process of green product and process innovation, enterprises acquire the unique advantages of green innovation by absorbing and learning green knowledge and developing green products and innovative technologies, thereby improving enterprise performance. Therefore, organizational learning capability plays a mediating role in the relationship between green innovation and enterprise performance. In summary, organizational learning capability has a mediating effect on the relationship between green innovation and enterprise performance. Therefore, the following hypotheses are proposed:

H4c: Organizational learning capability plays a mediating role in the impact of green innovation on enterprise performance.

H4c1: Organizational learning capability plays a mediating role in the impact of green product innovation on market performance.

H4c2: Organizational learning capability plays a mediating role in the impact of green product innovation on financial performance.

H4d1: Organizational learning capability plays a mediating role in the impact of green process innovation on market performance.

H4d2: Organizational learning capability plays a mediating role in the impact of green process innovation on financial performance.

In the process of green product and process innovation, enterprises with environmental insight capability have a stronger capability to adapt to the environment. They can accurately understand the dynamism of the environment, identify the green consumption demand in the market, detect new market opportunities for green products and technologies, and take the lead in occupying emerging green markets, which will help enterprises gain leading superiority in the market and improve enterprise performance. In carrying out the different types of green innovation, enterprises need to capture external business opportunities in a timely manner and improve their speed and efficiency in responding to environmental changes through the reorganization, allocation, optimization, and integration of heterogeneous resources to form a capability that competitors cannot imitate to improve enterprise performance. Thus, environmental insight capability acts as a bridge between green innovation and enterprise performance. In summary, green dynamic capability has a mediating effect on the relationship between green innovation and enterprise performance. Therefore, the following hypotheses are proposed:

H4e: Environmental insight capability plays a mediating role in the impact of green innovation on enterprise performance.

H4e1: Environmental insight capability plays a mediating role in the impact of green product innovation on market performance.

H4e2: Environmental insight capability plays a mediating role in the impact of green product innovation on financial performance.

H4f1: Environmental insight capability plays a mediating role in the impact of green process innovation on market performance.

H4f2: Environmental insight capability plays a mediating role in the impact of green process innovation on financial performance.

The conceptual framework of this study is shown in Figure 1.

3. Research Design

3.1. Data Collection and Research Method. The data in this study were collected through a questionnaire survey. To improve the recovery rate of the questionnaires and ensure the sample quality, with the help of university alumni, MBA students, industry associations, etc., the managers of the sampled enterprises were surveyed by distributing paper questionnaires, conducting telephone interviews, and sending links of questionnaires through emails, QQ, and WeChat. A total of 300 questionnaires were distributed, in which 236 complete questionnaires were recovered, with an effective recovery rate of 78.67%. Tables 1 and 2 present the composition and distribution of the sampled enterprises. As required, the information provided by the respondents is anonymous, and the information collected will only be used for academic research.

Table 2 shows the statistical description of the characteristics of a large sample of enterprises.

3.2. Variable Measurement. In this article, the key variables are green innovation, green dynamic capability, and enterprise performance. To ensure the validity and reliability of the measurement tool, a mature scale is adopted from the previous literature. After combining lots of studies on green innovation, green dynamic capability, and enterprise performance by both domestic and foreign scholars, the variable indices were set according to the research objective of this study, and a 7-point Likert scale, with 1 representing "strongly disagree" and 7 representing "strongly agree," is used. The survey items for specific research variables are presented in Table 3.

4. Empirical Results

4.1. Reliability and Validity Test. Table 4 presents the reliability test results of each variable. Using the SPSS software, the measurement results indicate that the reliability coefficient Cronbach's α for each variable is greater than 0.8. The Cronbach's α coefficients for the variables of green product innovation and green process innovation are 0.938 and 0.937, respectively; those for green resource integration capability, organizational learning capability, and environmental insight capability are 0.952, 0.961, and 0.958, respectively; and those for the financial performance and environmental performance of enterprises are 0.939 and 0.962, respectively. The research results indicate that the measurement variables have better consistency and stability, and the analytical scales have better reliability.

In addition, KMO and Bartlett tests are performed in this study. The KMO of the variables is 0.956, which is greater than 0.9, and the Bartlett test reveals that the variables are significant ($\chi^2 = 8523.738$, $p < 0.001$), which is suitable for factor analysis.

4.2. Exploratory Factor Analysis

4.2.1. Factor Analysis of Green Dynamic Capability. Table 5 presents the results of the exploratory factor analysis of green dynamic ability. The KMO value is $0.934 > 0.9$, indicating that the factor analysis has excellent applicableness. The result of Bartlett's sphericity test is 3810.828; the degree of freedom is 66, and the significance probability (p value) is 0.000, which is significant at the 0.001 level and is suitable for factor analysis. Then, according to the criterion that the eigenvalue should be greater than 1, the maximum variance rotation method is used to extract three common factors, among which GRC1–GRC3 represent green resource integration capability, OLC1–OLC5 represent organizational learning capability, and EIC1–EIC4 represent green environment insight capability. The analysis results of the above indices reveal that the scale for green dynamic capability has a higher structure validity.

4.2.2. Factor Analysis of Green Innovation. Table 6 presents the results of the exploratory factor analysis of green innovation. The KMO value is $0.951 > 0.9$; the result of Bartlett's sphericity test is 2163.578; the degree of freedom is 36, and the significance probability (p value) is 0.000, which is significant at the 0.001 level, indicating that it is suitable for factor analysis. Then, according to the criterion that the eigenvalue should be greater than 1, the maximum variance rotation method is used to extract three common factors, among which GPI1–GPI4 represent green product innovation, and GRI1–GRI5 represent green process innovation. The analysis results of the above indices indicate that the scale for green innovation has a higher structure validity.

4.2.3. Factor Analysis of Firm Performance. The structure validity of the scale for firm performance is tested (Table 7). The KMO value is 0.872; the result of Bartlett's sphericity test is 1851.726; the degree of freedom is 10, and the significance probability (p value) is 0.000, which is significant at the 0.001 level, indicating that it is suitable for factor analysis. The maximum variance rotation method is adopted to extract two common factors, among which MP1–MP2 represent market performance, and FP1–FP3 represent financial performance. The analysis results of the above indices indicate that the scale for enterprise performance has a higher structure validity.

4.3. Confirmatory Factor Analysis. The construct reliability of this study is good, and the average variance extracted (AVE) is used to reflect the convergent validity of the measurement scale. In this study, the AVE values of green product innovation, green process innovation, green

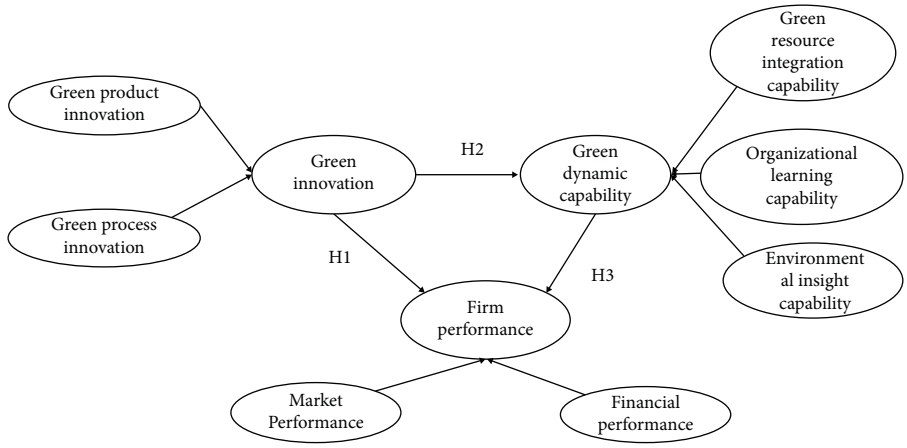

Figure 1: Conceptual framework.

Table 1: Respondent demographics.

Dimension		*N*	Percentage
Gender	Female	75	31.78
	Male	161	68.33
Age	20–29 years old	24	10.17
	30–39 years old	63	26.69
	40–49 years old	80	33.9
	50–59 years old	67	28.39
	60 years old or older	2	0.85
Job title	Senior managers	107	45.34
	Middle managers	68	28.81
	Grassroots managers	61	25.85
Education	Less than junior college	26	11.02
	Undergraduate degree	76	32.2
	Postgraduate degree (Master/PhD)	134	56.78

Table 2: A statistical description of the characteristics of sample enterprises.

Dimension		*N*	Percentage
Northeast China	Northeast China	57	24.15
	East China	27	11.44
	Central China	105	44.49
	West China	47	19.92
Enterprise age	5 years or less	10	4.24
	5–10 years	55	23.31
	11–20 years	63	26.69
	More than 20 years	108	45.76
Nature of ownership	State-owned enterprises	93	39.41
	Private-owned enterprises	112	47.46
	Other	30	13.13
Enterprise scale	Fewer than 200 people	20	8.47
	200–999 people	88	37.29
	1000–4999 people	70	29.66
	5,000 or more	58	24.58

resource integration capability, organizational learning capability, green environment insight capability, market performance, and financial performance are 0.792, 0.750, 0.879, 0.833, 0.853, 0.866, and 0.903, respectively, all of which are higher than the critical value of 0.50, indicating that the measurement model has better convergent validity.

In this study, composite reliability (CR) coefficient is used to examine whether all items in each latent variable consistently explain the variable. The CR coefficients of green product innovation, green process innovation, green resource integration capability, organizational learning capability, green environmental insight capability, market

Table 3: Construct and survey items.

Variables	Dimension		Measurement methods
Green innovation (GI)	Green product innovation (GPI)	GPI1	Enterprises use environmentally friendly product materials during product development, design, improvement, and production
		GPI2	Enterprises use degradable packaging for existing or new products
		GPI3	Enterprises assess whether a product is easy to be recycled, reused, and decomposed during product improvement and design
		GPI4	Enterprises use fewer resources during product development, design, improvement, and production and use green product labels
	Green process innovation (GRI)	GRI1	Enterprises reduce the use of water, electricity, coal, petroleum, and other energy sources in the production process
		GRI2	Enterprises use cleaner production technology to save energy sources and prevent pollutant generation
		GRI3	Enterprises can recycle, reuse, and remanufacture materials
		GRI4	Enterprises effectively reduce the discharge of hazardous substances and wastes in the manufacturing process
		GRI5	Enterprises effectively reduce the use of raw materials in the manufacturing process
Green dynamic capability	Green resource integration capability (GRC)	GRC1	Enterprises can continuously improve their green resource endowments
		GRC2	Enterprises can use integrated internal and external resources to improve work efficiency and effectiveness
		GRC3	Enterprises are satisfied with the development and expansion of green resources
	Organizational learning capability (OLC)	OLC1	Enterprises realize the internal sharing of green knowledge
		OLC2	Green communication channels in the enterprises are unimpeded
		OLC3	Enterprises can process and utilize new environmental knowledge
		OLC4	Enterprises often discuss solutions to environmental problems with suppliers and customers
		OLC5	Enterprises can create new environmental knowledge
	Environmental insight capability (EIC)	EIC1	Enterprises can timely understand and grasp support policies about green development
		EIC2	Enterprises can timely keep up with and respond to changes in green technology in the industry
		EIC3	Enterprises can timely understand and grasp the development trend in the industry
		EIC4	Enterprises can keep up with the green demand of customers timely to adapt to market changes
Enterprise performance	Market performance (MP)	MP1	Enterprises' products are more influential in the market than their competitors
		MP2	Enterprises provide customers with better services and products than their competitors
	Financial performance (FP)	FP1	Enterprises' sales revenue increases faster than that of their competitors
		FP2	Enterprises' business profits grow faster than those of their competitors
		FP3	Enterprises have higher growth in market shares than their competitors

Table 4: Cronbach'α coefficient.

Variables	Green product innovation	Green process innovation	Green resource integration capability	Organizational learning capability	Environmental insight capability	Market performance	Financial performance
Cronbach's α	0.938	0.937	0.952	0.961	0.958	0.939	0.962

performance, and financial performance are 0.938, 0.937, 0.956, 0.961, 0.959, 0.939, and 0.966, respectively (Table 8), all of which are greater than 0.9, indicating that the scale has better internal consistency, and the model has excellent internal quality.

Table 9 reveals that the main variables, that is green product innovation, green process innovation, green dynamic capability, and enterprise performance, have significant correlations. Moreover, the square root value of the AVE of each variable is always greater than the corresponding correlation coefficient, indicating that the scale used has better discriminant validity.

In addition, Table 10 depicts goodness-of-fit indices. To enhance the reliability of the conclusions and the robustness of the model, the structural equation model is used to conduct tests ($x^2/df = 2.636 < 3.0$); the values for NFI, CFI,

Table 5: Rotated component matrix of green dynamic capability.

Variables			Component		
			1	2	3
Green dynamic capability	Green resource integration capability (GRC)	GRC1	0.449	0.413	0.716
		GRC2	0.558	0.363	0.692
		GRC3	0.574	0.377	0.677
	Organizational learning capability (OLC)	OLC1	0.758	0.382	0.325
		OLC2	0.830	0.265	0.353
		OLC3	0.839	0.327	0.311
		OLC4	0.871	0.260	0.188
		OLC5	0.821	0.287	0.346
	Environmental insight capability (EIC)	EIC1	0.307	0.822	0.247
		EIC2	0.261	0.896	0.205
		EIC3	0.256	0.895	0.245
		EIC4	0.328	0.845	0.254

Table 6: Rotated component matrix of green innovation.

Variables	Dimension		Component	
			1	2
Green innovation (GI)	Green product innovation (GPI)	GPI1	0.356	0.847
		GPI2	0.458	0.809
		GPI3	0.465	0.791
		GPI4	0.531	0.740
	Green process innovation (GRI)	GRI1	0.638	0.617
		GRI2	0.743	0.501
		GRI3	0.810	0.387
		GRI4	0.797	0.423
		GRI5	0.812	0.415

Table 7: Rotated component matrix of firm performance.

Variables			Component	
			1	2
Firm performance	Market performance (MP)	MP1	0.733	0.631
		MP2	0.473	0.857
	Financial performance (FP)	FP1	0.861	0.485
		FP2	0.844	0.509
		FP3	0.543	0.797

IFI, and TLI are all greater than 0.9; the value for RMSEA is less than 0.1; the values for PNFI and PGFI are all greater than 0.5. All the indices meet the standard, indicating that the model fits well with the data.

4.4. Regression Analysis. Table 11 presents the results of the regression analysis. First, green product innovation has a significant positive impact on the market performance of enterprises ($\beta = 0.658$, $p < 0.001$), with an adjusted R^2 of 0.431. Green product innovation has a significant positive impact on the financial performance of enterprises ($\beta = 0.677$, $p < 0.001$), with an adjusted R^2 of 0.456. Green process innovation has a significant positive impact on the market performance of enterprises ($\beta = 0.608$, $p < 0.001$), with an adjusted R^2 of 0.367. Green process innovation has a significant positive impact on the financial performance of enterprises ($\beta = 0.614$, $p < 0.001$), with an adjusted R^2 of 0.375. Therefore, the research findings support H1a–H1d.

Second, green product innovation has significant positive effects on green resource integration capability ($\beta = 0.747$, $p < 0.001$), organizational learning capability ($\beta = 0.661$, $p < 0.001$), and environmental insight capability ($\beta = 0.742$, $p < 0.001$). Moreover, green process innovation has a significant positive effect on green resource integration capability ($\beta = 0.819$, $p < 0.001$), organizational learning capability ($\beta = 0.736$, $p < 0.001$), and environmental insight capability ($\beta = 0.738$, $p < 0.001$). Therefore, the research findings support H2a–H2f.

Third, green resource integration capability, organizational learning capability, and environmental insight capability have a significant impact on the market performance of enterprises, and their standardized coefficients (β) are 0.545 ($p < 0.001$), 0.457 ($p < 0.001$), and 0.723 (p < .001),

Table 8: The result of convergent validity.

Variables			Standardized factor load	CR	AVE
Green innovation (GI)	Green product innovation (GPI)	GPI1	0.857	0.938	0.792
		GPI2	0.907		
		GPI3	0.897		
		GPI4	0.896		
	Green process innovation (GRI)	GRI1	0.868	0.937	0.750
		GRI2	0.875		
		GRI3	0.849		
		GRI4	0.862		
		GRI5	0.875		
Green dynamic capability	Green resource integration capability (GRC)	GRC1	0.872	0.956	0.879
		GRC2	0.958		
		GRC3	0.972		
	Organizational learning capability (OLC)	OLC1	0.889	0.961	0.833
		OLC2	0.931		
		OLC3	0.946		
		OLC4	0.874		
		OLC5	0.921		
	Environmental insight capability (EIC)	EIC1	0.874	0.959	0.853
		EIC2	0.938		
		EIC3	0.956		
		EIC4	0.925		
Firm performance	Market performance (MP)	MP1	0.980	0.939	0.886
		MP2	0.903		
	Financial performance (FP)	FP1	0.980	0.966	0.903
		FP2	0.975		
		FP3	0.894		

Table 9: Result of discriminant validity.

	GPI	GRI	GRC	OLC	EIC	MP	FP
GPI	**0.890**						
GRI	0.866	**0.869**					
GRC	0.747	0.819	**0.938**				
OLC	0.661	0.736	0.858	**0.912**			
EIC	0.742	0.738	0.722	0.653	**0.924**		
MP	0.658	0.608	0.545	0.457	0.723	**0.941**	
FP	0.673	0.607	0.523	0.464	0.747	0.939	**0.950**

Note. discriminant validity: Pearson correlation and AVE square root value. The bold numbers on the clinodiagonal are the square root value of AVE.

respectively. Moreover, green resource integration capability, organizational learning capability, and environmental insight capability have significant effects on the financial performance of enterprises, and their standardized coefficients (β) are 0.534 ($p < 0.001$), 0.467 ($p < 0.001$), and 0.750 ($p < 0.001$), respectively. Therefore, H3a–H3f are supported.

To further verify the mediating hypotheses, the bias-corrected bootstrapping method is used in this study. Table 12 reveals that the indirect effects of green product innovation (indirect effect = 0.098, 95% CI = [0.084, 0.100]) and green process innovation (indirect effect = 0.129, 95% CI = [0.068, 0.079]) on market performance through green resource integration capability are significantly positive, with the confidence interval not including zero. Therefore, H4a1 and H4b1 are supported. The indirect effects of green product innovation (indirect effect = 0.052, 95% CI = [0.099, 0.118]) and green process innovation (indirect effect = 0.084, 95% CI = [0.122, 0.141]) on financial performance through green resource integration capability are significantly positive, with the confidence interval not including zero. Therefore, H4a2 and H4b2 are supported. In addition, the indirect effect of green product innovation (indirect effect = 0.028, 95% CI = [0.055, 0.077]) on market performance through organizational learning capability is significantly positive, with the confidence interval not including zero. Therefore, H4c1 is supported. The indirect effect of green process innovation (indirect effect = 0.016, 95% CI = [−0.000, 0.000]) on market performance through organizational learning capability is negative, with the confidence interval including zero. Therefore, H4d1 is not supported. Moreover, the indirect effects of green product innovation (indirect effect = 0.025, 95% CI = [0.069, 0.096]) and green process innovation (indirect effect = 0.026, 95% CI = [0.034, 0.044]) on financial performance through organizational learning capability are significantly positive, with the confidence interval not including zero. Therefore, H4c2 and H4d2 are supported. The indirect effects of green product innovation (indirect effect = 0.427, 95% CI = [0.363, 0.430])

Table 10: Goodness-of-fit indices.

	x^2/df	NFI	CFI	IFI	TLI	RMSEA	PNFI	PGFI
Recommended values	<3.0	>0.9	>0.9	>0.9	>0.9	<0.10	>0.5	>0.5
Model values	2.636	0.918	0.947	0.947	0.938	0.083	0.785	0.644

Table 11: Empirical results of regression analysis.

Paths	Unstandardized coefficients β (SE)	Standardized coefficients β	R^2	Adjusted R^2	F
GPI ⟶ MP	0.726 (0.054)***	0.658***	0.434	0.431	179.082***
GPI ⟶ FP	0.732 (0.052)***	0.677***	0.459	0.456	198.295***
GRI ⟶ MP	0.672 (0.057)***	0.608***	0.370	0.367	137.203***
GRI ⟶ FP	0.666 (0.056)***	0.614***	0.377	0.375	141.871***
GPI ⟶ GRC	0.804 (0.047)***	0.747***	0.558	0.556	295.721***
GPI ⟶ OLC	0.685 (0.051)***	0.661***	0.436	0.434	181.207***
GPI ⟶ EIC	0.693 (0.041)***	0.742***	0.551	0.549	286.729***
GRI ⟶ GRC	0.883 (0.040)***	0.819***	0.671	0.669	477.011***
GRI ⟶ OLC	0.766 (0.046)***	0.736***	0.542	0.540	276.402***
GRI ⟶ EIC	0.691 (0.041)***	0.738***	0.545	0.543	280.093***
GRC ⟶ MP	0.558 (0.056)***	0.545***	0.297	0.294	98.742***
GRC ⟶ FP	0.537 (0.056)***	0.534***	0.286	0.282	93.512***
OLC ⟶ MP	0.485 (0.062)***	0.457***	0.208	0.205	61.630***
OLC ⟶ FP	0.487 (0.060)***	0.46***	0.218	0.215	65.345***
EIC ⟶ MP	0.854 (0.053)***	0.723***	0.523	0.521	256.607***
EIC ⟶ FP	0.868 (0.050)***	0.750***	0.562	0.560	300.235***

Table 12: Bootstrap analysis.

Path	Indirect effect	Standard error	95% confidence interval	
			Lower limit	Upper limit
GPI ⟶ GRC ⟶ MP	0.098	0.004	0.084	0.100
GPI ⟶ GRC ⟶ FP	0.052	0.005	0.099	0.118
GPI ⟶ OLC ⟶ MP	0.028	0.006	0.055	0.077
GPI ⟶ OLC ⟶ FP	0.025	0.007	0.069	0.096
GPI ⟶ EIC ⟶ MP	0.427	0.017	0.363	0.430
GPI ⟶ EIC ⟶ FP	0.441	0.019	0.420	0.498
GRI ⟶ GRC ⟶ MP	0.129	0.003	0.068	0.079
GRI ⟶ GRC ⟶ FP	0.084	0.005	0.122	0.141
GRI ⟶ OLC ⟶ MP	0.016	0.000	−0.000	−0.000
GRI ⟶ OLC ⟶ FP	0.026	0.002	0.034	0.044
GRI ⟶ EIC ⟶ MP	0.492	0.022	0.414	0.500
GRI ⟶ EIC ⟶ FP	0.520	0.026	0.494	0.598

and green process innovation (indirect effect = 0.492, 95% CI = [0.414, 0.500]) on market performance through environmental insight capability are significantly positive, with the confidence interval not including zero. Therefore, H4e1 and H4f1 are supported. Moreover, the indirect effects of green product innovation (indirect effect = 0.441, 95% CI = [0.420, 0.498]) and green process innovation (indirect effect = 0.520, 95% CI = [0.494, 0.598]) on financial performance through environmental insight capability are significantly positive, with the confidence interval not including zero. Therefore, H4e2 and H4f2 are supported.

5. Conclusion

In this study, under the realistic background that the environmental pollution from the heavy pollution manufacturing industry has caused all sectors to pay high attention to the environmental responsibility of enterprises, empirical research is conducted using the data of heavy pollution manufacturing enterprises at the micro level to study the mechanism of the effect of green innovation on enterprise performance and green dynamic capability. The results suggest important implications for business strategy. The following policy suggestions are proposed.

First, heavy pollution manufacturing enterprises should establish awareness of green innovation and explore the green innovation suitable for their development. Unlike traditional innovation, green innovation takes into account the ecological, economic, and environmental benefits. Green innovation does not only help improve the environmental performance of heavy pollution enterprises but also helps improve enterprise performance. Therefore, heavy pollution manufacturing enterprises should incorporate the concept of green development into process development and product

design process; constantly determine the green differentiated product strategy; and integrate the concept of environmental protection into the design, production, packaging, sales, and recycling of green products to explore the green innovation suitable for their development, which will ultimately help enterprises achieve a "win-win" between economic efficiency and environmental protection.

Second, in the face of the current ever-changing business environment, manufacturing enterprises should pay attention to cultivating green dynamic capability. The green dynamic capability of enterprises is a dynamic function that is difficult for competitors to replicate. It is conducive to stimulating the green innovation vitality of an enterprise and improving enterprise performance. To develop green dynamic capability, enterprises should improve their green resource integration capability; effectively allocate key green resources; develop green product innovation and green process innovation; and actively cooperate with customers, suppliers, and investors to integrate, create, acquire, share, and transform green resources, thereby forming resource endowment, enhancing sustainable competitive advantages of enterprises, and improving enterprise performance. It is also necessary to strengthen the learning motivation of internal employees, create a strong learning atmosphere, and establish a performance evaluation system based on the internal learning performance of the enterprise. Moreover, enterprises should have timely insight into the internal and external environments, accurately grasp the expectations and potential needs of customers, conduct innovative research and development based on their demands, and reduce the blindness in the early stage of designing green products, thus making the innovation and upgrading of the green process more targeted, that is, to be more consistent with market demand.

Third, the government should strengthen the synergistic effect of policies and strengthen the guidance of enterprises to actively carry out green innovation activities. Green innovation is an inexhaustible driving force for the green development of manufacturing enterprises, and it is also a key factor for enhancing the green competitiveness of enterprises. The government should formulate reasonable environmental regulation policies to offer partial subsidies to enhance the green innovation activities of enterprises, strengthen the role of environmental regulations to put pressure on the polluting behaviors of enterprises, and guide pollution enterprises to actively implement green innovation practices, thereby better cultivating green vitality and enhancing the core competitiveness of enterprises.

This study explores the effects of green product innovation and green process innovation on enterprise performance, which has certain theoretical and practical significance. However, it has some limitations. This study only focuses on the green innovation behaviors of heavy pollution manufacturing enterprises in China. The research conclusions have industrial limitations. Future studies can use enterprises in different industries as research objects to enrich the research on green development to improve the generalizability of the research results. In addition, due to the influence of factors such as the survey method and the source of questionnaire data, the attribute and regional distribution of the sampled enterprises are not uniform, which will affect the results of the empirical research. For future research, it is necessary to focus more on selecting and controlling the structure of the sampled enterprises to reduce the influence of sample bias on the research conclusions [22].

Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest to report regarding the present study.

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