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Unveiling the impact of green innovation on organizational performance: An empirical study on FMCG sector in Bangladesh

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Abstract
Purpose: This study aims to examine how green innovation affects organizational performance in Bangladesh's fast-moving consumer goods (FMCG) industry. It explores the effects of green product innovation (GPDI) and green process innovation (GPCI) on the financial and non-financial performance of the organizations.
Methodology/approach: A quantitative research design was adopted, using a structured questionnaire to collect data from 151 employees working in FMCG companies in Dhaka. Data were analyzed using SPSS through descriptive statistic, reliability analysis, correlation analysis and multiple regression analysis.
Results/findings: Multiple regression analysis revealed that both types of green innovation had significant positive relationships with organizational performance metrics. GPDI was found to positively impact financial and non-financial performance. Similarly, GPCI has positive effects on financial and non-financial performance.
Conclusion: The study concludes that implementing green innovation strategies is crucial for achieving sustainable competitive advantage in the FMCG sector. Integrating environmental practices in product design and production processes enhances both economic and social dimensions of organizational success.
Limitations: The study is limited to only FMCG sector in Bangladesh and also include two dimensions such as green – product and process – innovations. Moreover, it relies solely on quantitative methods, rather than qualitative investigation.
Contribution: This study contributes to the existing body of knowledge by empirically validating the Resource-Based View (RBV) theory in explaining how green product and process innovations enhance both financial and non-financial organizational performance. It provides valuable insights for policymakers to integrate eco-friendly strategies that promote long-term organizational resilience in the FMCG sector of Bangladesh.

Keywords: *Bangladesh, FMCG Sector, Green Innovation, Green Product Innovation, Green Process Innovation, Organizational Performance*

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1. Introduction

Bangladesh's fast-moving consumer goods (FMCG) industry has grown remarkably over the last several years, fueled by demographic shifts, economic expansion, and evolving consumer preferences (Baker & Friel, 2016). The FMCG sector is one of the most vibrant areas of the national economy and contributes significantly to the nation's GDP (Hossain, Polas, Rahman, Islam, & Jamadar, 2020).

Factors such as rising disposable income, rapid urbanization, and increased consumer awareness have significantly shaped the competitive landscape of this sector (Baker & Friel, 2016; Dahiya & Kumar, 2017). FMCG products, which include food and beverages, personal care, over-the-counter medications, household items, and toiletries, are characterized by low unit value, high consumption frequency, and short shelf life (Berumen, Fischer, & Baumers, 2023). The accessibility and essential nature of these goods ensure consistent demand across all socioeconomic groups in India.

The structure of the FMCG sector in Bangladesh can be categorized into three major segments: food and beverages, personal care, and household care (Khayer, Rahul, & Chakraborty, 2023). Its profitability is driven by low capital requirements, a broad customer base, well-established distribution networks and efficient manufacturing processes (Patil, 2016). However, with increased environmental awareness and a global emphasis on sustainability, FMCG firms are now urged to reconsider traditional production and operational models in favor of more environmentally sustainable practices.

Green innovation (GI) has become a crucial strategic method for companies seeking to strike a balance between environmental stewardship and economic performance (Sheng, Ding, & Yang, 2024). These include eco-friendly product designs, waste reduction, recycling initiatives and pollution control measures (Li et al., 2017). Increasingly, organizations are adopting green innovation not only in response to regulatory pressures but also as a means to gain competitive advantage, improve brand image, and drive long-term profitability (Fernando, Jabbour, & Wah, 2019).

Incorporating green innovation into core business strategies is particularly relevant in the FMCG sector, where production processes and packaging practices have substantial environmental impacts. Studies indicate that firms engaging in green innovation are more likely to experience enhanced financial outcomes, operational efficiencies, and improved stakeholder relations (Guoyou, Saixing, Chiming, Haitao, & Hailiang, 2013). Accordingly, assessing the relationship between green innovation and organizational performance is essential for understanding the strategic value of sustainability in emerging markets, such as Bangladesh.

Organizational performance, both financial and non-financial, serves as a key indicator of a firm's ability to implement and benefit from strategic initiatives, including those related to environmental sustainability. Financial performance encompasses profitability, revenue growth, and cost efficiency, while non-financial performance includes operational effectiveness, customer satisfaction, and corporate reputation (Smriti & Das, 2018; Zehir, Yıldız, Köle, & Başar, 2016). High levels of organizational performance are critical for sustaining competitive advantage, particularly in dynamic and resource-constrained business environments (Obeidat, 2016).

While studies have examined green innovation in various contexts, research on its impact specifically within Bangladesh's FMCG sector is limited. This study aims to address this gap by investigating how green product innovation and green process innovation influence the financial and non-financial performance of FMCG companies in Bangladesh. By empirically examining the linkages between green innovation dimensions and performance outcomes, this study provides valuable insights into the strategic importance of sustainability initiatives for emerging market firms.

2. Literature Review

2.1 Green Innovation

The concept of green innovation has garnered attention as industries seek to balance environmental sustainability with economic growth. Green innovation refers to enhancing systems, products, processes, technologies, and management strategies to lessen the potential negative environmental effects of production and operations (X. Chen, Yi, Zhang, & Li, 2018). Numerous scholars have examined the variables influencing green innovation in recent times. Chang (2011) discovered a positive relationship between green innovation and business ethics. Weng, Chen, and Chen (2015) emphasized that pressure from internal and external stakeholders plays a crucial role in influencing green innovation. Moreover, highlighted how sustainable development is facilitated by green innovation, which encourages creativity and creativity. Lastly, Dangelico, Pujari, and Pontrandolfo

(2017) illustrated how green innovation is impacted by organizational environment-oriented competencies. Green innovation includes a spectrum of initiatives to develop environmentally friendly products and processes that reduce environmental impact while enhancing corporate competitiveness. The following subsections elaborate on the specific dimensions of green innovation: green product innovation and green process innovation.

2.1.1 Green Product Innovation

Green product innovation embodies the development of products designed to minimize environmental impact throughout their life cycle. This concept extends to enhancements in product functionality and sustainable practices. Muangmee, Dacko-Pikiewicz, Meekaewkunchorn, Kassakorn, and Khalid (2021) defines green innovation broadly as improvements in product processes that enhance organizational environmental performance. Such product innovations can significantly boost firms' economic, environmental, and social performance. Furthermore, Y.-S. Chen (2008) describes green product innovation as encompassing technologies focused on energy-saving, pollution prevention, and waste recycling, clarifying the critical role these innovations play in corporate environmental management.

Empirical studies have demonstrated the positive effects of green product innovation on overall corporate performance. For instance, Helmi and Widiastuty (2023) assert that successful green product innovations can lead to superior firm performance, emphasizing that businesses leveraging eco-friendly technologies not only optimize resource use but also gain competitive advantage. In a similar vein, (Qiu, Hu, & Wang, 2020) observe that external pressures, such as environmental regulation, stimulate green product innovations, which enhance financial performance more than green process innovations.

2.1.2 Green Process Innovation

Conversely, green process innovation focuses on improving industrial techniques and organizational systems to mitigate adverse environmental effects of production. This innovation is essential for altering operational practices to achieve sustainable goals. As noted by Xu, Cheng, and Zhang (2023), green process innovations frequently involve optimizing production methods to save energy, reduce waste, and manage pollution more effectively. Evidence suggests that these process innovations contribute to environmental sustainability and bolster organizational efficiency, thereby fostering a competitive advantage (S. Chen & Huang, 2024; Y.-S. Chen, Lai, & Wen, 2006).

Cao, Tong, Chen, and Zhang (2022) identify that both green product and process innovations foster positive competitive advantages within firms, emphasizing that companies with strong green innovation capabilities are better positioned to respond to the market demand for sustainability. Further support comes from Yang and Zhu (2022) highlight that green process innovations play a significant role in enhancing environmental performance while simultaneously responding to the broader economic challenges faced by manufacturing industries.

Additionally, the interconnectivity between green products and process innovations is crucial, as firms must typically integrate these efforts to optimize sustainability outcomes. For example, Soewarno, Tjahjadi, and Fithrianti (2019) demonstrated that green innovation strategies positively impact both product and process innovations, mediated by factors such as organizational identity and creativity, further exhibiting the complexity of innovation dynamics.

2.2 Organizational Performance

Organizational performance is a multifaceted concept that encompasses both financial and nonfinancial metrics to evaluate an organization's effectiveness and efficiency. Organizational performance is a central construct in management and business research and is widely recognized as a critical indicator of an organization's success and sustainability, particularly in competitive and dynamic business environments (Mwosi, Eton, Olupot, & Ogwel, 2024; Udodiugwu, 2024). Several definitions emphasize performance-goal alignment. Tomal and Jones Jr (2015) described organizational performance as a comparison between actual output and expected results.

2.2.1 Organizational Financial Performance

Financial performance often serves as a primary measure of organizational performance, including profitability, revenue growth, and cost management. Financial performance is measured using financial indicators such as sales revenue, cost efficiency, business growth, return on equity (ROE), return on assets (ROA), and return on investment (ROI) (Obeidat, Tarhini, Masa'deh, & Aqqad, 2017). These metrics reflect the economic impact of managerial decisions and offer insights into their operational viability.

Other studies suggest several critical factors that influence financial performance. One notable study (Zaidan et al., 2023) examined the effect of organizational contingencies, such as human resource policies and organizational culture, on financial performance. Their findings reveal that effective crisis management and supportive organizational structures lead to enhanced financial outcomes, particularly during times of uncertainty. Similarly, Awan, Sroufe, and Kraslawski (2019) highlight the essential role of information technology competencies in driving financial performance, suggesting that strong IT capabilities enable organizations to innovate and respond effectively to market demands, thus enhancing financial outcomes.

Furthermore, the leadership style within an organization markedly influences its financial performance. Both transformational and transactional leadership styles positively correlate with organizational financial performance and growth (Tong, 2020). These findings align with those of Dahal (2021), who emphasized that effective leadership is instrumental in boosting financial performance through the establishment of performance-driven organizational cultures.

2.2.2 Organizational Non-financial Performance

Non-financial performance encompasses metrics that do not directly relate to financial results but are equally essential for an organization's success. Non-financial performance is measured by factors like customer satisfaction, employee engagement, operational efficiency, innovation, product and service quality, workforce development, and market share (Mbamalu, Chike, Oguanobi, & Egbunike, 2023; Obeidat et al., 2017).

Some studies have demonstrated that non-financial indicators can serve as leading indicators of future financial success. For instance, Ghumiem and Alawi (2022) suggest that organizational commitment significantly impacts non-financial performance, particularly in public sector contexts, where measuring performance extends beyond financial metrics to include employee engagement and service quality. Moreover, nonprofits may derive significant programmatic benefits from strong financial health, thereby indirectly linking financial and non-financial performance measures (M. Kim, 2017). Besides, Broad involvement of employees in decision-making processes can substantially improve an organization's overall performance (Hawlader, Rana, Kalam, & Polas, 2022).

Leadership plays a pivotal role in enhancing non-financial performance. Anning-Dorson (2017) assert that innovative organizational leadership promotes both financial and non-financial performance outcomes by fostering a culture of continuous improvement and adaptability within organizations. Furthermore, Le and Tran (2020) underscore the mediating role of trust in leadership, highlighting its importance in affecting followers' attitudes and behaviors, which in turn enhances non-financial performance metrics such as employee satisfaction and organizational loyalty. Various studies have explored the significance of organizational learning as a non-financial performance driver. The research conducted by Basri et al. (2023) emphasized that harnessing organizational learning can facilitate improvements in both operational capabilities and social performance, thereby ensuring long-term organizational sustainability.

2.3 Green Innovation and Organizational Performance

2.3.1 Green Product Innovation (GPDI) and Organizational Financial Performance (OFP)

The relationship between Green Product Innovation (GPDI) and Organizational Financial Performance (OFP) has gained significant attention in recent academic discourse, with a growing body of evidence pointing to a generally positive correlation, albeit influenced by contextual factors such as firm size.

Green product innovation has been widely recognized as a strategic approach that contributes to environmental sustainability and enhances a firm's financial outcomes. Multiple studies suggest that GPDI contributes to improved sales growth, cost efficiency, and profitability while reducing financial risk and environmental compliance costs (Cheng, Lin, & Yang, 2025; Tariq, Badir, & Chonglerttham, 2019); (Ahmad, Khalil, & Nafees, 2024).

The mechanisms underlying this relationship are complex and are often mediated by factors such as environmental performance, green trust, and corporate legitimacy. For instance, the GPDI improves environmental outcomes, which subsequently enhances financial performance (Sari, 2024). Similarly, consumer trust in a firm's environmental practices, termed green trust, acts as a mediating factor, as does the enhancement of corporate legitimacy through visible green initiatives (Acquah, Essel, Baah, Agyabeng-Mensah, & Afum, 2021; Hang, Sarfraz, Khalid, Ozturk, & Tariq, 2022).

Several moderating variables also influence the GPDI-OFP relationship. Market resource intensity and technological turbulence can amplify the positive effects of the GPDI, while factors such as a firm's green image and digital transformation capabilities further strengthen this link (Maghfuriyah et al., 2024; Tariq et al., 2019; Turkcan, 2025). However, the GPDI outcomes may vary significantly based on geographical and organizational contexts. For example, in countries with weaker environmental regulations or authoritarian regimes, green product strategies tend to show stronger associations with financial performance (J. Kim, Woo, Balven, & Hoetker, 2023). Small and medium-sized enterprises (SMEs) in developing nations may derive greater financial benefits from green process innovations than from green product innovations (Ji, Zhou, Wan, & Lan, 2024).

Additional factors, such as stakeholder interest, management commitment, market demand for green products, and corporate environmental ethics, have been identified as crucial enablers of the GPDI-OFP relationship. Firms responsive to these dynamics are more likely to achieve superior financial results (Ahmad et al., 2024; Kyong-won, Yuxin, & Xuehua, 2024). However, high financial leverage can undermine these benefits, although proactive deleveraging can offset these negative effects (Ai, Luo, & Bu, 2024). Finally, green marketing innovation and a strong innovation orientation enhance the effectiveness of GPDI in improving organizational financial performance (Appiah & Essuman, 2024).

2.3.2 Green Process Innovation (GPCI) and Organizational Financial Performance (OFP)

The relationship between Green Process Innovation (GPCI) and Organizational Financial Performance (OFP) has attracted considerable scholarly attention in recent years, largely because of growing environmental concerns and the push toward sustainable business practices. A substantial body of research suggests that GPCI positively influences OFP by enhancing operational efficiency, reducing production costs, and fostering opportunities in emerging green markets (Huang & Li, 2017; Wang & Ahmad, 2024; Xie, Huo, Qi, & Zhu, 2016). The integration of environmentally sustainable processes often leads to resource efficiency and waste reduction, directly contributing to profitability (Cheng et al., 2025). Additionally, GPCI helps organizations achieve competitive advantage as environmentally responsible practices increasingly resonate with eco-conscious consumers and investors (Ahmad et al., 2024; Qing, Chun, Dagestani, & Li, 2022).

Several studies have highlighted the mediating role of environmental performance in the GPCI-OFP relationship. Green process innovations typically lead to improved environmental performance, such as reduced emissions or pollution control, which, in turn, supports financial performance improvements (Bibi & Narsa, 2022; Sari, 2024). Investments in pollution prevention technologies contribute to environmental compliance and offer long-term cost savings and performance benefits (Cheng et al., 2025).

Several moderating variables also influence the GPCI-OFP relationship in the study. For example, firms with greater absorptive capacity are better positioned to harness the potential of the GPCI for financial gain (Qing et al., 2022; Xie et al., 2016). Furthermore, top management commitment has been identified as a significant driver of successful GPCI implementation (Ahmad et al., 2024; Kyong-won et al., 2024). In addition, a company's green image and environmental orientation mediate the financial impact of

the GPCI. Organizations with strong environmental reputations often experience enhanced customer loyalty and competitive standing, which translates into superior financial performance (Maghfuriyah et al., 2024; Zehir & Ozgul, 2020).

Contextual variables, such as industry type, firm size, and geographic location, further shape the GPCI-OFP dynamic. For instance, in the manufacturing sector, GPCI often enhances financial performance by increasing production efficiency and reducing production costs (Huang & Li, 2017; Wang & Ahmad, 2024). Geographic differences, especially between emerging and developed economies, influence the effect of the GPCI on financial outcomes. In emerging economies such as China and Indonesia, the impact of the GPCI on financial performance is often influenced by government policies and subsidies (Sri & Susi, 2024; Xie et al., 2016), whereas in developed economies, firms may be more driven by market demand and consumer preferences for green products and processes (Kyong-won et al., 2024).

2.3.3 Green Product Innovation (GPDI) and Organizational Non-financial Performance (ONP)

The relationship between Green Product Innovation (GPDI) and Organizational Non-financial Performance (ONP) is both complex and significant. The GPDI addresses environmental concerns while influencing organizational culture and consumer perceptions, which in turn affects non-financial outcomes such as stakeholder satisfaction and brand reputation (Puspajati & Ali, 2025). Research indicates that a strong emphasis on the GPDI can lead to improved non-financial performance metrics. For instance, Weng et al. (2015) showed that organizations engaging in green innovation typically respond to stakeholder pressures and regulations, subsequently leveraging it as a competitive advantage, leading to enhanced organizational performance across both financial and non-financial dimensions.

Moreover, organizational culture was identified as a mediating factor in the relationship between the GPDI and ONP. Organizational culture significantly enhances the impact of product innovation on performance, establishing it as a vital element that strengthens the link between GPDI and ONP (Anning-Dorson, 2017). Evidence suggests that the GPDI fosters enhanced capabilities within organizations, leading to superior green innovation performance and market competitiveness. Zhang and Liu (2023) found that corporate sustainability efforts linked to Environmental, Social, and Governance (ESG) performance facilitate green innovation initiatives, which ultimately enhance non-financial metrics such as public perception and customer loyalty.

2.3.4 Green Process Innovation (GPCI) and Organizational Non-financial Performance (ONP)

The extant literature demonstrates that green process innovation (GPCI) can positively influence organizational non-financial performance (ONP) by enhancing intangible assets such as legitimacy, reputation, and stakeholder trust. For example, Acquah et al. (2021) report that in the Ghanaian manufacturing context, green process innovation significantly improves organizational legitimacy, an important non-financial outcome, although its influence on financial performance is less pronounced.

Complementing this perspective, Maletič, Gomišček, and Maletič (2021) revealed that sustainability innovation practices, including process-oriented innovations, are significantly associated with better non-financial performance outcomes. These studies emphasize that while financial metrics, such as cost savings or profitability, are critical, organizations that pursue green process innovations often realize improvements in aspects such as brand reputation, regulatory legitimacy, and overall stakeholder trust.

Furthermore, the synthesis of these studies suggests that adopting green process innovation involves a broader reorientation towards sustainable operational practices. These innovations enhance production efficiency and create value in terms of corporate image and social legitimacy (Acquah et al., 2021). Thus, investing in the GPCI may yield dividends that are predominantly non-financial, further encouraging firms to integrate these practices into their broader sustainability strategies (Maletič et al., 2021).

2.4 Underlying Theory

The Resource-Based View (RBV) of the firm serves as the underlying theoretical foundation for this study, offering a robust lens through which to explore the relationship between green innovation and

organizational performance. Originally, the Resource-Based View (RBV) theory was developed by Wernerfelt (1984) and further expanded by (J. Barney, 1991). RBV asserts that a firm's sustainable competitive advantage stems from its internal resources and capabilities that are valuable, rare, inimitable, and non-substitutable (J. Barney, 1991; J. B. Barney, Ketchen Jr, & Wright, 2011).

Within the context of this study, green innovation, comprising both green product and process innovations, can be conceptualized as a strategic organizational capability. These innovations respond to growing environmental regulations and societal expectations and create internal competencies that are difficult for competitors to replicate. When firms develop environmentally responsible products and processes, they accumulate unique knowledge, technological capabilities, and operational efficiencies that can drive both financial and nonfinancial performance outcomes.

The RBV suggests that organizations that embed sustainability into their innovation practices—by investing in green technologies, eco-friendly product design, waste reduction processes, and energy-efficient operations— effectively build strategic assets. These capabilities allow firms to meet consumer expectations, enhance brand reputation, enter new markets, and improve operational efficiency, all of which can translate into superior organizational performance.

In the context of Bangladesh's FMCG sector, where environmental concerns are becoming increasingly salient and regulatory pressures are tightening, the ability to successfully implement green innovation represents a valuable and differentiating capability. Therefore, this study posits that green innovation acts as a resource-based capability that can enhance both the financial (e.g., profitability, return on assets, sales growth) and non-financial (e.g., customer satisfaction, brand image, employee morale) performance of FMCG firms.

2.5 Development of Hypotheses and Conceptual Framework

Based on the above discussion and literature review, the following hypotheses are proposed:

H1: Green Product Innovation (GPDI) has a positive and significant effect on Organizational Financial Performance (OFP).

H2: Green Process Innovation (GPCI) has a positive and significant effect on Organizational Financial Performance (OFP).

H3: Green Product Innovation (GPDI) has a positive and significant effect on Organizational Non-financial Performance (ONP).

H4: Green Process Innovation (GPCI) has a positive and significant effect on Organizational Non-financial Performance (ONP).

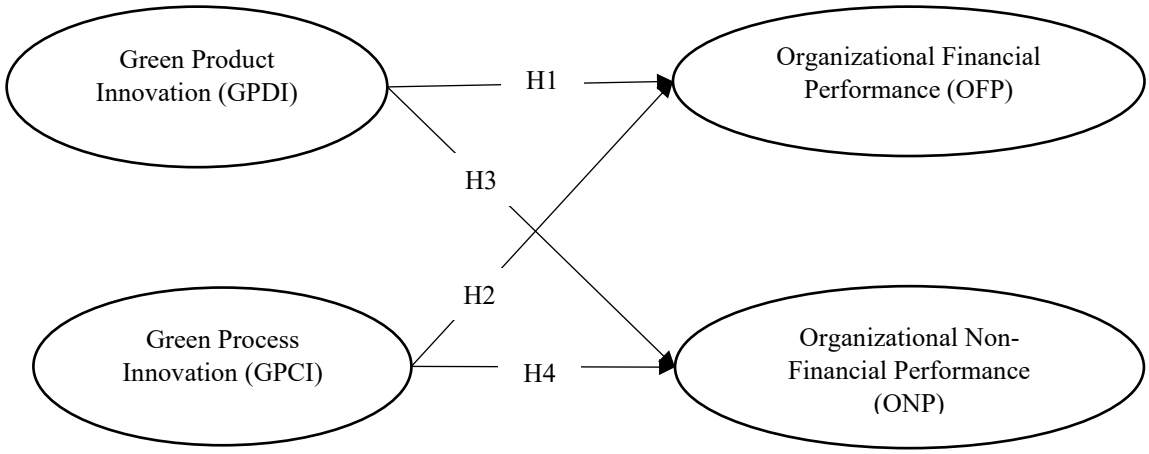

Figure 1. Conceptual Framework

3. Research Methodology

3.1 Research Design and Sampling

The relationship between green innovation and organizational performance was investigated using quantitative research methodology. The goal of the research design was to gather numerical data and use statistical analysis to test the hypotheses. A structured questionnaire was used to gather information from the executives, managers, and officials working in the different organizations of the FMCG sector (such as the Food & Beverage, Cosmetics & Personal Care, and Household Care sectors) in Bangladesh. We took approximately four months, from September 2024 to December 2024, to collect data. Stratified random sampling was used to collect data.

3.2 Data Collection and Analysis

To collect data, the researchers used a Google form, and the link was distributed among the employees of the FMCG sector. A total of 151 employees completed the questionnaire. The primary focus of this study was Dhaka, Bangladesh's largest metropolis. The questionnaire consisted of 17 items derived from previous research and self-administered tests.

The first nine questions (Part A, 1-9) asked about the name of the organization, name of the department, designation, gender, age, marital status, educational level, length of service in the current organization, and length of total service life. The dependent and independent components were identified based on the remaining questions (Part B). Green innovation was the independent factor, as determined by green product and green process innovation, while organizational performance, as determined by organizational financial and non-financial performance, was the dependent variable. Responses were scored on a 5-point Likert scale, where 1 denoted strong disagreement and 5 denoted strong agreement. After data collection, the researchers coded the data and entered them into statistical analysis programs such as SPSS. Numerous statistical techniques, including multiple regression, reliability, and correlation analyses and descriptive statistics, were used to examine the findings.

3.3 Measurement

3.3.1 Green Product Innovation (GPDI)

Four items were adopted from Y.-S. Chen et al. (2006) were used to measure the relationship between green product innovation and organizational financial & non-financial performance: (i) The organization selects materials for their products which minimize environmental pollution effects; (ii) The organization selects products materials which minimize their energy and resource requirements; (iii) The organization selects the minimal necessary materials to build their products; (iv) The organization must carefully examine how easily their products can be recycled and decomposed and reused – for conducting the product development or design.

3.3.2 Green Process Innovation (GPCI)

Four elements were identified by Y.-S. Chen et al. (2006) were utilized to assess the link between green process innovation and both financial and non-financial organizational performance: (i) The organization's manufacturing process efficiently minimizes the release of harmful substances or waste; (ii) The organization's manufacturing process efficiently recycles waste and emissions that can be processed and reused; (iii) The organization's manufacturing process efficiently decreases the use of water, electricity, coal, or oil; (iv) The organization's manufacturing process efficiently reduces the consumption of raw materials.

3.3.3 Organizational Financial Performance (OFP)

To assess the link between green product and green process innovation and a company's financial performance, five items were adapted from Lee, Azmi, Hanaysha, Alshurideh, and Alzoubi (2022) and De Vass, Shee, and Miah (2018): (i) The organization consistently enhances its productivity, including assets, operating costs, and labor expenses; (ii) The organization consistently boosts sales of its current products; (iii) The organization consistently improves its financial metrics, such as return on assets, return on investment, and return on equity; (iv) The organization consistently adopts cost-saving measures in the production process, focusing on raw materials, energy, water, human resources, machinery, and equipment; (v) The organization consistently shortens the cash-to-cash cycle time.

3.3.4 Organizational Non-Financial Performance (ONP)

Five items, as adopted from Lee et al. (2022) and De Vass et al. (2018), were utilized to assess the link between green product and green process innovation and an organization's non-financial performance: (i) The organization consistently fosters strong and ongoing relationships with customers by enhancing customer satisfaction and minimizing customer complaints; (ii) the organization consistently acquires accurate insights into customer purchasing behaviors; (iii) the organization consistently boosts employee satisfaction, including their welfare, such as health and safety; (iv) the organization consistently decreases energy consumption; (v) the organization consistently enhances the return/re-use/recycle process.

4 Result and Discussion

4.1 Demographic Analysis

To ensure the representativeness of the data, 151 employees were selected as a sample from the FMCG sector of Bangladesh. The demographic distribution of the respondents, including variables such as gender, age, marital status, educational level, length of current service, and length of total service, are presented in Table 1.

Table 1. Demographic Profile of Respondents

Demographical Information	Frequency	Percent
Gender		
Male	134	**88.7**
Female	17	11.3
Age		
21 – 30 Years	103	**68.2**
31 – 40 Years	42	27.8
41 – 50 Years	6	4.0
Marital Status		
Married	76	**50.3**
Unmarried	75	49.7
Educational Level		
Below Undergraduate	27	17.9
Undergraduate / Honors	62	**41.1**
Postgraduate / Masters	54	35.8
Others	8	5.3
Length of Current Service		
Below 01 Year	32	21.2
01 – 05 Years	78	**51.7**
06 – 10 Years	25	16.6
11 – 15 Years	12	7.9
16 – 20 Years	3	2.0
Above 25 Years	1	.7
Length of Total Service		
Below 01 Year	15	9.9
01 – 05 Years	65	43.0
06 – 10 Years	37	**24.5**
11 – 15 Years	24	15.9
16 – 20 Years	5	3.3
21 – 25 Years	2	1.3
Above 25 Years	3	2.0

Bold values are the highest percentage values.

The majority of respondents were male (88.7%, *n* = 134), and the rest were female (11.3 %, n = 17). Most respondents (68.2%, *n* = 103) were aged 21 – 30 years, followed by the 31 – 40 years age group (27.8%, *n* = 42). The proportion of married and unmarried respondents was nearly equal, with 50.3% (*n* = 76) being married and 49.7% (*n* = 75) unmarried. From the education perspective, the highest proportion of respondents held an undergraduate or honors degree (41.1%, *n* = 62), followed by 35.8% (*n* = 54) with a postgraduate or master's degree, 17.9% (*n* = 27) with below undergraduate level, and the rest, 5.3% (*n* = 8) with other educational qualifications.

Over half of the respondents (51.7%, *n* = 78) had been in their current service for 1 – 5 years, followed by 21.2% (*n* = 32) who had served for less than one year, and 16.6% (*n* = 25) who had served for 6 – 10 years among the smaller proportions. Furthermore, the majority (43.0%, *n* = 65) reported a total service length of 1 – 5 years, followed by 24.5% (*n* = 37) with 6 – 10 years of total service, and 15.9% (*n* = 24) who had served for 11–15 years of total service length among smaller proportions.

4.2 Descriptive Analysis

Descriptive statistics, including the mean and standard deviation (SD), were used to summarize the results of the constructs and variables (such as GPDI, GPCI, OFP, and ONP), which are shown in **Table 2**.

Table 2. Descriptive Analysis of Constructs and Variables

Items	Constructs	Source	Mean	SD	Variable	Mean	SD
GPDI 1	The organization selects materials for their products that result in the minimal pollution during the product design or development process.	(Y.-S. Chen et al., 2006)	3.62	1.25	**Green Product Innovation (GPDI)**	3.67	.89
GPDI 2	The organization selects materials for their products that require minimal energy and resources during the development or design process.		3.78	1.07			
GPDI 3	The organization utilizes the minimum number of materials necessary to create their products during the development or design process.		3.53	1.09			
GPDI 4	The organization would carefully consider whether their products are designed to be easily recycled, reused, and decomposed during the product development or design process.		3.74	1.12			
GPCI 1	The organization's production method efficiently minimizes the release of harmful substances or waste.	(Y.-S. Chen et al., 2006)	3.69	1.14	**Green Process Innovation (GPCI)**	3.71	.87
GPCI 2	The organization's production process efficiently recycles waste and emissions that can be processed and reused.		3.72	1.10			

GPCI 3	The organization's production method efficiently minimizes the use of water, electricity, coal, and oil.		3.81	1.01			
GPCI 4	The organization's production method efficiently minimizes the consumption of raw materials.		3.62	1.11			
OFP 1	The organization continually boosts its productivity by optimizing resources such as assets, operating expenses, and labor expenses.	(De Vass et al., 2018; Lee et al., 2022)	4.03	.99	**Organizational Financial Performance (OFP)**	3.93	.78
OFP 2	The organization always improves the sales of existing products.		4.04	.99			
OFP 3	The organization always improves the sales of existing products.		3.97	.91			
OFP 4	The organization consistently adopts a cost-saving strategy throughout the production process, focusing on raw materials, energy, water, personnel, machinery, and equipment.		3.85	1.04			
OFP 5	The organization always reduces the cash-to-cash cycle time.		3.75	.97			
ONP 1	The organization consistently fosters strong and lasting relationships with its customers by enhancing their satisfaction and decreasing the number of complaints.	(De Vass et al., 2018; Lee et al., 2022)	4.07	1.09	Organizational Non-Financial Performance (ONP)	3.92	.81
ONP 2	The organization consistently acquires accurate insights into customer purchasing behaviors.		3.96	.89			
ONP 3	The organization consistently enhances employee satisfaction, focusing on aspects like health and safety.		3.83	1.19			
ONP 4	The organization always reduces the use of energy.		3.85	.92			
ONP 5	The organization always improves the return/re-use/recycle process.		3.87	.98			

Green Product Innovation (GPDI) had a mean score of 3.67 and a standard deviation (SD) of 0.89, indicating a moderately high agreement among respondents that the organization emphasizes environmentally friendly product design. GPDI 2 has the highest mean (3.78, SD = 1.07), suggesting that organizations focus most on selecting materials that consume minimal energy and resources. GPDI

3 had the lowest mean (3.53, SD = 1.09), indicating that minimizing the quantity of materials used in products is relatively less prioritized.

Green Process Innovation (GPCI) had a mean score of 3.71 and a standard deviation of 0.87, reflecting a slightly higher adoption of environmentally friendly manufacturing processes compared to GPDI. GPCI 3 has the highest mean (3.81, SD = 1.01), highlighting a focus on reducing resource consumption such as water, electricity, and fuel. GPCI 4 has the lowest mean (3.62, SD = 1.11), suggesting that reducing the use of raw materials receives less emphasis.

Organizational Financial Performance (OFP) has the highest mean (3.93, SD = 0.78), signifying strong financial performance outcomes. OFP 2 achieved the highest mean score (4.04, SD = 0.99), reflecting significant improvements in product sales. OFP 5 had the lowest mean (3.75, SD = 0.97), indicating that reducing the cash-to-cash cycle time could be further optimized.

Organizational Non-Financial Performance (ONP) had a mean score of 3.92 (SD = 0.81), suggesting high but slightly variable performance in non-financial aspects. ONP 1 recorded the highest mean (4.07, SD = 1.09), indicating a strong emphasis on customer satisfaction and reducing complaints. ONP 3 had the lowest mean (3.83, SD = 1.19), suggesting a relatively lower focus on improving employee satisfaction.

4.3 Reliability Analysis

Data reliability was assessed using Cronbach's alpha values, which evaluate the internal consistency of a group of items within a variable. These values reflect the effectiveness with which the items capture the same underlying concept. Higher values represent greater reliability.

Table 3. Cronbach's alpha values

Variables	Cronbach's alpha	Decision
Green Product Innovation (GPDI)	.796	Good level of internal consistency
Green Process Innovation (GPCI)	.811	Good level of internal consistency
Organizational Financial Performance (OFP)	.855	Very good level of internal consistency
Organizational Non-Financial Performance (ONP)	.849	Very good level of internal consistency

Hair, Black, Babin, and Anderson (2019) suggested that Cronbach's alpha values above 0.60 are acceptable. In this analysis, all variables exceeded this benchmark. These results suggest that the constructs employed in this study were sufficiently reliable for further examination.

4.4 Hypothesis Testing

4.4.1 Correlation Analysis

A correlation analysis was performed to explore the connections between the GPDI, GPCI, OFP, and ONP. The correlation coefficients, which reveal the strength and significance of these relationships, are presented in Table 4.

Table 4. Correlation matrix

	GPDI	GPCI	OFP	ONP
GPDI	1			
GPCI	.750**	1		
OFP	.602**	.646**	1	
ONP	.654**	.668**	.823**	1

**. Correlation is significant at the 0.01 level (2-tailed).

The GPDI demonstrated a **moderate positive correlation** with OFP (r=0.602, p<0.01). Additionally, the GPDI exhibited a **strong positive correlation** with the ONP (r=0.654, p<0.01). Moreover, the GPCI showed a **moderate positive correlation** with OFP (r=0.646, p<0.01). Similarly, the GPCI displayed a **strong positive correlation** with ONP (r=0.668, p<0.01).

A **very strong positive correlation** was observed between OFP and ONP (r=0.823, p<0.01), indicating that improvements in financial performance are closely tied to non-financial outcomes. However, GPDI and GPCI were strongly positively **correlated** (r=0.750, p<0.01), suggesting that organizations implementing green product innovations are likely to engage in green process innovations. In summary, the findings indicate that both GPDI and GPCI have significantly positive relationships with organizational financial and non-financial performance metrics.

4.4.2 Multicollinearity Test

To evaluate the potential problem of multicollinearity among the independent variables, the Variance Inflation Factor (VIF) and tolerance levels were examined according to the guidelines set by Hair et al. (2019). A VIF score under 5 and a tolerance level exceeding 0.10 suggest an acceptable degree of collinearity, ensuring that the regression model estimates remain dependable and are not significantly influenced by multicollinearity.

Table 5. Results of multicollinearity test

Independent Variable	Collinearity Statistics	
	Tolerance	VIF
GPDI	.438	2.283
GPCI	.438	2.283

Dependent Variable: OFP or ONP

The collinearity statistics for the independent variables, Green Product Innovation (GPDI) and Green Process Innovation (GPCI), are presented in Table 5. Both variables exhibited a tolerance value of 0.438 and a VIF of 2.283, which were well within the recommended thresholds. The findings indicate that multicollinearity does not pose a problem in this study. The findings from the multicollinearity test confirm that the independent variables, GPDI and GPCI, are appropriate for inclusion in the regression model that predicts the dependent variable, OFP or ONP.

4.4.3 Multiple Regressions Analysis

The hypotheses developed were evaluated using regression analysis. Three tables were incorporated to facilitate this analysis. **Table 6** presents a model summary with three key figures: R, R Square, and Adjusted R Square. **Table 7** displays the ANOVA results, including the F values and significance levels. **Table 8** illustrates the outcomes of the multiple regression between the independent variables and operational performance, featuring the p-value, regression coefficients (Beta), and t-statistics.

4.4.3.1 Model Summary

Table 6 displays the summary results of multiple regression analyses for two dependent variables: OFP and ONP, with GPCI and GPDI serving as predictors.

Table 6. Model Summary

Dependent Variable	R	R Square	Adjusted R Square	Std. Error of the Estimate
OFP	.670	.449	.442	.58364
ONP	.707	.500	.493	.57444

Predictors: (Constant), GPCI, GPDI

Organizational Financial Performance (OFP): The model yielded an R value of 0.670, indicating a moderate-to-strong linear relationship between the predictors (GPCI and GPDI) and dependent variable (OFP). The R Square value of 0.449 implies that approximately 44.9% of the variance in OFP is

explained by the predictors. The adjusted R Square value of 0.442 accounts for the number of predictors in the model, confirming a slightly reduced but still substantial explanatory power.

Organizational Non-Financial Performance (ONP): The model achieved an R value of 0.707, suggesting a stronger linear relationship between the predictors (GPCI and GPDI) and ONP than that of OFP. The R Square value of 0.500 indicates that 50.0% of the variance in ONP is explained by the GPCI and GPDI. The adjusted R Square value of 0.493 reflects the model's robustness after accounting for the predictors, showing slightly diminished but meaningful explanatory power.

4.4.3.2 ANOVA

Table 7 presents the ANOVA outcomes for the multiple regression analyses concerning the two dependent variables: OFP and ONP. These analyses evaluated the overall significance of the regression models, with the GPCI and GPDI serving as predictors.

Table 7. ANOVA

Dependent Variable		Sum of Squares	df	Mean Square	F	Sig.
OFP	Regression	41.075	2	20.537	60.291	.000
	Residual	50.415	148	.341		
	Total	91.489	150			
ONP	Regression	48.798	2	24.399	73.942	.000
	Residual	48.837	148	.330		
	Total	97.635	150			

Predictors: (Constant), GPCI, GPDI

Organizational Financial Performance (OFP): The F-statistic for the model is 60.291, which is statistically significant at $p < 0.001$ (Sig. = 0.000). This indicates that the regression model, which includes the GPCI and GPDI, explains a significant proportion of the variance in OFP.

Organizational Non-Financial Performance (ONP): The F-statistic for the model is 73.942, which is also statistically significant at $p < 0.001$ (Sig. = 0.000). This confirms that the GPCI and GPDI significantly explained the variance in ONP.

The ANOVA results demonstrate that both regression models are statistically significant, indicating that the GPCI and GPDI collectively provide a strong and meaningful contribution to explaining the variability in both the OFP and ONP.

4.4.3.3 Coefficients

Table 8 examines the proposed connections between the independent variables, GPDI and GPCI, and the dependent variables, OFP and ONP. To assess the proposed hypotheses, regression coefficients, t-values, and significance levels were utilized.

Table 8. Coefficients

Dependent Variable		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Decision
		B	Std. Error	Beta			
OFP	(Constant)	1.588	.218		7.275	.000	
	GPDI	.235	.081	.269	2.913	.004	Supported **H1**
	GPCI	.398	.083	.445	4.823	.000	Supported **H2**
ONP	(Constant)	1.365	.215		6.353	.000	
	GPDI	.315	.079	.348	3.966	.000	Supported **H3**
	GPCI	.377	.081	.407	4.635	.000	Supported **H4**

H1: GPDI has a positive and significant effect on OFP.
The unstandardized coefficient for GPDI is **B = 0.235**, indicating that for each one-unit increase in GPDI, OFP is expected to increase by **0.235 units**, with GPCI held constant. The t-statistic for GPDI is **2.913**, with a corresponding **p-value of 0.004**. As the p-value was less than 0.05, this relationship was statistically significant. These results support **H1**, confirming that the GPDI has a significant positive effect on OFP.

H2: GPCI has a positive and significant effect on OFP.
The unstandardized coefficient for the GPCI is **B = 0.398**, suggesting that for each one-unit increase in the GPCI, the OFP is predicted to increase by **0.398 units**, holding the GPDI constant. The t-statistic for GPCI is **4.823**, with a corresponding **p-value of 0.000**. This highly significant p-value ($p < 0.001$) demonstrates a robust positive relationship. These findings support **H2**, confirming that the GPCI has a significant positive effect on OFP.

H3: GPDI has a positive and significant effect on ONP.
The unstandardized coefficient for GPDI is **B = 0.315**, indicating that for each one-unit increase in GPDI, ONP is expected to increase by **0.315 units**, with GPCI held constant. The t-statistic for GPDI is **3.966**, with a corresponding **p-value of 0.000**. As the p-value is less than 0.001, this relationship is thus statistically significant. These results support **H3**, confirming that the GPDI has a significant positive effect on ONP.

H4: GPCI has a positive and significant effect on ONP.
The unstandardized coefficient for the GPCI is **B = 0.377**, suggesting that for each one-unit increase in the GPCI, ONP is predicted to increase by **0.377 units**, holding the GPDI constant. The t-statistic for the GPCI is **4.635**, with a corresponding **p-value of 0.000**. This highly significant p-value ($p < 0.001$) indicates a robust positive relationship. These findings support **H4**, confirming that the GPCI has a significant positive effect on ONP.

4.5 Discussion
An empirical investigation into the effects of green innovation on organizational performance in Bangladesh's Fast-Moving Consumer Goods (FMCG) industry highlights notable connections between green product innovation (GPDI), green process innovation (GPCI), and both financial and non-financial performance metrics. The results validate the proposed hypotheses, demonstrating that the GPDI and GPCI positively impact both organizational financial performance (OFP) and organizational non-financial performance (ONP). The positive relationship between GPDI and OFP is substantiated by the unstandardized coefficient of 0.235, suggesting that an increase in GPDI correlates with an increase in OFP, while holding GPCI constant.

This is consistent with earlier studies suggesting that green innovations can boost financial performance by enhancing operational efficiency and increasing market competitiveness (Deb, Rahman, & Rahman, 2023). The significance of this relationship, with a p-value of 0.004, underscores the importance of green product initiatives in driving financial success in the FMCG industry. Similarly, the stronger impact of GPCI on OFP, evidenced by a coefficient of 0.398 and a p-value of 0.000, suggests that process innovation is crucial for financial performance. This finding is consistent with studies that emphasize the role of process innovations in enhancing operational efficiencies and reducing costs, thereby improving financial outcomes (Dai, Siddik, & Tian, 2022).

In terms of non-financial performance, both GPDI and GPCI demonstrate significant positive relationships with ONP. The coefficients of 0.315 for GPDI and 0.377 for GPCI indicate that these innovations contribute to financial metrics and enhance broader organizational performance indicators, such as customer satisfaction, brand reputation, and environmental sustainability. This is supported by literature that highlights the multifaceted benefits of green innovations, which include improved stakeholder relations and enhanced corporate social responsibility (CSR) profiles (Dai et al., 2022; Zheng, Siddik, Masukujjaman, Fatema, & Alam, 2021). The statistical significance of these

relationships (p = 0.000) further reinforces the notion that green innovation is integral to achieving comprehensive organizational performance. The findings of this study resonate with the broader discourse on the role of green innovation in fostering sustainable business practices.

Evidence suggests that organizations in the FMCG sector that prioritize green innovations are likely to experience improved financial outcomes and enhanced non-financial performance metrics. This dual impact underscores the synergistic relationship between product and process innovations, suggesting that firms should adopt a holistic approach to green innovation strategies to maximize their overall performance (Hasan & Rahman, 2023). Moreover, the implications of these findings extend beyond the immediate financial and operational metrics. The integration of green innovations aligns with global sustainability goals and can position organizations favorably in the eyes of consumers who are increasingly concerned about environmental issues.

As such, the FMCG sector in Bangladesh stands to benefit significantly from adopting and promoting green innovations, which can lead to long-term sustainability and competitive advantages in an evolving market landscape (Abatan et al., 2024). In summary, the findings of this study confirm the hypotheses that both GPDI and GPCI have a positive impact on organizational performance within Bangladesh's FMCG industry. The results highlight the critical role of green innovations in driving both financial and non-financial performance, suggesting that organizations should strategically invest in these areas to enhance their overall sustainability and market positions.

5. Conclusion

This study investigates how green innovation, particularly Green Product Innovation (GPDI) and Green Process Innovation (GPCI), affects organizational performance in Bangladesh's FMCG sector. Through empirical analysis, this study reveals that implementing green innovation practices has a positive and significant impact on both the financial and non-financial aspects of organizational performance.

The findings reveal that the GPDI contributes to financial performance (OFP) by fostering product development strategies that minimize pollution, reduce energy consumption, and enhance recyclability. Similarly, the GPCI significantly impacts financial outcomes by streamlining manufacturing processes, reducing waste, and optimizing resource usage. Non-financial performance (ONP) also benefits from green innovation, with improvements in customer satisfaction, employee welfare, and sustainability practices. These relationships were statistically significant, underscoring the importance of integrating environmental sustainability into organizational strategies.

This study enriches the existing literature by showcasing the dual benefits of green innovation in boosting both financial performance and non-financial sustainability. This emphasizes the necessity for FMCG sector organizations to embrace a comprehensive green innovation strategy and harmonize product and process innovations to secure enduring success. The study's results have significant practical implications for policymakers and industry executives. By focusing on eco-friendly initiatives, organizations can align themselves with international sustainability objectives, satisfy the demands of environmentally aware consumers and secure a competitive edge in the marketplace. As the FMCG sector in Bangladesh evolves, green innovation will serve as a cornerstone for fostering organizational resilience, ensuring sustainable growth, and achieving a balance between economic success and environmental responsibility in the industry.

5.1 Future Research Directions and Limitations

Future investigations could widen the scope by assessing the influence of green innovation across various sectors, such as manufacturing, technology, and services. Longitudinal studies are recommended to examine the long-term effects of green practices on both financial and non-financial performance, while qualitative approaches, such as case studies or interviews, can capture the nuanced challenges and opportunities organizations face in implementing green innovations. Additionally, investigating the role of emerging technologies, such as artificial intelligence, blockchain, and IoT, in driving green innovation could reveal new pathways for sustainable practices.

This study has some limitations that should be considered when interpreting its findings. First, it focuses exclusively on the FMCG sector in Bangladesh, limiting its generalizability to other sectors in the country. Additionally, this study does not address other dimensions of green innovation, such as green marketing or supply chain practices. Finally, the emphasis on quantitative methods means that the contextual factors influencing green innovation adoption and outcomes are unexplored. Future studies that address these issues may offer a more comprehensive understanding of how green innovation contributes to improved organizational performance.

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