

# The Effect of Green Innovation on Corporate Financial Performance: A Literature Review

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**Abstract:** *Heightening environmental challenges, increasing environmental awareness, and continuous refinement of environmental regulations have prompted corporations to increasingly focus on the development of green innovation in recent years. However, previous research has not reached a conclusive understanding of how green innovation affects corporate financial performance. In this case, this study seeks to categorize and summarize research conducted over the past five years on the relationship between green innovation and corporate financial performance, aiming to illustrate the reasons behind varied research conclusions.*

**Keywords:** Green Innovation; Green Process Innovation; Green Product Innovation; Corporate Financial Performance.

## 1. INTRODUCTION

Due to the increasing awareness of environmental protection and the pressure of relevant regulations, stakeholders are increasingly focusing on the green innovation performance of a corporation. An increasing number of scholars have conducted research on the topic of green innovation, such as its implementation, driving factors and its impact on corporate finance. Since studying the relationship between green innovation and corporate financial performance contributes to a deeper understanding of the investment returns and economic benefits for corporations in the environmental field, this relationship has been paid significant attention in the field of green innovation. In this case, this research includes four aspects, including the background of this relationship, definitions of the key items, literature review of this relationship and conclusion. In addition, this relationship is categorized and described through the relationship between green process innovation and corporate financial performance, the association between green product innovation and corporate financial performance and the correlation between undifferentiated green innovation and corporate financial performance.

## 2. BACKGROUND

Although fossil fuels have been regarded as a kind of important contributor to economic growth, growth dependent on fossil fuels clearly has significant disadvantages. It is attributed to the finite characteristic of fossil fuels and the harmful impact on the environment (Soeder, 2020). Especially, in recent decades, there has been increasing severity of environmental issues with the increased development of the economy, including climate change, air pollution and resource scarcity. For example, the occurrence of extreme weather events globally in various regions is increasing, which may be partly attributed to uncontrolled emissions of greenhouse gases. In addition, based on the prediction from the World Health Organization, climate change is projected to lead to approximately 250,000 additional deaths annually. Furthermore, by the year 2030, the annual economic costs associated with climate change are expected to reach from \$2 billion to \$40 billion. In this case, environmental issues have attracted some attention from some stakeholders, including the government, environment protection groups, scholars, corporations and the public.

Specifically, the government is mainly responsible for the mitigation of environmental issues. In this case, based on the environmental rule of law from the United Nations Environment Programme in 2019, the governments of different countries have issued various environmental regulations to limit the carbon emissions from firms. For example, the Climate Change Act (Northern Ireland) was also issued in 2022 to achieve the net-zero emission target. Similarly, the UK has issued the new Energy Act in 2023 to regulate the oil and gas activities. In addition, the US Environmental Protection Agency introduced a new technology standard for the energy sector to control the largest greenhouse gas emission in 2023. Besides, China also has established an initial carbon market to control and reduce greenhouse gas emissions through market mechanisms. Under this circumstance, corporations adopt sustainable development as a key strategy to respond to the environmental regulatory measures from the government. In addition, it is widely accepted that green innovation is regarded as an effective approach to

achieving sustainable development (Liao et al., 2022), which may be valued by corporations.

However, although the government issued some environmental regulatory measures, corporations seem to lack the motivation to pursue green innovation. This phenomenon may be explained by the characteristics of green innovation. Green innovation is characterized by high risks, high costs and a long-term process (Ji et al., 2023), which may reduce the motivation of corporations to pursue green innovation. In this case, corporations need to determine the relationship between green innovation and corporate financial performance to evaluate the economic effects of developing green innovation. In addition, the government proposes policies to support and promote green innovation, such as government subsidies, green finance policies and tax incentives. Therefore, the effect of green innovation on corporate financial performance has become a trending topic in recent years.

### **3. DEFINITIONS OF TERMS**

#### **3.1 Green Innovation**

Green innovation is developed from the combination of green and innovation. Specifically, green innovation refers to the process and practice of developing and promoting new products, services, and processes to promote environmental protection and sustainable development (Tang et al., 2023). The measurement of undifferentiated green innovation is typically assessed using green patents or employing research and development investment in prior studies.

It is widely accepted that green innovation consists of green process innovation and green product innovation (Li, 2022). In specific, green process innovation is defined as the improvement of existing production processes or the development of new production processes to reduce environmental pollution and control energy consumption (Xie et al., 2019). It includes reducing emissions of waste during production, minimizing water consumption, transitioning from fossil fuels to bioenergy and employing "end-of-pipe" technologies and pollution control devices (Khan et al., 2021). However, the focus of green process innovation is on improving production processes rather than changing the products themselves. Through the transformation of green production processes, resource utilization efficiency in production is likely to be enhanced, which may lead to cost advantages. In addition, this approach can reduce environmental costs for the corporation.

By contrast, green product innovation refers to the development of new products or modifications to existing product designs to reduce environmental impact and improve resource utilization efficiency during the whole life cycle (Tariq et al., 2019), which can provide competitive advantages. In addition, The critical feature of green product innovation is its life-cycle approach, which includes manufacturing, distribution, usage and disposal.

#### **3.2 Corporate Financial Performance**

Corporate financial performance refers to the evaluation and measurement of the company's performance and achievements in financial aspects, demonstrating the extent to which corporate strategies and their implementation and execution contribute to the overall operational results (Holzner & Wagner, 2022). Generally, financial performance is assessed by a range of indicators and methods, which typically involve the company's financial data and metrics over a specific time. In addition, the type of corporate financial performance can be divided into short-term financial performance and long-term financial performance.

Specifically, corporate short-term financial performance shows the past financial situation and present financial situation of the corporation (Mugisha et al., 2020). It mainly focuses on short-term capital flows, profit status and debt solvency. In previous studies, return on assets (ROA) and return on equity (ROE) are usually regarded as indicators to measure short-term financial performance. In addition, some other accounting-based indicators are also used to reflect a company's short-term financial performance, such as return on invested capital (ROIC), net profit margin, operating margin, sales growth rate, inventory turnover and degree of financial leverage.

By contrast, long-term financial performance shows the future financial situation of the corporation. It mainly focuses on the long-term development and sustainable growth of the corporation, which is associated with shareholders' interests (Shirasu & Kawakita, 2021). In the prior research, it is widely accepted that market-based indicators seem to represent corporate long-term financial performance. For example, Tobin's Q as a market-based indicator is defined as the ratio of market capitalization to total asset value (Shuwaikh et al., 2023), which indicates that it is likely to be used to assess the investment value and market valuation of a corporation. In this case, Tobin's Q

is usually used to evaluate long-term financial performance. In addition, market value (MV) is considered as another indicator to represent long-term financial performance in prior studies. Specifically, MV refers to the total market capitalization of a corporation in the market and it reflects investors' overall valuation of a corporation and its market position (Qing et al., 2022). Moreover, it is widely accepted that the price-earnings ratio (Estep, 2020) and Altman's Z-score (Wedari et al., 2022) are also employed in measuring corporate long-term financial performance.

## 4. LITERATURE REVIEW

The traditional view of the relationship between green innovation and corporate financial performance is negative (Palmer et al., 1995). This association is changed from the proposal of the "win-win" hypothesis by Porter and Linde (1995). In this hypothesis, the corporation can obtain the economic performance from the environmental performance, which overturns the previously observed negative association. In addition, Reinhardt (1998) proposes the "it depends" hypothesis which suggests that whether the relationship between green innovation and corporate financial performance is positive or negative depends on different circumstances. Based on the "win-win" hypothesis and the "it depends" hypothesis, a considerable number of studies have been conducted by scholars. According to the results of the research, the literature review is divided into three parts, including the relationship between green process innovation and corporate financial performance, the relationship between green product innovation and corporate financial performance and the relationship between undifferentiated green innovation and corporate financial performance.

### 4.1 Green Process Innovation and Corporate Financial Performance

The positive association, the negative relationship and no relationship between green process innovation and corporate financial performance have been observed in previous studies. On the one hand, the positive association can be explained by three reasons. Firstly, green process innovation seems to reduce the operating costs of the corporation. Specifically, green process innovation is defined as the enhancement of existing production processes and the creation of a new production process to minimize the environmental harm impact (Xie et al., 2019). It indicates that implementing green process innovation may reduce the rate of waste generation, which is likely to decrease losses and waste during the production process. In this case, the overall production costs appear to be reduced in some degree. Hence, green process innovation has a positive influence on corporate financial performance.

Secondly, corporations appear to lower environmental costs. In specific, based on the definition of green innovation process, corporations implementing green process innovation tend to have better compliance with environmental regulations and industry standards compared to those that do not pursue such innovation. It indicates that corporations are likely to avoid legal liabilities and fines resulting from environmental pollution, which is considered as a reduction in environmental costs for corporations. In addition, the corporation may reduce legal risks and additional costs due to the implementation of green process innovation, which may enhance the stability of corporate financial performance. Hence, corporate financial performance is positively influenced by green process innovation.

Thirdly, green process innovation helps shape a corporate environmental and social responsibility image. In specific, there is evidence that the fulfillment of corporate social responsibility is considered a critical factor by stakeholders when evaluating firms in an environment of heightened environmental awareness (Przychodzen et al., 2019). In this case, corporations with an advanced environmental image are likely to attract favor from consumers and investors. It indicates that the corporation may obtain a larger market share and more customer trust, which is likely to lead to increased sales and financial performance. Hence, there is a positive relationship between green process innovation and corporate financial performance.

In the previous studies, Xie et al. (2019) prove that green process innovation is positively associated with corporate financial performance by using the measurement of ROA. Similarly, Tang et al. (2018) also demonstrate this positive relationship by using five measurements of corporate financial performance. In addition, Li (2022) proves that the positive relationship between green process innovation and financial performance is mediated by green dynamic capability in Chinese heavy-polluting corporations. By contrast, Xie et al. (2022) demonstrate with 172 Chinese manufacturing firms that green process innovation has no significant impact on ROA in the short term, but it shows a positive correlation with ROA after a lag of three periods. Moreover, Qing et al. (2022) find that green process innovation is positively associated with both short-term corporate financial performance and long-

term corporate financial performance in semiconductor firms. Similarly, Ji et al. (2024) use Tobins' Q as the measurement of corporate financial performance to prove this positive correlation.

On the other hand, the negative relationship between green process innovation and corporate financial performance can be illustrated by three aspects. The first reason is that green process innovation is likely to result in additional costs and financial burdens. In specific, implementing green process innovation may require significant initial investment, including purchasing new environmentally-friendly equipment, introducing new production technologies and conducting employee training. In this case, these expenditures seem to negatively impact the short-term financial performance of the corporation.

The second reason is that the additional costs associated with green process innovation may not be fully compensated by an increase in sales revenue. Specifically, due to the incomplete and inconsistent eco-label index in production processes (Yao et al., 2019), customers may be unable to directly observe green process innovation in some degree. In this case, the positive impact of green process innovation on product sales appears to be reduced, which seems to affect the revenue generated from product sales. Hence, green process innovation is negatively correlated with corporate financial performance.

The third explanation is that green process innovation may lead to increased cash flow volatility, which in turn affects corporate financial performance. In specific, an effective and efficient supply chain is indispensable in green process innovation, but corporations may lack relevant experience because green process innovation is widely accepted as an innovative activity. In this case, there is likely to be inadequate management of green process innovation may have a negative influence on the cash flow stability of the corporation. In prior studies, Yao et al. (2019) use the data from China to demonstrate green process innovation is negatively associated with firm value which is measured by Tobins' Q.

In addition to the positive association and negative correlation between green process innovation and corporate financial performance, Holzner and Wagner (2022) use a questionnaire survey method to demonstrate the null association between green process innovation and corporate financial performance under the environmental uncertainty in German manufacturing firms.

#### **4.2 Green Product Innovation and Corporate Financial Performance**

Previous studies have identified positive, negative, and no relationships between green process innovation and corporate financial performance.

Based on empirical evidence from prior studies, the positive association can be explained by three aspects. Firstly, implementing green product innovation is likely to reduce costs. On the one hand, green product innovation is likely to decrease production costs. In specific, green product innovation refers to the employment of more efficient and environmentally friendly materials or technologies to advance existing products or to create new products (Tariq et al., 2019). It means that the reduction of products' energy consumption and the increase in production efficiency and lead to cost savings in some degree. In this case, it is likely to enhance the profitability of corporations. On the other hand, the adoption of green product innovation is expected to lower compliance costs. Green product innovation is beneficial for reducing adverse environmental impacts, which indicates that it may reduce potential environmental fines and litigation costs. Hence, it may facilitate long-term stable performance.

Secondly, green product innovation can increase the sales revenue of products. On one hand, green product innovation meets the growing environmental awareness of consumers, which is likely to provide a competitive advantage. Under this circumstance, corporate market share appears to increase to some extent, leading to higher sales revenue. On the other hand, green product innovation provides an opportunity for differentiated competition, which leads consumers to be willing to pay a premium for green innovative products. Hence, sales revenue is likely to be increased.

The third explanation is related to corporate image. Specifically, corporations may cultivate an environmentally friendly and sustainable image by launching green innovative products. It is likely to enhance brand value and reputation, which appears to attract consumers and investors. In this case, the long-term corporate financial performance may be promoted to some extent. Previous studies provide empirical evidence for this positive correlation. For example, Tariq et al. (2019) demonstrate that green product innovation performance leads to higher profitability and lower corporate financial risks by using data from Thailand manufacturing firms. Similarly, Hu

et al. (2021) prove there is a positive association between green product innovation and financial performance from the perspective of government subsidy. Li (2022) uses the resource-based view to explain why green product innovation is positively associated with corporate financial performance. By contrast, Qing et al. (2022) propose that green product innovation is related to long-term financial performance rather than short-term financial performance.

However, the negative relationship between green product innovation and corporate financial performance is proved by Yao et al. (2019). They claim that a negative association emerges in the chosen Chinese-listed firms of their research. In addition, the negative association can be concluded by three influencing factors. In specific, the first explanation is that the limited consumer understanding of green innovation products has an adverse impact on the sales revenue of these products. In addition, it is widely accepted that the price of green innovation products is higher than other products (Sana, 2020), which may further reduce consumers' purchasing intentions. In this case, green product innovation leads to a decrease in expected cash flows.

Moreover, green product innovation is characterized by high costs and long payback periods, which may harm the short-term financial performance of the corporation. Especially for small and medium enterprises (SMEs), the relatively limited financial resources of SMEs may exacerbate the negative impact of green product innovation on financial performance than large corporations. It may contribute to financial strain, which has a negative influence on the day-to-day operations and financial performance of SMEs. In addition, Ji et al. (2023) prove this situation in SMEs. Thirdly, the market for green innovation products faces the challenge of imitation, which may affect the sales of green innovation products in the market. Therefore, corporate financial performance may be adversely affected to some extent. Besides, Tang et al. (2017) fail to prove green product innovation is associated with corporate financial performance by using data from China.

### 4.3 Undifferentiated Green Innovation and Corporate Financial Performance

Three types of results are observed in previous studies, including the positive relationship, U-shaped association and insignificant correlation between undifferentiated green innovation and corporate financial performance.

In recent research, a significant proportion of the outcomes demonstrate a positive correlation. For example, Rezende et al. (2019) prove that green innovation is positively associated with corporate financial performance based on the data of multinational corporations. In addition, Zhang et al. (2019) have a similar conclusion by using the data from Chinese listed firms. Yi et al. (2023) observe board green innovation is positively associated with corporate financial performance by observing related studies. However, Przychodzen et al. (2019) demonstrate that green innovation has a significant, positive and lagged effect on company valuation based on the data from corporations in the S&P 500 Index. Similarly, Tang et al. (2022) find that green innovation leads to an increase in ROA two periods later. In addition, Qing et al. (2023) provide evidence for different impacts of positive green innovation and reactive green innovation on corporate financial performance. Apart from the explanations of positive relationships between firm financial performance and green product innovation and green process innovation described above, the perspective of stakeholder theory and "first-mover" advantage are considered as two main explanations for this positive association.

On the one hand, from the perspective of stakeholder theory, corporations are responsible for all stakeholders and they need to meet stakeholders' expectations by enhancing corporate image and improving financial performance (Freeman et al., 2021). In the strategy of green innovation, customers and investors are considered as two kinds of critical stakeholders. As for customers, since green innovation meets certain customers' requirements for environmentally friendly products, customer retention rates seem to increase, which may further explore consumer green demands. In this case, it may facilitate the promotion of subsequent sales of green products, which is likely to have a positive influence on sales revenue. Furthermore, as for investors, it is widely accepted that higher green innovation performance is associated with higher levels of environmental legitimacy (Mulaessa & Lin, 2021). It appears to represent relatively higher stability in corporate financial performance, which is likely to increase the willingness of investors to invest in the corporation. Hence, green innovation has a positive influence on corporate financial performance.

On the other hand, green innovation has certain first-mover advantages, which may lead to its positive association with corporate financial performance (Przychodzen et al., 2019). Specifically, if a company introduces green innovations early, a market leader in sustainable practices may be established. It seems to lead to brand recognition and customer loyalty, which may expand the market share of its products. Moreover, the corporation gains priority

access to resources and benefits from lower procurement costs compared to firms introducing green innovations later. In this case, as a result of increased sales revenue and reduced costs, corporate financial performance is likely to be enhanced to some extent.

Furthermore, some scholars have demonstrated that undifferentiated green innovation has a U-shaped impact on corporate financial performance. For example, Riillo (2017) proposes that the association between green management and corporate financial performance is U-shaped. This U-shaped relationship can be illustrated by two stages of corporate financial performance. In the initial time, high initial costs are needed in the process of developing green innovation, such as training costs, labor costs and management expenses. In addition, compared to other operation activities, green innovation has higher risks, uncertainties and longer payback periods (Lai et al., 2021). These characteristics are likely to increase the risks faced by corporations developing green innovation. Hence, the higher costs and risks may have an adverse impact on the short-term financial performance of the corporation. However, as green innovation progresses and green products are gradually introduced, it positively influences the financial performance of corporations. Additionally, government subsidies for green products further promote improvements in corporate financial performance. Therefore, green innovation and corporate financial performance exhibit a U-shaped relationship. Besides, some research fails to prove undifferentiated green innovation affects corporate financial performance. For example, Borsatto et al. (2022) use 159 industrial corporations to show this result.

## 5. CONCLUSIONS

In conclusion, based on the related literature review, there is no definite conclusion for the relationship between green innovation and corporate financial performance. It can be attributed to three reasons. Firstly, the measurement of corporate financial performance is different from prior studies. Specifically, some research uses short-term indicators of corporate financial performance, such as ROA, ROE, net profit and so on. The other studies employ long-term indicators, such as Tobin's Q, market value and Altman's Z-score. In addition, there is evidence that green innovation seems to have a negative influence on the short-term financial performance of a corporation and it is beneficial for the long-term financial performance of a firm. Hence, different measurements of dependent variables may obtain different results in previous empirical studies. Secondly, different aspects of green innovation have been focused on in previous studies. In specific, undifferentiated green innovation, green process innovation and green product innovation are regarded as the independent variables in prior research. However, the definition and measurement of the three aspects of green innovation are different, which may result in different results of the relationship between green innovation and corporate financial performance. Thirdly, the targeted industry may have an influence on the relationship between green innovation and corporate financial performance. Specifically, compared to industries with a strong reliance on fossil fuels, technologically advanced industries are likely to develop and implement green innovation easily. Hence, it is likely to lead to enhanced financial benefits.

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