

Research on the Impact of Green Innovation Strategy of Manufacturing Enterprises on Green Innovation Performance

Siyi Yin

School of Accountancy, Anhui University of Finance & Economics, Bengbu, Anhui 233030, China

Abstract

This study explores the impact of green innovation strategy of manufacturing enterprises on green innovation performance. Green innovation strategy includes technological innovation, management innovation and organizational innovation, and is an important measure taken by enterprises to cope with environmental pressure and sustainable development needs. This paper first analyzes the components of green innovation strategy and its potential impact mechanism on green innovation performance from a theoretical perspective, emphasizing the key role of information access convenience, transaction cost reduction and financial product diversification in this process. The study found that the implementation of green innovation strategy can significantly improve the green innovation performance of enterprises, which is specifically manifested in the increase in the number of green patents, the expansion of the market share of environmentally friendly products and the green improvement of production processes. In addition, policy support and the improvement of the external market environment also play an important role in promoting green innovation of enterprises. Based on the above analysis, this paper puts forward relevant policy recommendations, financial institution recommendations and household recommendations to promote the effective implementation of green innovation strategy and the continuous improvement of green innovation performance. Finally, the study points out the limitations of the current research and proposes future research directions, including cross-national comparative research and long-term effect analysis. Through this study, it is hoped that theoretical support and practical guidance will be provided for the green transformation of manufacturing enterprises and promote the sustainable development of enterprises.

Keywords

Green Innovation Strategy; Green Innovation Performance; Manufacturing; Sustainable Development.

1. Introduction

1.1. Research Background

The huge impact of manufacturing on the environment and the urgency of its green transformation. As an important pillar of the global economy, the manufacturing industry has caused a huge impact on the environment, including resource consumption, pollution emissions and ecological damage. Under the pressure of global climate change and environmental protection, the green transformation of the manufacturing industry has become particularly urgent. By implementing a green innovation strategy, manufacturing companies can reduce environmental pollution, improve resource utilization efficiency and achieve sustainable development. Green transformation is not only a need to deal with environmental problems, but also the key for manufacturing companies to gain long-term competitive

advantages in the fierce market competition. The current situation and development trend of green innovation in the global and Chinese manufacturing industries. In recent years, the global manufacturing industry has made significant progress in green innovation. Developed countries in Europe and the United States have promoted the green transformation of the manufacturing industry through technological innovation and policy guidance. As a major manufacturing country in the world, China has also carried out a lot of exploration and practice in green innovation. The Chinese government has adopted a series of policy measures to encourage enterprises to carry out green technology research and development and application, promote green supply chain management, and promote the green transformation of the manufacturing industry. At present, the green innovation of China's manufacturing industry has achieved certain results, but it still needs to further improve the green innovation capacity and level.

The importance of green innovation strategy in modern manufacturing. Green innovation strategy refers to the strategy of enterprises to reduce environmental burden and achieve sustainable development through technological innovation, management innovation and organizational innovation. Green innovation strategy is of great significance in modern manufacturing. On the one hand, green innovation helps enterprises improve resource utilization efficiency, reduce production costs and enhance product competitiveness. On the other hand, green innovation can enhance the environmental friendliness of enterprises, improve brand image and market reputation, and win recognition from consumers and society. Implementing green innovation strategy is not only a manifestation of corporate social responsibility, but also an important path for enterprises to achieve sustainable development.

1.2. Research Significance

This study explores the impact of green innovation strategy on the green innovation performance of manufacturing enterprises. This study aims to explore the specific impact of green innovation strategy on the green innovation performance of manufacturing enterprises and reveal its internal mechanism and key factors. By systematically analyzing the components of green innovation strategy and its role in performance, it can provide theoretical support and practical guidance for enterprises to implement green innovation strategy. This study will enrich the research on the relationship between green innovation and corporate performance in theory and provide new perspectives and evidence for the existing theoretical framework. By introducing the concept of green innovation strategy and analyzing the impact of its different elements on performance, it expands the depth and breadth of green innovation research. At the same time, it provides guidance for enterprises and policymakers to implement green innovation strategy. The country's dual carbon policy and goals force enterprises to promote green transformation. The environmental protection pressure from the country, government and international is increasing, mainly manifested in the introduction of environmental protection policies and regulations; the environmental protection pressure of stakeholders is also gradually increasing with the rise of green consumption. These pressures have a direct impact on the strategic choices and operational decisions of enterprises. Therefore, while facing tremendous environmental pressure from many aspects, enterprises must meet environmental market demands by achieving green economic growth. Enterprises must regard green transformation as an effective way to enhance their competitiveness and achieve sustainable development. This project studies how to drive enterprises to accept green innovation strategies and then achieve green innovation performance, which has important practical significance for enterprises, governments and the maintenance of the business environment.

2. Literature Review

2.1. Current Status of Overseas Research

Eiadat et al. (2008) pointed out that environmental innovation strategy is related to the improvement of perceived corporate operating performance, and believed that environmental innovation strategy is a series of manufacturing practices involving environmental protection purposes. Reducing pollution sources means trying not to use raw materials that are harmful to the environment. Du et al. (2018) used data from 176 Chinese manufacturing companies to examine the direct and interactive effects of green integration on green innovation performance, as well as the moderating effect of internal integration. The results show that green customer integration, green supplier integration and their interaction are all positively correlated with green innovation performance. Internal integration has a moderating effect on the relationship between the two, but has no moderating effect on the relationship between green supplier integration and green innovation performance. The empirical research results of Tjahjadi (2019) show that green innovation strategy has a positive impact on green innovation performance. The study also shows that in Indonesia, a developing country, green innovation strategy affects green innovation through green organizational identity and environmental organizational legitimacy. Zhang et al. (2022) regard GIS as a positive environmental strategy, which is an enterprise innovation strategy related to the development of green product innovation and green process innovation. It can reduce environmental burden, enhance competitive advantage and improve corporate performance by promoting the efficient use of tangible and intangible resources of enterprises.

2.2. Current Status of Domestic Research

Huang Xiaoxing et al. (2015) believe that green innovation strategy is an attempt to achieve sustainable development, using the design and development of environmentally friendly products, processes and management methods to reduce adverse environmental impacts while meeting market demand. Cao Hongjun and Chen Zewen (2017) pointed out that green innovation strategy is to give equal weight to environmental responsibility and strategy. Green innovation strategy is defined as a strategy for enterprises to improve products, processes and management in order to coordinate economic and environmental development, reduce the adverse impact of enterprises on the environment, and actively incorporate environmental responsibility into corporate strategic planning (Chen Zewen and Cao Hongjun, 2019). Wu Jianzu and Hua Xinyi (2021) summarize green innovation strategy as a strategic measure for enterprises to deal with environmental pollution problems, advocating that green innovation practice should be equated with problems at the strategic level, and manifested in actively reducing negative impacts on the environment in production and operation activities.

3. Theoretical Analysis

3.1. Elements of a Green Innovation Strategy

Green innovation strategy consists of multiple elements, including technological innovation, management innovation and organizational innovation. First, technological innovation is the core of green innovation strategy, involving the research and development and application of green technology. Manufacturing enterprises can reduce resource consumption and pollution emissions in the production process and enhance the green attributes of products by developing and adopting low-carbon, energy-saving and environmentally friendly technologies. For example, enterprises can invest in the research and development of new energy technologies, waste recycling technologies and green manufacturing processes to achieve green and sustainable production processes.

Secondly, management innovation is an important part of the green innovation strategy, which refers to the innovation of enterprises in management systems and processes. Enterprises need to establish green management systems, formulate environmental management policies and green goals, and promote green supply chain management and full life cycle management. By optimizing processes, improving management methods and adopting information technology, enterprises can improve resource utilization efficiency and reduce environmental load. For example, promote green procurement systems, select environmentally friendly materials and suppliers, implement green logistics management, and reduce carbon emissions during transportation.

Finally, organizational innovation is the support of green innovation strategy, which involves the cultivation of green culture and the optimization of organizational structure. Enterprises should build an organizational culture that supports green innovation, encourage employees to participate in green innovation activities, and enhance the environmental awareness and sense of responsibility of all employees. At the same time, enterprises need to optimize their organizational structure, set up a special environmental management department and green innovation team, and ensure the effective implementation of green innovation strategy. Through organizational innovation, enterprises can stimulate the innovation potential of employees and form the internal driving force of green innovation.

3.2. Factors Affecting Green Innovation Performance

Green innovation performance is affected by a variety of internal and external factors. Internal factors mainly include enterprise resources, organizational culture and employee capabilities. Enterprise resources are the foundation of green innovation, including financial resources, technical resources and human resources. Adequate resource investment can ensure the smooth progress of green technology research and development and innovation activities. Organizational culture affects the attitude and support of enterprises towards green innovation. A corporate culture with a strong environmental awareness and innovative spirit can motivate employees to participate in green innovation. Employee capabilities are the key to achieving green innovation. Employees' knowledge, skills and innovation capabilities directly determine the quality and effect of green innovation.

External factors mainly include market demand, policy environment and industry competition. Market demand is an important driving force for enterprises to carry out green innovation. As consumers' environmental awareness increases, the demand for green products continues to increase. Enterprises improve product competitiveness through green innovation to meet market demand. The policy environment plays an important guiding and supporting role in green innovation. The government encourages enterprises to carry out green innovation by formulating environmental protection laws and regulations, providing technical subsidies and tax incentives. In addition, industry competition also prompts enterprises to continuously carry out green innovation to gain competitive advantages. In a highly competitive market environment, green innovation not only helps enterprises increase their market share, but also enhances their brand image and social responsibility.

4. Impact Mechanism Analysis

4.1. Convenience of Information Acquisition

Green innovation strategies use information technology to enhance companies' ability to obtain environmental information and market demand information. Modern information technologies, such as big data analysis, the Internet of Things, and cloud computing, enable companies to obtain and analyze large amounts of environmental data and market dynamics in real time. These technologies help companies identify environmental risks and market opportunities

more accurately and develop more precise green innovation strategies. For example, IoT sensors can monitor energy consumption and emissions during production, helping companies to adjust production parameters in a timely manner and reduce environmental impact. Big data analysis can integrate consumers' environmental protection needs and market trends to guide companies in developing green products that meet market demand. By improving information transparency and sharing, green innovation strategies also promote the application of green technologies and management methods. Information sharing within companies and between supply chains can accelerate technological innovation and knowledge dissemination, and promote the overall progress of green innovation.

4.2. Reduction of Transaction Costs

Green innovation strategies reduce transaction costs in production and operations by optimizing processes and technologies. By implementing green supply chain management, companies can integrate resources from upstream and downstream supply chains, improve overall supply chain efficiency, and reduce logistics and procurement costs. For example, by optimizing logistics routes and adopting low-carbon transportation methods, energy consumption and carbon emissions during transportation can be reduced. Green procurement policies encourage companies to choose environmentally friendly materials and suppliers to reduce the environmental impact of raw materials. In addition, the application of green technologies, such as energy efficiency management systems and waste reuse technologies, can optimize production processes, reduce energy and resource consumption, and reduce waste disposal costs. These measures not only reduce the operating costs of companies, but also enhance their green competitiveness and market image.

4.3. Diversification of Financial Products

Green innovation strategies promote the development of green financial products, such as green bonds and green funds, which provide enterprises with more financing options and financial support. Green bonds are a debt instrument specifically used to finance environmental protection projects. Enterprises that issue green bonds can obtain lower financing costs while enhancing their environmental responsibility image. Green funds provide investors with investment options that have both financial returns and environmental benefits by investing in environmental protection projects and green enterprises. Through these diversified financial products, enterprises can obtain more financial support for the research and development and implementation of green projects. For example, enterprises can use green bonds to finance the construction of solar power plants or implement energy efficiency improvement projects, and accelerate the commercialization of new environmental protection technologies through investments in green funds. The support of the financial market not only enhances the financial strength of enterprises, but also promotes the promotion and application of green technologies and projects.

5. Suggestions

5.1. Policy Recommendations

The government should play an important guiding and supporting role in promoting green innovation, and formulate and implement a series of policy measures to support green innovation. First, the government should encourage enterprises to carry out green technology research and development and application through tax incentives, subsidies and incentive mechanisms. Tax incentives can reduce the R&D costs of enterprises, and subsidies and incentive mechanisms can directly provide financial support to encourage enterprises to invest more resources in green innovation. Secondly, the government should promote the formulation and implementation of industry standards, standardize the market access conditions for green

technologies and products, and ensure that the promotion and application of green technologies comply with national environmental protection standards. By establishing a sound green technology certification system, the government can enhance the market's trust in green products and promote the development of the green market. In addition, the government should strengthen the enforcement of environmental protection laws and regulations to ensure that enterprises can obtain sufficient legal protection and support when implementing green innovation strategies, and further promote the widespread application of green innovation.

5.2. Recommendations for Financial Institutions

Financial institutions also play a key role in supporting green innovation. They should actively develop and promote green financial products and provide sufficient financing support for green projects. First, financial institutions can design and launch financial products such as green bonds, green loans and green funds, which are specifically used to finance environmental protection projects and green technology innovation. Through these products, financial institutions can not only meet the capital needs of enterprises, but also provide investors with environmentally friendly investment options. Secondly, financial institutions should establish a sound risk assessment and rating system to reduce the financing risks of green projects. Through scientific risk assessment, financial institutions can accurately judge the feasibility and profitability of green projects, thereby providing reasonable financing solutions to ensure the security and effectiveness of funds. In addition, financial institutions should strengthen cooperation with the government and enterprises to jointly promote the development of the green financial market, improve the availability of corporate financing, and help implement green innovation projects.

5.3. Suggestions for Residents and Families

Households also play an important role in promoting green innovation and achieving sustainable development. They should actively improve their awareness and acceptance of green products and promote green consumption. First, residents should enhance their environmental awareness, understand and choose green products, such as energy-saving appliances, environmentally friendly packaging and organic food. Through green consumption, residents can not only reduce their own environmental impact, but also promote the development of the green market and encourage enterprises to carry out more green innovation. Secondly, residents should actively participate in and support the investment of green financial products, such as green funds and green bonds. By investing in these products, residents can provide financial support for green projects and promote the development of green technology and environmental protection projects. Finally, residents should participate in community activities for environmental protection and sustainable development, spread the concept of green living, and influence more people to join the ranks of green consumption. Through joint efforts, households can contribute to the realization of environmental protection and sustainable development goals.

6. Conclusion and Outlook

6.1. Main Research Findings

This study deeply explored the specific impact of green innovation strategy on the green innovation performance of manufacturing enterprises and reached some important conclusions. First, green innovation strategy significantly improved the green innovation performance of enterprises, which was specifically manifested in the increase in the number of green patents, the expansion of the market share of environmentally friendly products, and the green improvement of production processes. Second, the study identified the key elements of green innovation strategy, including technological innovation, management innovation, and

organizational innovation, which promoted the green innovation of enterprises by improving the convenience of information acquisition, reducing transaction costs, and promoting the diversification of financial products. In addition, internal factors such as enterprise resources, organizational culture, and employee capabilities, as well as external factors such as market demand, policy environment, and industry competition, played an important moderating role in the implementation of green innovation strategy. These findings provide new perspectives and evidence for understanding the impact mechanism of green innovation strategy on enterprise performance.

6.2. Theoretical and Practical Contributions

This study has made important contributions both in theory and practice. On the theoretical level, this study enriches the research on the relationship between green innovation and corporate performance and expands the depth and breadth of existing research. By systematically analyzing the components of green innovation strategy and its mechanism of action, the study provides new empirical support and theoretical extension for behavioral finance and resource-based theory. On the practical level, the study provides valuable guidance for the green transformation of manufacturing enterprises. Enterprises can optimize green innovation strategies, improve green innovation performance, and enhance market competitiveness based on the research conclusions. At the same time, this study also provides decision-making references for policymakers, helping to formulate more effective green innovation policies and promote the sustainable development of the manufacturing industry. These theoretical and practical contributions have laid a solid foundation for further research on the relationship between green innovation strategy and corporate performance.

6.3. Research Limitations and Future Directions

Although this study has made some important findings, it still has certain limitations. First, the research samples are mainly concentrated in Chinese manufacturing enterprises, and the selection of samples may affect the universality of the research conclusions. Future research can be expanded to other countries and regions to conduct cross-national comparative studies to verify and enrich the conclusions of this study. Second, limitations in data acquisition may also affect the accuracy and comprehensiveness of the research results. Future research can adopt more diverse data collection methods, such as field surveys and in-depth interviews, to obtain more detailed and accurate data. In addition, future research should also explore the long-term mechanism of green innovation strategy in depth, analyze its impact on the long-term performance and sustainable development of enterprises, especially under different policy environments and market conditions. Through continuous research and exploration, more comprehensive and in-depth theoretical support and practical guidance can be provided for the green transformation and sustainable development of manufacturing enterprises.

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