

Driving Green Innovation Through Organizational Change and Policy Support

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Abstract: *This study investigates the effect of organizational innovation on green innovation performance and the moderating role of the synergy between external innovation resources and government policies. Analyzing survey data from 330 firms in China's Pearl River Delta via structural equation modeling, we find that organizational innovation significantly boosts green performance, and this positive effect is strengthened by the interaction of resources and policy support. The findings highlight the complementarity of firm-level initiatives and government interventions in fostering sustainable innovation.*

Keywords: Organizational innovation; Green innovation performance; Innovation resources; Innovation policy; Moderating effect; Structural equation modeling.

1. Introduction

In recent years, factors such as deglobalization and trade protectionism have hindered international exchanges and economic trade, impacting national and regional economic development and bringing high uncertainty to the global economy. Environmental uncertainty has not only altered individual consumption behaviors and corporate operational models but also prompted changes in economic development approaches and social systems. In uncertain business environments, every enterprise faces significant challenges, but these challenges drive innovation. Advances in artificial intelligence technology and digital intelligence applications are leading future industries; only by correctly recognizing crises can businesses innovate and transform their organizations, turning crises into opportunities.

Facing environmental uncertainty, enterprises need organizational innovation and reform to survive. Organizational innovation is the core competitiveness for enterprises to respond to environmental changes, improving management efficiency, market share, and economic benefits, significantly positively impacting corporate performance. Besides organizational inertia being a major obstacle to organizational innovation, innovation resources and external environmental innovation policies are also critical factors.

In the face of environmental uncertainty, the central and local governments have promptly introduced a series of supportive policies and measures to assist enterprises from various aspects such as financial credit, tax reduction and fee reduction, and financial subsidies. Innovative policies help enterprises cope with environmental uncertainty and overcome difficulties. These innovative policies include national policies, local policies, and capital market policies, mainly involving enterprises in manufacturing, logistics, commodity circulation, and catering services. Institutional innovation theory suggests that after sudden public incidents, the government will actively formulate innovative policies to provide supply and security for the market to stabilize economic development. Previous literature also points out that innovative policies play an important role in the green innovation performance of enterprises. Enterprises will perceive the external business environment, adjust their

development strategies and organizational structures in time, utilize external innovative policies and resources for innovation, and seek new niches.

In summary, based on organizational learning theory, resource-based theory, and institutional innovation theory, this study conducts a questionnaire survey on enterprises in the Pearl River Delta region to analyze the impact of organizational innovation on the green innovation performance of enterprises and verify the moderating effect of the interaction between innovative resources and innovative policies, aiming to provide decision-making ideas for enterprises and local governments to deal with environmental uncertainty.

2. Literature Review and Research Hypotheses

2.1 The Impact of Organizational Innovation on Green Innovation Performance of Enterprises

In the digital age, corporate value and innovation activities are realized through organizations and driven by organizational innovation to bring about business transformation, which in turn drives social change. In the process of corporate innovation, organizational innovation is more important than technological innovation. Resource-based theory holds that organizational innovation is an important driver for enhancing corporate competitiveness and green innovation performance. The OECD defines organizational innovation as the introduction of new business management methods in the workplace or in the relationship between companies and external agents. Therefore, organizational innovation refers to the degree of management innovation in corporate activities such as planning, organizing, leading, and controlling, as well as technological innovation in products, processes, and equipment. Organizational innovation is further divided into dual-core models, win-win bilateral models, dual-core and win-win bilateral models, as well as incremental innovation and radical models.

The purpose of organizational innovation is to help enterprises adapt to uncertain external environments in order to enhance their green innovation performance. Previous literature studies have pointed out that organizational

innovation and green innovation performance are very important. Although there are individual differences, overall it has been proven that organizational innovation has a significantly positive impact on green innovation performance. Enterprises implement management systems such as quality, environment, occupational health and safety in organizational innovation, along with high-performance management models, process reengineering, process improvement, personnel capability and structural optimization, involving corporate strategy, operational models, management systems, supply chains, and employees, making it a highly complex social system. Organizational innovation is a structured, systematic, and rational task. Enterprises can reduce costs through organizational innovation, improve organizational work efficiency, employee morale, and core competencies. In response to crises, organizational innovation takes the lead; only by innovating to address environmental uncertainty can enterprises enhance green innovation performance, turning crises into opportunities, hence the proposal of hypothesis H1:

H1: Organizational innovation is positively correlated with green innovation performance.

2.2 The Moderating Effect of Innovation Resources

Resource-based theory suggests that innovation resources include both internal and external elements of an enterprise, divided into intangible and tangible assets, characterized by richness, value, and scarcity, forming one of the core competencies of a business. The OECD notes that innovation resources encompass talents, patents, technologies, R&D funding, research institutions, academic bodies, and service intermediaries, which are effective combinations of tangible and intangible assets in business activities reflecting innovation capabilities and other societal resources. Innovation resources refer to all resources required for enterprises to engage in innovative activities, including tangible assets such as talent, technology, infrastructure, and production materials within the organization, as well as intangible assets like knowledge, information, and patents. It also includes external resources such as higher education institutions, research organizations, academic groups, and technical service intermediaries. Innovation resources also possess learning curve characteristics that involve continuous learning → application → integration → re-innovation → and the creation of knowledge processes.

Innovation is a complex dynamic process that requires resource investment, organizational innovation, and resource integration. Drucker pointed out that the process of organizational innovation requires the support of existing resources, and the lack of innovative resources will also affect the implementation of innovation activities. Constrained by innovative resources, it will not only affect employees' enthusiasm for innovation but also influence managers' decision-making, and even the success of innovation projects. According to the first-mover advantage theory in economics, the first mover has advantages in technology, resources, transfer costs, and decision uncertainty, such as technological leadership through learning curves and patent protection, which can create higher economic benefits. Therefore, excellent enterprises will establish their own knowledge

circulation channels and connection networks, collect external information, cooperate with external organizations, and allocate innovative resources.

The driving force for enterprise growth comes from the managers utilizing or reorganizing internal resources for new purposes. One part emphasizes that cultivating and developing intangible capabilities (such as organizational innovation) and resources within the organization contributes to business growth (such as performance improvement). It also particularly emphasizes the alignment between various tangible and intangible resources and competitive advantages within the organization to facilitate the pursuit of growth and performance. In the face of a highly competitive and uncertain environment, in addition to applying new technologies or management systems, changes in technology and management must be integrated into the organizational structure to enhance green innovation performance. Therefore, this paper infers that the richness and scarcity of corporate innovation resources have a moderating effect on organizational innovation and green innovation performance, thus proposing hypothesis H2:

H2: Innovation resources have a positive moderating effect on organizational innovation and green innovation performance.

2.3 The Joint Effect of Innovation Resources and Innovation Policies

Government innovation policies play a very important role both during economic crises and in the process of corporate innovation. Innovation policies can stabilize the market and stimulate economic growth, while enterprises will promptly adjust their strategies, utilizing external innovation policies and resources to innovate and find new niches. The purpose of innovation policy is to promote the improvement of green innovation performance and build core competitiveness for enterprises. Innovation policies have a direct impact, drive, and moderating effect on green innovation performance. Previous literature studies have found that innovation policies moderate the effect of organizational innovation on green innovation performance through technological innovation capabilities, and under low innovation policy conditions, organizational innovation positively affects green innovation performance through technological innovation capabilities. High innovation policies may weaken firms' learning ability; firms with strong learning ability often quickly meet market demands through learning and imitation and engage in exploratory innovation to develop new products or inventions to satisfy customer needs, thereby leading the market.

Resource-based theory suggests that firms should explore both physical resources (e.g., R&D costs, equipment) and intangible resources (e.g., government-led innovation policies) to assess their impact on competitive advantage. A single firm relying solely on its own resources to carry out innovation activities for enhancing competitive ability faces high financial costs and significant risks of insufficient organizational management capacity. External resources such as innovation policies are needed to promote the enhancement of firms' technological innovation capabilities—R&D capability, manufacturing capability, process capability, organizational capability, and sales capability—thereby

influencing green innovation performance. Therefore, this study posits that the combined effect of innovation resources and innovation policies moderates organizational innovation and green innovation performance, proposing research hypothesis H3:

H3: The joint effect of innovation resources and innovation policies positively moderates organizational innovation and green innovation performance.

3. Research Design

3.1 Questionnaire and Variables

The questionnaire items in this study mainly reference foreign literature, and after pre-testing with 30 senior executives and conducting statistical analysis, the accuracy, adaptability, and

ease of completion of the questionnaire items were ensured. After further revisions, the final questionnaire was completed using a 7-point Likert scale. Organizational innovation refers to enterprises engaging in business activities where new methods, processes, and external relationships are utilized within the organization and its workplace to conduct innovative activities, based on a scale constructed by Chen et al., comprising 9 items. Innovation resources include internal and external, tangible and intangible assets, based on a scale developed by Huang Shizheng et al., consisting of 7 items. Innovation policy refers to new measures provided by the government such as funding, talent development, financing platforms, and technology cooperation, based on a scale created by Cai Xiantang and Huang Shizheng, comprising 5 items. Green innovation performance includes indicators such as green products, green processes, and green management innovations, based on a scale constructed by Xie et al., totaling 5 items.

Table 1: Correlation Coefficient Matrix and Square Root of Average Variance Extracted

Variable	Mean	Standard Deviation	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1. Green Innovation Performance	5.02	1.20	0.86							
2. Organizational Innovation	4.78	1.12	0.48***	0.72						
3. Innovation Resources	4.45	1.13	0.40***	0.66***	0.71					
4. Innovation Policy	4.14	1.50	0.36***	0.60***	0.68***	0.77				
5. Industry Category	1.42	0.49	-0.02	-0.09	0.04	-0.05	1			
6. Enterprise Type	2.16	0.69	-0.03	0.16	0.09	0.03	-0.32	1		
7. Enterprise Age	4.29	1.08	-0.01	-0.01	0.06	0.05	0.07	0.07	1	
8. Enterprise Size	2.25	0.72	0.06	0.01	0.09	0.10	0.08	-0.02	0.07	1
Cronbach's α			0.85	0.83	0.81	0.82				
CR			0.93	0.88	0.88	0.89				
AVE			0.73	0.52	0.51	0.60				

Note: The diagonal values represent the square root of the average variance extracted (AVE) for the variables; the off-diagonal values represent the correlation coefficients between the variables; N=330, * indicates $p < 0.05$, ** indicates $p < 0.01$, *** indicates $p < 0.005$, same below.

Table 2: Model Analysis Results

Variable	Green Innovation Performance			
	Model 1	Model 2	Model 3	Model 4
Industry	-0.04	-0.01	-0.04	-0.03
Scale	0.08	0.10	0.10	0.09
Age	-0.04	0.06	-0.03	-0.03
Category	-0.04	-0.09**	-0.19*	-0.19*
Organizational Innovation		0.39***	0.44***	0.36***
Innovation Resources		0.10	0.14"	0.04
Innovation Policy		0.06		0.03
Organizational Innovation $\times$ Innovation Resources			0.01	0.08
Organizational Innovation $\times$ Innovation Policy				-0.06
Innovation Resources $\times$ Innovation Policy				0.02
Organizational Innovation $\times$ Innovation Resources $\times$ Innovation Policy				0.05"
R^2	0.07	0.51	0.50	0.52
ΔR^2	0.04	0.26	0.25	0.27
F	0.70	15.84***	15.71***	10.72**

3.2 Sample and Data

The study sample was drawn from enterprises in the Pearl River Delta region using a random sampling method. Respondents included senior and middle-level managers of enterprises, as well as personnel related to innovation activities. A total of 330 valid questionnaires were collected. Sample analysis showed that traditional manufacturing accounted for 33.94%, electronics and information industry accounted for 41.21%, and service industry accounted for 24.85% within the industrial categories; small and medium-sized enterprises accounted for 24.24%, medium-sized enterprises accounted for 43.94%, and large enterprises accounted for 31.82%; state-owned enterprises accounted for 14.55%, private enterprises accounted for

56.36%, and wholly foreign-owned enterprises accounted for 29.09%; the average age of enterprises was 5.8 years.

4. Empirical Analysis

4.1 Measurement Model Analysis

Table 1 shows the mean, standard deviation, correlation coefficients, and square root values of the average variance extracted for all variables in this study. The results show that the correlation coefficients between organizational innovation, innovation resources, innovation policy, and green innovation performance range from 0.36 to 0.68, all reaching significant levels, indicating a positive association between each variable and green innovation performance. The common method bias

issue was tested using a single-factor model detection method, which showed poor fit and was significantly lower than the measurement model's fit ($\Delta\chi^2 = 967.81$, d.f. = 344, $p < 0.001$), indicating no common method bias problem.

Confirmatory factor analysis was used to test the reliability, convergent validity, and discriminant validity of the questionnaire scale. The Cronbach's α coefficient for each research variable was greater than 0.7, composite reliability values were greater than 0.7, and the average variance extracted reached 0.5, meeting the recommended standards of relevant scholars for convergent validity. Discriminant validity was assessed using the confidence interval test method. The test results showed that the correlation coefficients between variables did not include 1 after adding or subtracting two standard errors, meeting good discriminant validity standards. CFA results showed ($df=2.45<3$, $p<0.001$; SRMR=0.06<0.08; CFI=0.92>0.90; IFI=0.91>0.90; RMSEA=0.07<0.08), indicating that the questionnaire has good reliability and validity, and the adopted scale has good measurement quality.

4.2 Hypothesis Testing

This study uses SPSS 23.0 and the PROCESS statistical analysis software proposed by Hayes to test the hypotheses on the sample data, with results shown in Table 2. The validation results of Model 2 indicate that organizational innovation has a significantly positive impact on green innovation performance ($\beta = 0.39$, $P < 0.005$), supporting hypothesis H1; however, innovation resources show no significant effect on green innovation performance ($\beta=0.10$, $P>0.05$), and innovation policies also show no significant effect on green innovation performance ($\beta=0.06$, $P>0.05$); Model 3 examines the moderating role of innovation resources, showing that the moderating effect of innovation resources on the relationship between organizational innovation and green innovation performance is not significant ($\beta = 0.01$, $P > 0.05$), thus hypothesis H2 is not supported. This indicates that government innovation policies and firms' innovation resources need to enhance green innovation performance through organizational innovation, but innovation resources do not moderate the relationship between organizational innovation and green innovation performance.

Model 4 categorizes innovation resources and innovation policies into low and high levels to verify the joint moderating effect of innovation resources and innovation policies on the relationship between organizational innovation and green innovation performance. The results indicate that the joint effect of innovation resources and innovation policies significantly influences the relationship between organizational innovation and green innovation performance ($\beta = 0.05$, $P<0.01$). When innovation resources are at a lower level, the interaction between innovation policies and low-level innovation resources has a significantly positive impact on green innovation performance ($\beta = 0.47$, $P < 0.001$), and the interaction between innovation policies and high-level innovation resources also has a significantly positive impact on green innovation performance ($\beta = 0.47$, $P<0.001$), therefore hypothesis H3 is supported.

Similarly, when innovation policy is at a higher level, the interaction between organizational innovation and

low-intensity innovation resources has a significantly positive impact on green innovation performance ($\beta = 0.45$, $P < 0.001$), and the interaction between organizational innovation and high-intensity innovation resources also has a significantly positive impact on green innovation performance ($\beta = 0.11$, $P>0.05$). When innovation policy is at a lower level, the coexistence of organizational innovation and high-intensity innovation resources has a stronger promoting effect on green innovation performance than the coexistence of organizational innovation and low-intensity innovation resources, showing that enterprises rely more on government innovation policy provision when innovation resources are scarce. When innovation policy is at a higher level, the coexistence of organizational innovation and low-intensity innovation resources has a stronger promoting effect on green innovation performance than the coexistence of organizational innovation and high-intensity innovation resources, indicating that when innovation resources are abundant, enterprises gradually reduce their reliance on government innovation policy provision.

5. Conclusions and Implications

In an uncertain environment, enterprises need to engage in organizational innovation and transformation while also requiring the government to timely formulate innovation policies to provide supply and assurance for the market. This study analyzed firms in the Pearl River Delta region, examining the impact of organizational innovation on corporate green innovation performance and verifying the moderating effect of the joint action of innovation resources and innovation policies. The results show: Organizational innovation has a significantly positive impact on green innovation performance, indicating that companies can enhance green innovation performance through organizational innovation; the interaction between organizational innovation and innovation resources has no impact on green innovation performance. Under the joint moderating influence of innovation resources and innovation policies, there are differences between organizational innovation and green innovation performance, meaning that when innovation resources are scarce, reliance on government innovation policy provision increases; when innovation resources are abundant, dependence on government innovation policy provision gradually weakens. This indicates that in the face of environmental uncertainty, timely government issuance of innovation policy provision and support helps enterprises overcome difficulties.

When innovation policies are at a lower level, the coexistence of organizational innovation and high-intensity innovation resources has a stronger promoting effect on green innovation performance than the coexistence of organizational innovation and low-intensity innovation resources, indicating that enterprises need to rely more on the government's innovation policy supply when innovation resources are scarce. They should integrate internal and external innovation resources, optimize business models in a timely manner, improve processes, adjust organizational structures, and engage in incremental innovation. When innovation policies are at a higher level, the coexistence of organizational innovation and low-intensity innovation resources has a stronger promoting effect on green innovation performance

than the coexistence of organizational innovation and high-intensity innovation resources. This indicates that when enterprises have abundant innovation resources, their reliance on government innovation policy supply gradually decreases. When innovation policies are efficient, enterprises should proactively engage in organizational innovation, adjust business models, enhance product development, and pursue breakthrough innovation.

In the face of environmental uncertainty, government departments need to promptly introduce innovation policies to help enterprises survive and develop. When enterprises face changes and uncertain environments: First, they must respond quickly and activate organizational innovation. Enterprises need to respond rapidly, demonstrating leadership and social responsibility, with senior executives leading employees through difficulties together; reduce costs, divest unprofitable businesses, eliminate losses and growth without quality, and ensure cash flow. At the organizational innovation level, an innovative culture should be established, integrating innovation activities into every process and job position to promote continuous improvement of innovation activities. Second, adjust the business model and transform operations. Enterprises need to adjust strategies and business models according to their own situations, practicing "subtraction" in business models, changing operational management and work modes, focusing on customer value, and creating customer value. Finally, turn crises into opportunities and seek new niches. A crisis is an opportunity, and an uncertain business environment is the norm. Enterprises face not only the environment but also adjustments within themselves.

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