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Green Image and Incentives: Unraveling Their Moderating Impact on Green Innovations, Investor Perception and Financial Performance

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Abstract

This study examines the linkages between technological green innovations, financial performance and investor enthusiasm in listed Indian manufacturing firms, a context under-represented in extant literature. It aims to address the gap in understanding how investor enthusiasm drives the adoption of green innovation practices and their subsequent impact on financial performance. Moreover, the study investigates the moderating effects of green image and green production incentives, providing comprehensive insights into adopting environmentally sustainable practices. Using a quantitative analysis approach, the research uncovers that green process innovation positively influences green product innovation, contributing to financial performance and investor enthusiasm. However, it also reveals that macroeconomic factors and consumer purchasing power challenge green process innovation. Unexpectedly, no empirical evidence supports the moderation effect of green image between green production incentives and investor enthusiasm. Overall, the study contributes to a better understanding of the complex interplay between green innovation, financial performance and investor enthusiasm in the Indian manufacturing context. The findings hold significant implications for practitioners, policymakers and investors towards fostering a more sustainable future for the Indian manufacturing sector. Future research directions include further exploring dynamic relationships, incorporating other types of green innovations, and considering additional metrics for financial performance and investor enthusiasm.

Key terms: technological green innovations, financial performance, investor enthusiasm, listed Indian manufacturing firms, green image, green production incentives

JEL Classification: Q56, M14, L25, O39, O14

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1. Introduction

In recent years, the increasing emphasis on environmental sustainability has prompted firms to adopt green innovation practices to reduce their environmental impact and enhance competitiveness (Lee *et al.*, 2015). Green innovation encompasses product and process innovations that minimize environmental harm, conserve resources and improve overall sustainability (Chen *et al.*, 2012). Consequently, green innovation has become a critical determinant of long-term success for firms, especially in the manufacturing sector (Hou *et al.*, 2021).

Several studies have investigated the relationship between green innovation and financial performance (Zamir & Mujahid, 2022; Montabon *et al.*, 2006). These studies have found that green product and process innovations positively impact the companies' financial performance, leading to increased revenues, performance reduced costs and enhanced competitiveness (Horbach *et al.*, 2012; Liu *et al.*, 2012; Xie *et al.*, 2019). However, the extant literature has overlooked investor enthusiasm's role in driving green innovation practices and their impact on financial performance (Choi *et al.*, 2021; Girod & Whittington, 2016).

This study aims to bridge this gap by examining the linkages between technological green innovations, financial performance and investor enthusiasm in listed Indian manufacturing companies. India's manufacturing sector has experienced significant growth and plays a vital role in its economy, making it a suitable context for this investigation (Gupta, 2017). Furthermore, the Indian Government's recent policy initiatives, such as the Production Linked Incentive (PLI) scheme, have incentivized firms to adopt environmentally sustainable technologies and practices (Gupta & Gupta, 2020).

Existing literature has also revealed the importance of green image as a moderator in the relationship between green innovation and financial performance (Chen *et al.*, 2006; Geng *et al.*, 2017). A robust green image can positively influence customer perceptions, market share and financial performance (Huang & Li, 2015; Park, 2023). However, there is limited evidence on the moderating effect of the green image in the context of Indian manufacturing firms (Le, 2022).

To address these gaps, we employ a quantitative analysis approach to explore the associations between green process innovation, green product innovation, financial performance and investor enthusiasm in the Indian manufacturing sector. By incorporating the moderating effects of green image and green production incentives, we provide a comprehensive understanding of the factors influencing the adoption of green innovation practices and their impact on financial performance.

This paper makes several contributions to the literature on green innovation, financial performance and investor enthusiasm. Firstly, we provide a detailed analysis of the linkages between green innovation practices and financial performance in Indian manufacturing, which has been under-researched in the extant literature (Digalwar *et al.*, 2013). Secondly, we examine the role of investor enthusiasm in driving the adoption of green innovation practices, highlighting the importance of considering investor preferences in the strategic decision-making process (Choi *et al.*, 2021; Girod & Whittington, 2016). Finally, we investigate the moderating effects of green image and green production incentives on the relationships between green innovation, financial performance and investor enthusiasm, offering valuable insights for academics and practitioners (Zhang & Ma, 2021; Geng *et al.*, 2017).

The remainder of this paper is organized as follows: Section 2 reviews the relevant literature on green innovation, financial performance and investor enthusiasm, leading to the development of our research hypotheses. Section 3 outlines the methodology employed in this study, including the data collection and analysis procedures. In section 4, we present the results of our analysis, demonstrating the significant relationships between the variables of interest and the moderating effects of green image and green production incentives. Section 5 discusses the implications of our findings for theory and practice, the limitations of our study and directions for future research.

By investigating the complex relationships between green innovation, financial performance and investor enthusiasm in the context of Indian manufacturing firms, this study contributes to a better understanding of the factors influencing the adoption of environmentally sustainable practices and their impact on financial outcomes. Moreover, the insights gleaned from this research can help practitioners, policymakers and investors make more informed decisions regarding implementing green innovation strategies and allocating resources towards environmentally sustainable initiatives. Ultimately, this study aims to foster a more sustainable future for the Indian manufacturing sector and contribute to the global effort to combat climate change and promote environmental sustainability.

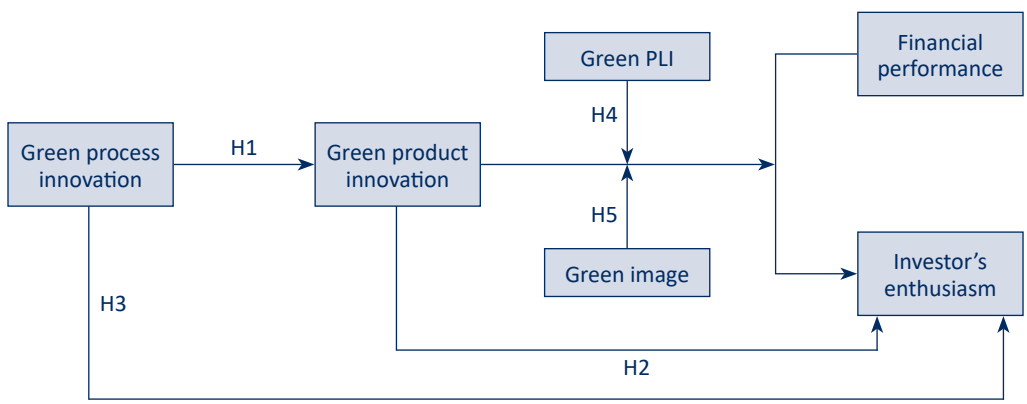
2. Theoretical background and hypotheses development

The theoretical background of this study is primarily supported by two theories, namely the Resource-Based View (RBV) theory and the stakeholder theory. These theories provide a foundation for understanding the relationship between green innovations, financial performance and investor enthusiasm in the context of listed Indian manufacturing companies.

The RBV theory posits that a firm's sustainable competitive advantage is derived from its unique resources and capabilities (Barney, 1991). According to this theory, green innovations, such as product and process innovations, can be considered valuable, rare, inimitable and non-substitutable resources contributing to a firm's competitive advantage (Hart, 1995; Singh *et al.*, 2020). Research has shown that firms that invest in green innovations can generate better financial performance and attract more investors, as these innovations serve as a source of differentiation and value creation (Chen *et al.*, 2012; Hu *et al.*, 2019). In the Indian manufacturing industry, green innovations can provide a competitive edge by reducing environmental impact and improving operational efficiency, ultimately enhancing financial performance and investor enthusiasm.

Stakeholder theory emphasizes the importance of addressing the needs and expectations of various stakeholders, including shareholders, employees, customers, suppliers and regulators, to achieve long-term business success (Freeman, 2010). Green innovations can be seen as a way for firms to meet the demands of stakeholders who increasingly value sustainability and environmental protection (Aguilera-Caracuel & Ortiz-de-Mandojana, 2013). According to stakeholder theory, firms that adopt green innovations and demonstrate their commitment to sustainability are more likely to gain the trust and support of stakeholders, leading to better financial performance and increased investor enthusiasm (Alonso-Martínez *et al.*, 2019). In the Indian context, firms that actively engage in green product and process innovations can effectively respond to the changing preferences of stakeholders, such as customers' increasing interest in environmentally friendly products and investors' growing attention to firms' sustainability performance.

These two theories offer complementary insights into the relationships among green innovations, financial performance and investor enthusiasm in the Indian manufacturing sector. The RBV theory highlights the strategic importance of green innovations as valuable resources that can enhance financial performance and environmental condition (Hou *et al.*, 2021). In contrast, stakeholder theory emphasizes the role of green innovations in meeting the expectations of various stakeholders and creating value for the firm. By applying these theoretical perspectives, this study aims to explore the linkages of technological green innovations, financial performance and investor enthusiasm in listed Indian manufacturing companies, as well as the moderating effects of green image and green production incentives on these relationships, as depicted in figure below.



Conceptual framework

2.1. The two types of green technological innovations

The relationship between green process innovation and green product innovation has been the subject of numerous studies in recent years. Several researchers argue that green process innovation positively influences green product innovation due to its complementary nature (Wang *et al.*, 2021). By improving operational efficiency and reducing environmental impacts, green process innovation enables firms to develop innovative green products that cater to the growing demand for sustainable solutions. Empirical evidence from various industries and countries supports this mutually reinforcing relationship between green processes and product innovations (Chen *et al.*, 2006; Yang *et al.*, 2011). This leads to the construction of H1.

Hypothesis 1: *Green process innovation is positively related to green product innovation.*

2.2. Green product innovation and investor enthusiasm

The impact of green product innovation on investor enthusiasm has been explored in the literature, with several studies suggesting a positive correlation between the two variables. Green product innovation is considered a source of competitive advantage that can attract investors, as it differentiates firms from their competitors and signals their commitment to sustainable development (Le, 2022; Xie *et al.*, 2019). Moreover, companies that successfully launch innovative green products will likely enjoy higher profit margins, greater brand recognition and a broader customer base, all of which contribute to higher valuations and greater investor interest (Trumpp & Guenther, 2015). This leads to the construction of H2.

Hypothesis 2: *Green product development is positively related to investor enthusiasm.*

2.3. Green process innovation and investor enthusiasm

The relationship between green process innovation and investor enthusiasm has been less extensively studied, with mixed results reported in the literature. Some studies suggest a positive correlation between these variables, as green process innovation can lead to cost savings, resource efficiency and a lower environmental footprint, enhancing firm value and attracting investors (Dangelico & Pujari, 2010; Hart & Ahuja, 1996). However, other research has found no significant association between green process innovation and investor enthusiasm, as the benefits of green process innovation may be less visible to investors compared to green product innovation (Wang *et al.*, 2022). This validated the construction of H3.

Hypothesis 3: *Green process innovation is positively related to investor enthusiasm.*

2.4. Mediating role of product linked incentives

Product linked incentives (PLIs) have been identified as essential policy instruments to promote green product innovation and enhance financial performance. The literature suggests that PLIs can encourage firms to invest in green technologies and processes by reducing the costs and risks associated with these investments (Lukitaruna & Sedianingsih, 2018). Furthermore, PLIs can help bridge the gap between the high costs of green product development and the willingness of consumers to pay for these products, ultimately improving firms' financial performance (Singh *et al.*, 2014; Chen *et al.*, 2006). This leads to the development of H4.

Hypothesis 4: *Product linked incentives have a significant moderating effect between green product innovation and firms' financial performance.*

2.5. Mediating role of green image

The moderating effect of green image on the relationship between green product innovation and investor enthusiasm has been investigated in several studies. Researchers argue that a robust green image can enhance the attractiveness of firms that engage in green product innovation, as it signals their commitment to sustainability and responsiveness to stakeholder concerns (Huang & Li, 2015; Lin *et al.*, 2013). However, the moderating role of a green image may vary across different contexts, as factors such as the stage of green policy adoption, consumer

preferences and macroeconomic conditions can influence the strength of this relationship (Melander, 2018). This leads to the construction of H5.

Hypothesis 5: *Green image has a significant moderating effect between green product innovation and investor enthusiasm.*

3. Data and variables

3.1. Data

Manufacturing firms listed on the National Stock Exchange and Bombay Stock Exchange were selected for this study. Initially, 320 manufacturing firms with a minimum market capitalization of 1,000 crore rupees (123 million dollars) were chosen, accounting for a total market capitalization of approximately 1.8 trillion dollars on the Indian market. Seventeen manufacturing industries were identified based on the emissions produced by each sector. Firms that did not publish corporate social responsibility (CSR) reports in 2021-2022 or whose data was not accessible or reliable were excluded, as we required this information to analyze the companies' green process and product advancements and achievements. Data for 228 firms listed on the National Stock Exchange or the Bombay Stock Exchange in 2023 was collected using the content analysis method. Data pertaining to green subsidies, financial performance, financial constraints, total assets turnover, age and size of the firms was extracted from the companies' annual financial, sustainability and CSR reports.

3.2. Variables

Table 1. Variable definition

Variables	Measurements	Data sources
Firm size	Total assets	Firm's annual reports
Total asset turnover	Ratio of main business income to total assets	Firm's annual reports
Firm age	Number of years listed on the Indian market to year 2023	Firm's annual reports
Green process innovation	PROC1: Aiming to reduce the consumption of resources and energy and increasing efficiency	Firm's corporate social responsibility reports
	PROC2: Using recycled materials, recycling techniques and sustainable technology to reduce emissions	
	PROC3: Applying environmental campaigns	
	PROC4: Adopting pollution control projects and techniques	
Green product innovation	PROD1: Making changes in product material	Firm's corporate social responsibility reports
	PROD2: Improving, designing and adopting environmentally friendly packaging	
	PROD3: Making product design to improve quality and efficiency	
Green image	GI1: Complying with environmental regulations and having high awareness of environmental risks	Firm's corporate social responsibility reports
	GI2: Demonstrating strength in improving energy efficiency	
	GI3: Demonstrating the ability to reduce waste	
	GI4: Manufacturing products eligible for end-of-life recovery	
Green production linked incentives	Amount of green production linked incentives related to environmental protection	Firm's annual reports
Financial performance	Return on assets	Firm's annual reports
Investor enthusiasm	Price-to-book ratio	Firm's financial data

■ **Dependent variables**

✓ ***Financial performance***

The return on assets (ROA) measure gains widespread recognition and acceptance as a valuable indicator of a company's profitability and operational efficiency in the green innovation literature (Derchi *et al.*, 2023). Its multifaceted utility is manifold, given its capacity to signify the consequences of past and present actions and its frequent use for scrutinizing the relationship between green innovation and corporate profitability. The calculation of ROA entails dividing net income by total assets, thereby assessing a firm's ability to maximize profits through asset leverage. As a comparative standard of financial performance, ROA facilitates an appraisal of a company's performance relative to its counterparts and across industries, thereby identifying areas of prospective enhancement. As an inclusive enveloping metric for income and asset management, ROA constitutes a valuable indicator of a company's overall financial performance. Consequently, in the current research context, ROA could function as an effective financial performance metric for appraising the impact of green innovation on Indian manufacturing companies and exploring the potential moderating influence of factors such as a green image or production linked incentives, as depicted in Table 1.

✓ ***Investor enthusiasm***

The price-to-book (PB) ratio, a quantitative instrument that compares a company's market value to its book value, is a surrogate measure of investors' anticipation of its future potential. In the present investigation, the PB ratio is an apt metric for assessing investors' eagerness toward Indian manufacturing firms at the forefront of green technological innovations. The PB ratio estimates a company's allure to investors, reflecting their future growth and earning opportunity predictions. A higher PB ratio signifies that investors are willing to pay a premium for a company's shares, indicating an optimistic outlook on the company's prospects. Furthermore, the PB ratio represents a valuable measure of investor confidence in a company's management team, business model and overall financial well-being. Thus, the PB ratio constitutes an invaluable tool for scrutinizing the connection between green innovation and investor enthusiasm in the Indian manufacturing industry. The research can leverage the PB ratio to investigate the extent of correlation between a company's green product and process innovation and its level of investor enthusiasm, while also examining how moderating factors, such as a company's green image or production linked incentives, might influence this association.

■ **Independent variables**

✓ ***Green process innovation***

Green process innovation is critical for firms seeking to boost their sustainability performance and meet ever-more stringent environmental regulations (Wang *et al.*, 2021). In this study, green process innovation is a crucial consideration due to its direct effect on a company's capacity to adopt sustainable practices and decrease its environmental impact. It refers to developing and implementing novel methods and technologies that enable firms to reduce energy and resource consumption, decrease waste and mitigate harmful emissions. The study measures green process innovation by bifurcating it into clean and end-of-pipe technologies. Based on the firm's corporate social responsibility report, each aspect is evaluated on a scale of 0 to 1. The computed value of green process innovation is the average of clean and end-of-pipe technologies. Furthermore, green process innovation can bolster a firm's green image, enhancing its appeal to investors and consumers. By analyzing the relationship between green process innovation and other variables in this study, such as financial performance, investor enthusiasm and green product innovation, researchers can gain insights into the significance of sustainable practices in the Indian manufacturing industry and identify potential areas for improvement.

✓ ***Green product innovation***

Green product innovation is a crucial variable in the present study, reflecting a company's ability and commitment to develop and introduce environmentally sustainable products. Organizations must design and market products with a reduced environmental impact throughout their lifecycle, from production to disposal. Green product innovation is vital for companies to enhance their financial performance and investor enthusiasm. It can meet consumers' growing demand for sustainable products and enhance the company's reputation as a socially responsible organization. The study employed three indexes to measure green product innovation (refer to Table 1), and the items were rated using content analysis. Green product innovation is treated as an independent variable in the study, as it is expected to directly impact a company's financial performance and investor enthusiasm and can also affect green process innovation. Companies can enhance their competitiveness, increase market share and generate higher profits by creating more environmentally sustainable products. In addition, green product innovation can improve brand recognition and reputation, attract more investors, and enhance the company's long-term prospects. Therefore, by analyzing the relationship between green product innovation and other variables in this study, such as financial performance, investor enthusiasm, and green process innovation, researchers can gain a better understanding of the role of sustainability in the Indian manufacturing sector and identify strategies to improve the sector's environmental performance and competitiveness.

■ **Moderators**

✓ ***Green image***

The perception of a company's environmental performance and commitment to sustainability, known as the green image, holds great importance in this study. As a moderator variable, a green image can influence the relationship between green product innovation, financial performance and investor enthusiasm. A favourable green image can boost a company's reputation and make it more appealing to investors and consumers. For example, even if a company's financial performance is not strong, a positive green image can attract higher investor interest. Conversely, a weak green image can make it difficult for companies to attract investors, even with strong financial performance. Therefore, by examining the moderating effect of the green image, researchers can gain valuable insights into the role of reputation and image in the relationship between sustainability and financial performance. This study evaluated the green image using four items, and the content analysis method was used to score them.

✓ ***Green production linked incentives***

The Indian Government offers green production linked incentives through tax breaks, subsidies and grants, to encourage sustainable practices among companies. These incentives can moderate the relationship between green processes, product innovation, financial performance and investor enthusiasm. Companies that receive green PLIs may have more resources to invest in sustainability, improving their financial performance and appealing to investors (Zolfagharinia *et al.*, 2023). Analyzing the moderating effect of green PLIs can shed light on the role of government policies in promoting sustainability in the Indian manufacturing sector and its impact on financial performance and investor enthusiasm. Green PLIs were measured based on government allocations for PLI and companies' annual reports, using the number of subsidies for environmental protection as a proxy.

■ **Control variables**

✓ ***Firm size***

Including firm size as a control, the variable can be valuable, since larger companies have more resources and different environmental regulations, potentially affecting their sustainability practices and financial

performance. By controlling for firm size, the study can isolate the impact of green processes and product innovation on financial performance and investor enthusiasm across different-sized firms.

✓ ***Firm age***

Controlling for firm age can also be beneficial, as older firms may have more experience and resources, while younger firms may be more agile in adopting new technologies and practices. By controlling for firm age, the study can better understand the impact of green processes and product innovation on financial performance and investor enthusiasm, while minimizing the influence of firm age as a confounding factor.

✓ ***Total asset turnover***

Total asset turnover is a financial metric that reflects a company's effectiveness in generating revenue from its assets. It can be a plausible control variable, since variations in asset utilization across firms can influence the relationship between sustainability practices and financial performance. By controlling for total asset turnover, the study can better isolate the impact of green processes and product innovation on financial performance and investor enthusiasm.

■ **Reliability test**

We collected data on green process innovation, green product innovation, green image and green production linked incentives through manual content analysis. Two coders then coded the data. The two coders initially coded 80 reports, and inter-coder reliability was evaluated. We used the Bayesian unidimensional reliability test to assess the data's reliability. Our criterion for drawing practical conclusions was a value of omega greater than 0.7. Previous researchers have demonstrated the capability of this method to test the reliability of data (Lukitaruna & Sedianingsih, 2018). Using the Bayesian unidimensional reliability analysis, we employed JASP to calculate McDonald's omega. The computed omega values for the indices of green process innovation, green product innovation, green production linked incentives and green image were all above the threshold of 0.67. Therefore, the data's reliability was affirmed.

4. Results

Table 2. Pearson correlation analysis

S. no	Variable	Green process	Green product	Green image	Firm age	Financial performance	Production linked incentives	Investor's enthusiasm	Firm size	Total asset turnover
1	Green process	1								
2	Green product	0.115*	1							
3	Green image	0.212***	0.269***	1						
4	Age	0.126*	0.313***	0.092	1					
5	ROA 5 year	0.038	0.063	-0.030	0.288***	1				
6	PLI	0.163**	0.150*	0.048	0.049	-0.056	1			
7	CMP/BV	-0.055	0.176**	-0.158	0.226***	0.393***	-0.020	1		
8	Firm size	0.170**	0.126*	0.046	0.116*	-0.085	0.313***	-0.085	1	
9	Total asset turnover	0.02	0.026	-0.002	0.070	0.209***	-0.037	0.336***	-0.090	1
*** p < 0.01 ** p < 0.05 * p < 0.1										

Table 2 illustrates the examined variables' descriptive statistics and Pearson correlation coefficients. The findings indicate a significant positive correlation between green process innovation and green product innovation, providing empirical support for H1. Further investigation of their interrelationships is crucial, given their significant impact on financial performance and investor perception. Recent studies suggest that green process innovation

can act as an enabler for green product innovation, helping to reduce environmental impact and adopt sustainable practices (Wang *et al.*, 2021). The success of green product innovation is contingent upon sustainable business operations. Green process innovation, which involves significant changes in all manufacturing dimensions, is a foundation for other green innovations and emission reduction practices. (Xie *et al.*, 2019)

The results reveal a positive correlation between a company's green product innovation and investor enthusiasm, supporting H2. However, H3 was not supported, as there was no correlation between green process innovation and investor enthusiasm. Green product innovation offers a more competitive advantage than green process innovation, helping companies differentiate themselves from competitors and achieve higher valuations. Although green process innovation is crucial for sustainability, it may not offer as much of a competitive edge in the market. Investors in India may have a stronger preference for companies that focus on green product innovation, as most listed firms are commodity-based manufacturing companies that produce and sell raw materials. Finished product manufacturers may enjoy higher profit margins, greater brand recognition and a broader customer base, all of which can contribute to higher valuations and greater investor interest.

Table 3 (Model 5) represents the regression outcomes of the moderating impact of production linked incentives on the relationship between green product innovation and the firm's financial performance. The findings indicate that PLIs have a substantial positive moderating effect on the relationship between green product innovation and the company's financial performance supporting H4. When these incentives are linked with green product innovation, companies are more likely to invest in environmentally sustainable technology and processes, which may reduce production costs and improve financial performance. Implementing more stringent environmental standards by western economies indirectly exerts significant pressure on Indian manufacturing firms to act and upgrade, in order to access those markets. However, achieving sustainability for these industries is an expensive undertaking, and consumers may bear the cost, resulting in high prices compared to international markets, which could potentially harm the financial performance and economy of the country.

Table 3. Results of moderation analysis

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Controls					
Firm size	0.571	0.57	0.584	0.570	0.568
Total asset turnover	0.687*	0.667**	0.677**	0.681**	0.681**
Firm age	0.786*	0.785*	0.782**	0.785**	0.785**
Predictors					
Green process innovation		0.032	0.025	0.031	0.029
Green product innovation		0.115*	0.154*	0.048*	0.048*
Mediators					
Green image			-0.550	-0.113	-0.112
Green PLI			-0.162	-0.157	-0.071**
Green image x Green product innovation				0.117	0.115
Green PLI x Green product innovation					0.021**
R squared	0.809	0.811	0.819	0.821	0.821
Adjusted R squared	0.500	0.496	0.501	0.502	0.496
F-value	2.621***	2.574***	2.578***	2.573***	2.527***
Change in R square	0.809	0.811	0.819	0.821	0.821
Change in F-statistic	2.484***	2.441**	2.446**	2.443**	2.400**
*** p < 0.01 ** p < 0.05 * p < 0.1					

Table 3 (Model 4) presents the regression outcomes of the moderating impacts of green image and green production linked incentives on the association between green product innovation and investor enthusiasm, resulting in the failure of H5. The findings reveal that green image has no significant moderating effect between green product innovation and investor enthusiasm. This outcome can be attributed to various factors, including the nascent stage of green policy adoption among Indian manufacturing firms, higher prices of green products and relatively higher interest rates in India, making borrowing money and investing in green product innovation more expensive for companies. These factors concern investors, as they can weaken the company's financial performance, ultimately impacting investors' returns.

5. Discussions and conclusions

This study employed the content analysis method to collect data on listed firms in India, revealing that green process innovation positively impacts green product innovation. Green process innovation and green product innovation can be viewed as two categories of financial resources. Adopting these two complementary innovations can provide tremendous competitive advantages for firms that apply them. As green process innovation is process-oriented and green product innovation is product-oriented, implementing both innovations can substantially benefit companies.

According to institutional theory and stakeholder theory, green innovation strategies can help firms gain the trust and support of external institutions and key stakeholders, by considering external parties' interests beyond just economic goals (Alonso-Martínez *et al.*, 2019). Additionally, our findings suggest that green product innovation positively affects investor enthusiasm, while green process innovation fails to do so. One of the main reasons for this could be the macroeconomic factors in the country that make it challenging and costly for companies to obtain loans for green technological innovations, as evidenced by Lukitaruna and Sedianingsih (2018). Companies need help to focus on green processes and product innovation. Although green process innovation may increase profitability by utilizing resources more efficiently, green product innovation generates new revenue streams, making this technological advancement more attractive to investors and thus positively impacting investor enthusiasm. Furthermore, our study reveals that green production linked incentives are a significant moderator between green product innovation and the company's financial performance. Recently, India's manufacturing sector has received considerable support from the government for producing green products. This can be attributed to the fact that the country's manufacturing sector comprises a significant percentage of commodity-based black companies, and it is critical to alter this situation to support global environmental objectives and remain competitive on the international market.

Unexpectedly, no empirical evidence supports the moderation effect of green image between green production incentives and investor enthusiasm. This could be because Indian companies have a low share of finished goods manufacturing, and the lack of purchasing power by the majority of the population forces them to prioritize pocket-friendly products over environmentally friendly products.

5.1. Theoretical contribution

This study makes two theoretical contributions. Firstly, it provides a foundation for further research on the relationship between green technological advancements and financial metrics in Indian manufacturing. In particular, the study examines the impact of green processes and product innovation on financial performance and investor enthusiasm, as well as the moderating effects of green image and green production incentives. By exploring the interplay between these different types of green strategies, the study helps fill the literature gap.

Secondly, the study's theoretical and empirical analysis framework sheds light on how a firm's green image and green subsidies interact with green product innovation to influence financial performance and investor enthusiasm. The findings suggest that the external environment for green product innovation remains uncertain,

and companies still need to succeed in motivating consumers to purchase their more expensive green products. However, production linked incentives have effectively encouraged firms to adopt green production practices.

Additionally, the study highlights the significant impact of the purchasing power of the Indian population on the results obtained. It also emphasizes the role of macroeconomic factors such as interest rates in shaping the adoption of sustainable practices among Indian manufacturing firms. Overall, this study contributes to a better understanding of the relationship between green technological advancements and financial parameters and the moderating effects of green image and incentives in the context of Indian manufacturing.

5.2. Managerial implications

The present study has managerial implications relevant to the Indian manufacturing industry, particularly given that India ratified the Paris Agreement in August 2022. Firstly, there is increasing international pressure for companies to reduce emissions and become more environmentally friendly, making it crucial for companies to focus on both green product innovation and green image. Moreover, green process innovation can act as a catalyst for green product innovation, and companies facing financial constraints can prioritize the former to promote the latter. Secondly, the government and firms must promote sustainability awareness to encourage companies to benefit from a green image. This will increase consumers' willingness to pay for green products and enable companies to enhance their market share. However, the spending power of major consumers can pose a significant obstacle to this approach. Therefore, companies catering to consumers with high purchasing power should focus on green products and process innovation. In contrast, those catering to consumers with lower purchasing power may focus on either green products or process innovation, depending on their economic and operational factors. Thirdly, green product innovation can stimulate investor enthusiasm (as indicated by the PB ratio) and indirectly impact the cost of debt by signalling the company's financial strength and growth potential to investors and lenders. This can lead to a lower risk perception, resulting in more favourable lending terms or lower investment returns. Consequently, the additional funds may be utilized for other sustainability initiatives.

5.3. Limitations and further research

Although this study contributes significantly to understanding green technological advancements in the Indian manufacturing industry, some limitations must be acknowledged. Firstly, the measurements of green process innovation, product innovation and green image were solely based on the information in the firm's corporate social responsibility reports and website. To enhance the exploration of the dynamic relationship between green technology innovation, financial performance and investor enthusiasm, additional measures could be considered, and data collected accordingly. Secondly, the conceptual model should include green management innovation, another kind of green innovation. Thirdly, future studies could incorporate other values to measure financial performance and investor enthusiasm, such as Tobin's Q ratio, foreign institutional investment and domestic institutional investment data.

Despite these limitations, our research holds great importance, as cutting down emissions has become a new international norm. The drive to have greener enterprises to protect the Earth is expected to continue.

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