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Green Customer and Supplier Integration for Competitive Advantage: The Mediation Effect of Sustainable Product Innovation

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Abstract: The purpose of this study is two-fold: first is to examine the direct effect of green customer integration, green supplier integration, and new product flexibility on sustainable green product innovation (henceforth sustainable innovation), and the second is to assess the mediating role of sustainable green product innovation in the relationship of the independent variables on competitive advantage of the firm. To test these relationships, a quantitative method is used, employing a cross-sectional survey targeting the senior managers of the manufacturing sector in Jordan. Out of 750 surveys administered to respondents, 378 complete responses were obtained, yielding a response rate of 50.4%. Covariance-based structural equation modelling (CBSEM) using AMOS 28 is utilized to analyse the data. The results suggest that green customer integration, green supplier integration, and new product flexibility have a significant impact on sustainable green product innovation. The results also suggest that sustainable green product innovation has a significant mediating effect on the relationship between the three predictor variables and competitive advantage. In addition, new product flexibility partially mediates the relationship between green supplier integration and sustainable green product innovation.

Keywords: sustainable green innovation; green customer integration; green supplier integration; new product flexibility; competitive advantage

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1. Introduction

Organizational success depends largely on the strategy the firm adopts to achieve and sustain its competitive advantage. Innovation is a key source of competitive advantage and important roadmap for a firm to differentiate itself from competitors in today's rapidly changing business environment. Therefore, a firm's capacity to innovate can be a determining factor of its success or failure. Innovation capability refers to the ability to offer new or enhanced products or services, as well as implementing new or improved processes [1] by pooling, linking, and transforming several different types of resources and knowledge to create a solution that is different from existing ones [2].

When a firm deals with highly demanding customers and intense competition, it should be more innovative in producing new products and services in order to succeed in the marketplace and increase its performance relative to its competitors [3]. Therefore, continuous innovation matters in today's business environment where it is the only source of sustainable competitive advantage [4]. Innovation deals with transforming, developing, and implementing new ideas to generate processes or products [5]. Through innovation, a firm can have new product flexibility that gives it the ability to launch new products into the market to respond quickly to changes in customer needs and to achieve competitive advantage [3]. However, product innovation calls for advanced knowledge, capabilities, resources, and technologies required in order to design and launch new products to the market, as a response to customer demands [6].

The literature on sustainability and green innovations shows the use of different terms that describe green innovations, such as eco-innovation [7,8], environmental innovation, sustainability innovation [9], and green innovation [10].

Green innovation, however, is derived from a broader concept of innovation called eco-innovation. The major concern of eco-innovation is to improve environmental performance through the reduction in environmental impacts caused by consumption and operations activities [7]. In the same vein [11], the concept of cleaner production is defined as a measure for sustainability that enables the firm to produce new products with less cost and low risks to protect humans and the environment. Moreover, the ultimate goal of eco-innovation is to achieve sustainable development, through reducing impacts on the environment or achieving a more efficient and responsible use of natural resources, including energy [12]. In this context, ref. [8] used eco-innovation and green innovation interchangeably and classified them into three main categories: eco-product innovation, eco-process innovation, and green managerial innovation.

Similarly, [9] extended the term innovation to include new or modified processes, practices, systems, and products. In the context of hospitality, ref. [13] reviewed green practices in hospitality and identified three research domains (organizational, operational, and strategic domains) that influence green practices. They recommend the integration of sustainability strategy into the firm's corporate strategy in order to influence stakeholder attitudes toward the adoption of green innovation practices. Similarly, ref. [10] classified the drivers of green innovation into seven factors that include cultural, strategic, HRM, managerial, individual, leadership, and external. Taken together, the above analyses support the idea that innovation is a complex and multidimensional construct which results from different antecedents and leads to positive outcomes for the firm and the customers.

In response to the calls for conducting more empirical research about green product innovation performance, this study was conducted to achieve the following objectives:

1. Investigate the impact of green customer integration and green supplier integration on new product flexibility;
2. Investigate the impact of new product flexibility, green customer integration, and green supplier integration on green product innovation;
3. Investigate the impact of green product innovation performance on competitive advantage;
4. Investigate the impact of sustainable green product innovation on the relationship between green customer integration, green supplier integration, and new product flexibility and competitive advantage.

To achieve the above objectives, the study used the quantitative method, employing a cross-sectional survey to target the senior managers of the manufacturing sector in Jordan and structural equation modeling was utilized.

This paper is organized as follows. Section 2 provides a literature review and the development of hypotheses. In Section 3, we describe materials and methods, including research gaps, the problem statement, and research methods. Section 4 presents data analysis and the results of hypothesis testing. Finally, Section 5 presents the study's conclusions, implications, and limitations, from which we identify avenues for future research.

2. Literature Review and Development of Hypotheses

Despite the significant level of research conducted on innovation and its antecedents and outcomes, there is a call for conducting more empirical studies in this area. In this context, ref. [14] argued that the studies that were conducted about innovation performance lack a better understanding of the actions, processes, and strategies that lead to improved innovation performance because they are not fully examined.

According to [15] there is limited empirical research about the relationship between strategy and new product flexibility in the supply chain context, which supports the need for empirical evidence to help managers develop and implement effective NPD strategies [15]. Similarly, refs. [16,17] recommended conducting more studies that address

NPF speed through developing highly innovative products due to highly competitive environments in order to drive managers to establish and maintain their organizations' competitive advantages. Considering the mentioned gaps, the present study contributes to sustainable green product innovation research by delving deeper into the role of green customer integration and green supplier integration in forming new green product flexibility, which in turn facilitates and sustains green product innovation. To our knowledge, this is the first or one of the first studies that address the role of green customer and supplier integration in developing new product flexibility, which is a main source for sustainable green product innovation.

The literature review is developed to address the hypothesized relationships depicted in Figure 1—the research model.

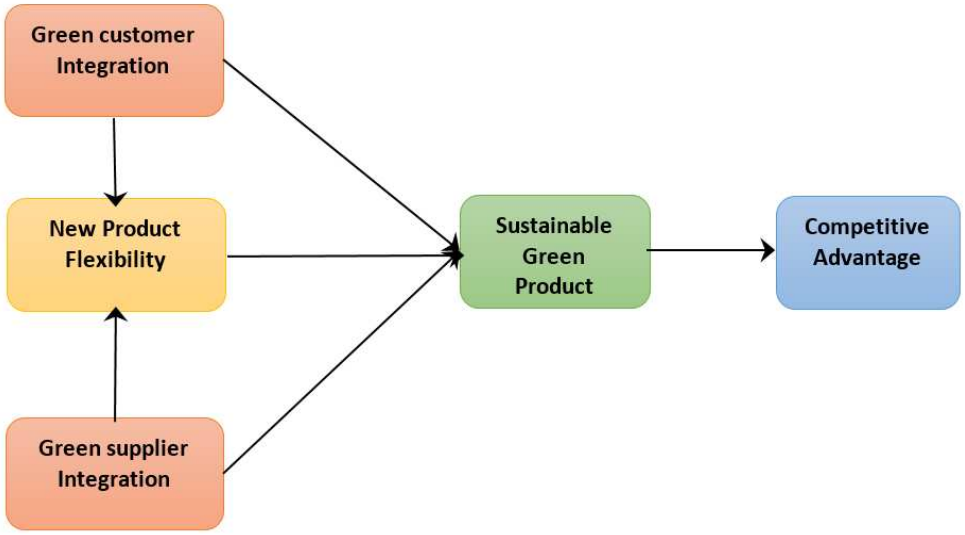

Figure 1. The proposed structural model.

2.1. Green Customer Integration and New Product Flexibility

New product flexibility (NPF) is the ability to develop and launch new products quickly [18], economically, and with no additional time needed to cope with changes in the market demand [19]. Green customer integration increases the capacity for NPF through quick and effective response to market changes, particularly changes resulting from customers' awareness of the environmental and societal utility of green innovations and their desire to consume sustainably. In other words, the high demand of customers on green products and the uncertainty of dynamic environments creates the need for new product flexibility. Moreover, for a firm to compete successfully regarding product differentiation in the marketplace, it has to have new product flexibility, which is a crucial source of competitive advantage and organizational knowledge. Broader organizational knowledge, however, gives the firm greater flexibility and adaptability to respond to environmental changes quickly, which means that the broader a firm's organizational knowledge, the greater is its ability to create innovations and design new products [20] that increase the level of customer service and satisfaction. This argument leads us to hypothesize that:

Hypothesis 1 (H1). *Green customer integration (GCI) has positive impact on new product flexibility (NPF).*

2.2. Green Supplier Integration and New Product Flexibility

With NPF, organizations can modify and foresee innovation strategies in changing the business environment [21]. As indicated earlier, supplier involvement in product innovation results in positive outcomes, such as low cost and product differentiation. According to [22], supplier integration has a positive on NPF because it allows suppliers share with the company their expertise regarding innovations. In addition, supplier integration

facilitates the creation of NPF by reducing internal complications and solving problems associated with NPF projects. Based on this argument, it can be hypothesized that:

Hypothesis 2 (H2). *Green supplier integration (GSI) has a positive impact on new product flexibility (NPF).*

2.3. New Product Flexibility and Sustainable Green Product Innovation

NPF is a strategic capability that guides a firm to manage innovation strategies in response to a changing business environment. Therefore, green innovations become a vital source of competitive advantage when the firm successfully develops NPF to cope with rapid technological changes on the one hand and meet the requirements and expectations of sophisticated and high demanding customers on the other. Therefore, organizations need NPF to successfully innovate in dynamic business environments through reactive and proactive responses that enable an organization to exploit opportunities and lessen threats in its task and general environments [23]. According to [22], the NPF is significantly affected by cross-functional practices, such as operations marketing, and HRM practices. For example, HRM practices facilitate NPF because empowered employees become more skilled in handling sophisticated systems and dealing smoothly with technological changes.

In other words, NPF becomes more important when organizations experience turbulence of business environments, in particular when technology is changing quickly, which requires organizations to develop new products and respond to needs of high customer demanding [22]. As a result, new product flexibility (NPF) has emerged as a competitive weapon for a firm to thrive in a turbulent business environment through enabling a firm to bring newly designed products quickly to market. Considering the fact that competitive advantage is based on low cost strategy and/or differentiation strategy, it can be concluded that NPF is necessary for firms to increase the speed as well as the scope of their strategic moves [15]. Therefore, for organizations to achieve greater competitive advantage and improve quality and performance of products [24], they need to increase NPF through managing three factors: technology, development process, and competences [25]. Therefore, it can be hypothesized that:

Hypothesis 3 (H3). *New product flexibility (NPF) has a positive impact on sustainable green product innovation (SGPI).*

2.4. Green Customer Integration and Sustainable Green Product Innovation

Customer satisfaction is the most important measure of performance, which gives a firm the insight and understanding of market expectations and opportunities to respond reactively and proactively to changes related to customer needs. Therefore, involving customers in the early stages of new product development is a key success factor for a firm's sustained competitive advantage [26].

Customer can perform reactive and proactive roles in the developments of new products. Reactive customer integration engages customers in exploration and understanding customer needs, provides unique insights, and facilitates the identification of latent and future customer needs. Proactive customer integration implies that customers share constructive feedback with the company, which in turn addresses their needs and expectations [27]. In the same vein, ref. [28] argue that customers can participate at various stages of new product development through involving them in problem solving, suggesting new ideas, and providing data and knowledge about customer needs [29]. In summary, integrating customers into new product developments calls for open innovation through exchanging ideas, knowledge, information, and technology with external others in order to improve innovation performance [30]. However, one advantage of customer integration is to improve accuracy of demand information, which reduces the cost and time of new product development, increases a firm's ability to respond to customer needs, creates greater value, and, at the end of day, leads to customer satisfaction. Based on the above argument, it can be hypothesized that:

Hypothesis 4 (H4). *Green customer integration (GCI) has a positive impact on sustainable green product innovation (SGPI).*

2.5. Green Supplier Integration and Sustainable Green Product Innovation

According to [31], supplier integration in the processes of new product development takes the following three roles:

- Discussing with suppliers the specifications/requirements related to the product;
- Sharing information and technology and together bearing the responsibility for making decisions related to products' design specifications and requirement;
- The supplier charged with the whole responsibility for designing and making products/services according to the purchasing company's specifications and requirements.

Customer integration in new product developments can increase the innovation capability and operations performance, leading to improved development flexibility, high product quality, better reliability, lower production unit costs, shorter time to market, and faster development time and costs [32]. Supplier integration has also been found to increase business performance (i.e., growth in sales, growth in profit, and growth in market share). Therefore, the contribution of suppliers to a firm's innovation capability lies in their expertise related to technology, resources, capabilities, and processes they use for making products and services that increase customers' value, which are critical success factors for innovation capabilities in driving and leading the competitive advantage in increasingly complex and changing business environments.

In addition, strategic advantages arise from the supplier integration, which includes easier planning, coordination, improving scheduling, and developing production plans, which, in turn, helps manufacturers achieve a high level of customer service, leading to customer satisfaction and loyalty. Considering this argument leads to the following hypothesis:

Hypothesis 5 (H5). *Green supplier integration (GSI) has a positive impact on sustainable green product innovation (SGPI).*

2.6. Sustainable Green Product Innovation and Competitive Advantage (CA)

Competitive advantage is defined as the capability of any firm to create a defensible position over their competitors [33]. It means that firms with superior resources can deliver greater benefits to their customers for a given cost or can deliver the same benefit levels for a lower cost [34]. To address the relationship between green product innovation and competitive advantage, there is a need to determine how a firm can create and sustain its competitive advantage. According to the resource-based view (RBV), firms can create CA if they have superior resources and capabilities that are valuable, rare, inimitable, and non-substitutable, which create and increase the competitive entry barriers that reduce the risk of potential entrants into industry [35]. Similarly, ref. [36] argues that achieving CA requires a firm to focus on core competencies (i.e., quality, customer service, team coaching innovation, flexibility, and responsiveness), acquiring distinctive technologies, and human capital.

According to [33], there are two types of competitive advantage: cost advantage and differentiation advantage. Cost advantage occurs when an organization is able to outperform competitors by producing goods and services at a lower cost, while differentiation advantage occurs when creating a product or service that is perceived to be unique in a way that its competitors cannot achieve.

According to [37], integrating strategic thinking into supply chain management is necessary for meeting stakeholders' claims and needs as well as increasing competitive advantage. They argue that firms can achieve a competitive advantage when adopting the best practices of supply chain management. In the same vein, ref. [38] point out that satisfying the final customer requires the integration and coordination of business processes (i.e., purchasing, manufacturing, marketing, logistics, and information systems) and strategy into supply chain management. This argument is in line with [39], who found that green innovation could be improved through the adoption of lean practices, such as JIT,

set-up time reduction, cellular manufacturing, and waste elimination. Therefore, consumers become aware of green products, and they are willing to buy low-carbon, energy-saving, and environmentally friendly products [40].

Green product innovation as a main source for competitive advantage can reflect a firm's performance through increasing sales and reducing production costs [41]. Thus, the performance of green product innovation increases when considering energy-saving, pollution-prevention, waste recycling, no toxicity, or green product designs [42]. In this context, ref. [13] points out that green innovation becomes a major concern of organizations to increase financial performance, fulfill customer demands, and build good relations with stakeholders. This argument implies that green product innovation results in positive impact on the competitive advantage, which leads us to hypothesize that:

Hypothesis 6 (H6). *Sustainable green product innovation has a positive impact on competitive advantage in terms of cost–leadership strategy and differentiation strategy.*

2.7. Indirect (Interacting) Effects

Considering the above arguments and the research model, the following hypotheses are formulated to address the mediating effects among the research constructs:

Hypothesis 7 (H7). *New product flexibility has a mediator effect on the relationship between green customer integration, green supplier integration, new product flexibility, and sustainable green product innovation.*

Hypothesis 8 (H8). *Sustainable green product innovation has a mediator effect on the relationship between green customer integration, green supplier integration, new product flexibility, and competitive advantage.*

3. Materials and Methods

3.1. Problem Statement

In a dynamic competitive environment characterized by rapid changes in technology, shorter product life cycles, and highly demanding customers, sustainability issues have become a major concern of both researchers and managers. For a company to sustain its competitive advantage it has to have new product flexibility that arises from green customer and supplier integration and leads to sustainable green product innovation, which in turn will be reflected in competitive advantage. This argument implies that sustainable green product innovation aims to protect the environment and cope with changing business environment, which emphasizes the importance of integrating sustainability in a firm's business strategy.

3.2. Research Methods

3.2.1. Samples and Procedures

The targeted population comprises the senior managers of manufacturing sector in Jordan. A cross-sectional survey to examine the integrated impacts of customer and supplier integration on new product flexibility, green product innovation and competitive advantage. Table 1 presents the breakdown of respondents in relation to the manufacturing activities.

Table 1 shows clear variation in the respondents' characteristics, out of 750 distributed surveys, only 378 of complete responses were obtained, yielding a response rate of 50.4%. As seen in Table 2, of the total respondents, 65.9% were male and the remaining were female. The majority of respondents (73.28%) were over 26 years old, and 41% had an experience over five (5) years in their current position. Furthermore, around (62.0%) of the respondents were working in the marketing and sales department.

Table 1. Industry breakdown.

Industry	Number of Companies	Respondents	Percentage from the Total Sample
Textiles, Leather, and Clothing	45	68	18%
Food and Beverages	47	73	19%
Engineering, Electronics, and Construction	35	75	20%
Ceramics and Glass, Mining and Extraction	18	47	12%
Chemical and Pharmaceutical Products	52	84	22%
Others: Paper and Cardboard	19	31	8%

Table 2. Characteristics of respondents.

Indicators	Category	Number	Percentages
Gender	Male	249.00	65.87%
	Female	129.00	34.13%
Age	Less than 25 Years	101.00	26.17%
	26–35 Years	82.00	21.69%
	36–45 Years	117.00	30.95%
	Over 45 Years	78.00	20.63%
Experience	Less than one year	87.00	23.02%
	1 to 5 years	136.00	35.98%
	Over five years	155.00	41.01%
Functional area	Marketing and sales	236.00	62.16%
	Operations	71.00	18.78%
	Accounting or Finance	32.00	8.47%
	Others	39.00	10.31%
Managerial level	Supervisor/manager	274.00	72.48%
	Senior management	104.00	27.51%

3.2.2. Scale Development Method

To test the proposed hypotheses, we used the questionnaire as a data collection instrument. The study relied on well-established previous validated scales to measure the related variables. Table 3 presents the source of each item. The questionnaire comprises three sections (Appendix A): the first section is about the respondents' socio-demographic data, followed by a technical questions section and presented as a seven-point Likert scale with anchors (1) not at all/strongly disagree and (7) extensively/strongly agree. The last section asked for general information about the manufacturing sector.

Table 3. Measurements of the study's variables.

Dimension	No. of Items	Source
Green Customer Integration	6	[43]
Green Supplier Integration	4	[43]
Green New Product Flexibility	6	[15]
Sustainable Green Product Innovation	4	[44,45]
Cost–Leadership Strategy	4	[46]
Differentiation Strategy	4	[46]
	28	

As the survey was distributed in Jordan, the original questionnaire was translated into the Arabic language by two strategic management professors. Then, two other professors

who are competent in both languages carried out a back-translation into English. In order to ensure the mutual consistency of both the Arabic and English version, a pre-test of the questionnaire was conducted.

4. Data Analysis

Table 4 provides the descriptive statistics of each construct.

Table 4. Descriptive statistics.

	No. of Items	Mean	Std. Deviation	Skewness	Kurtosis	Cronbach's Alpha
Green Customer Integration	6	4.21	0.97	0.69	−0.06	93.6
Green Supplier Integration	4	4.77	0.99	0.14	−0.70	81.8
New Product Flexibility	6	6.02	0.70	−0.69	1.30	94.3
Sustainable Green Product Innovation	4	4.91	0.91	0.06	−0.67	87.9
Cost–Leadership Strategy	4	5.98	0.65	−0.75	1.90	84.1
Differentiation Strategy	4	5.82	0.76	−0.83	1.48	87.7
All	**28**	**5.24**	**0.84**	**−0.18**	**0.47**	**84.7**

Table 4 suggests that non-normality was not excessive; the absolute values of skewness and kurtosis are less than (±1) and less than (±2), respectively [47]. Furthermore, the joint reliability indicator of each construct was assessed using internal consistency method estimated by Cronbach's alpha [48]. As Table 4 shows, that the Cronbach's alpha values exceeded the recommended alpha value of 0.7 [48]. It ranged from 0.841 to 0.943 with an overall reliability of 0.847. Moreover, the results implied an absence of multicollinearity as the item–total correlations for all constructs and items and were smaller than 0.80.

4.1. Validity and Reliability

So far, there has been no empirical provided for the relationships between green customer and supplier integration or green new product flexibility on sustainable green product innovation and on cost–leadership strategies and differentiation strategies. Therefore, to demonstrate the validity and reliability of the proposed model, the composite reliability and average variance extracted for each construct is reported in Table 5.

Table 5. Construct reliability and validity *.

	CR	AVE	MSV	MaxR(H)	GCI	NPF	GSPI	SGI	CLS	DIFS
GCI	0.945	0.709	0.062	0.948	**0.842**					
NPF	0.941	0.729	0.287	0.957	−0.117	**0.854**				
GSI	0.819	0.531	0.166	0.820	−0.189	0.284	**0.729**			
SGPI	0.863	0.613	0.186	0.879	−0.248	0.333	0.407	**0.783**		
CLS	0.843	0.574	0.437	0.844	−0.153	0.536	0.304	0.431	**0.758**	
DIFS	0.885	0.660	0.437	0.913	−0.093	0.521	0.166	0.218	0.661	**0.812**

CR: Composite Reliability
AVE: Average Variance Extracted
MSV: Maximum Shared Variance
MaxR(H): Maximal Reliability

Green integration:
GCI: Green Customer Integration
GSI: Green Supplier Integration
NPF: New Product Flexibility
SGPI: Sustainable Green Product Innovation

Competitive advantage
CLS: Cost–Leadership Strategy
DIFS: Differentiation Strategy

* These measures were calculated based on Gaskin, J., Excel StatTools. Excel Stats Tools Package. http://statwiki.gaskination.com/index.php?title=Main_Page (accessed on 7 August 2022).

Table 5 shows that the AVE of all constructs exceeded the value of 0.50, and both MSV and MaxR(H) were less than the AVE. The composite reliability (CR) values ranged from 0.819 to 0.945, with all the construct loadings significant at $p < 0.001$. This means that all the constructs in the scale fulfilled the requirements of convergent and discriminant validity. Cronbach's alpha (α) exceeded the value of 0.50.

Likewise, to further conduct Harman's single factor test, we applied confirmatory factor analysis (CFA) using AMOS 28. The model fit indices of the single-factor model are much worse than the 'rules of thumb' and worse than the same indices from the measurement model (X^2/df = 13.72, NFI = 0.384, CFI = 0.40, and RMSEA = 0.184). The unacceptable model indices of the single-factor model also indicate that the common method bias is not a risk in this research.

4.2. Measurement Model Confirmatory Factor Analysis

The fit of the measurement model to the data was assessed using comparative fit index (CFI), goodness-of-fit index (GFI), standardized root mean residual (SRMR), Tucker–Lewis index (TLI), normed fit index (NFI), and root mean square of error approximation (RMSEA). The ideal values of CFI, GFI, NFI, and TLI indices should be more than 0.90; however, the RMSEA value must be lower than 0.08 (Gefen et al., 2000). Table 6 summarises the results.

Table 6. Model fit measures.

Goodness-of-Fit Measures	χ^2/df (χ^2, *df*)	*p*-Value	GFI	SRMR	CFI	NFI	TLI	RMSEA
Recommended value	≤3.00	≥0.05	0.90	0.10	0.90	0.90	0.90	0.08
Measurement model	1.90 (625.5, 329)	0.00	0.898	0.03	0.960	0.920	0.954	0.049
Structural model	2.66 (725.5, 335)	0.00	0.881	0.05	0.947	0.907	0.941	0.056

Table 6 shows that the respective values of X^2/df, GFI, CFI, NFI, and TLI are 1.90, 0.898, 0.960, 0.920, and 0.954. The value of SRMR is 0.03 and the RMSEA is 0.049. Although the GFI value of 0.898 did not meet the criteria, this value is close to threshold and thus representing a good fit with the collected data.

4.3. Structural Model

The study now evaluated the structural model after establishing an acceptable measurement model. Table 6 illustrates the measurements of the structure model. Although the Chi-square value (725.53, *df* = 335) was unacceptable, other goodness-of-fit indices [CFI = 0.947, RMSEA = 0.056, NFI = 0.907, TLI = 0.941, RMR = 0.050] exceeded the recommended requirements of good fit thresholds. Therefore, the structural model secured a good fit with the collected data; thus, it can be concluded that the theoretical model (Figure 1) is consistent with the observed data.

4.4. Hypothesis Testing

AMOS 28.0 is employed to test the proposed hypotheses; Table 7 and Figure 2 present the results.

Table 7. Hypothesis testing results.

Hypothesis/Path	Path Coefficient	Std. Error	Critical Ratio	*p*-Value	Results
H1: GCI → NPF	0.07	0.039	4.24	***	Supported
H2: GSI → NPF	0.27	0.049	4.551	***	Supported
H3: NPF → SGPI	0.16	0.044	3.100	0.002	Supported
H4: GCI → SGPI	0.32	0.063	4.591	***	Supported
H5: GSI → SGPI	0.43	0.058	5.140	***	Supported
H6a: SGPI → CLS	0.24	0.056	4.245	***	Supported
H6b: SGPI → DIFS	0.45	0.039	7.328	***	Supported

*** Significant at $\alpha \leq 0.001$.

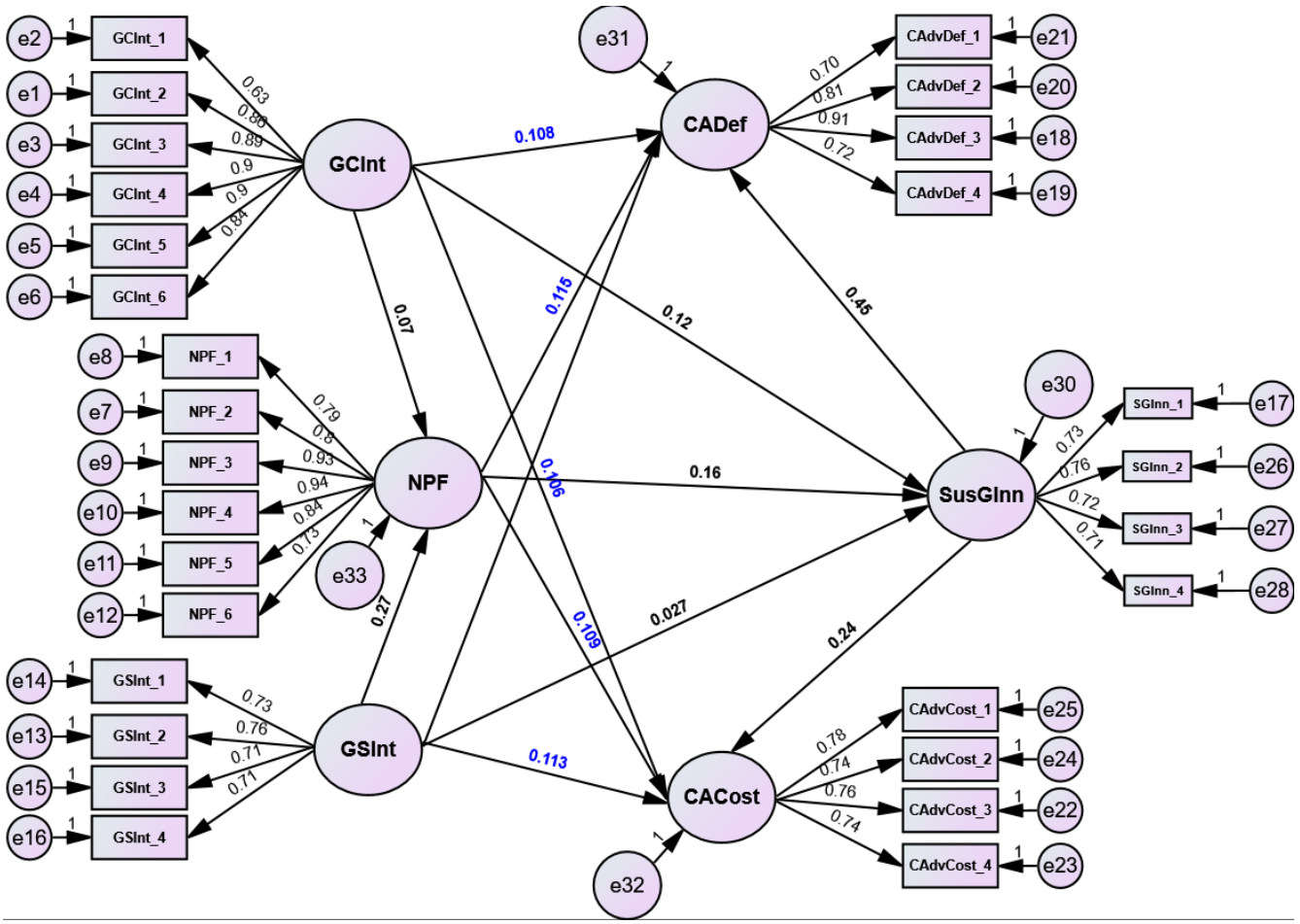

Figure 2. Results of hypothesis testing.

Table 7 shows that:

First, the relationships between green customer and supplier integration and new product flexibility. It is hypothesized that there is a significant positive relationship between green customer integration and new product flexibility. The result shows that the path coefficient is (β = 0.07) and it is significant at *p*-value less than or equal 0.001 ($p < 0.001$), which supports H1. The second hypothesis investigates the relationships between green supplier integration and new product flexibility. The results support this positive relationship (β = 0.27, $p < 0.001$), thus supporting H2.

Second, H3, H4, and H5 proposed the joint effect of green customer integration, green supplier integration, and new product flexibility on sustainable green product innovation. It is hypothesized that there is a significant positive relationship between green customer integration and sustainable green product innovation (H4). The result shows that the path coefficient is (β = 0.16), and it is significant at *p*-value less than or equal 0.005 ($p < 0.002$),

which supports H4. Likewise, the hypothesized relationships between green supplier integration (H5) and new product flexibility (H3) on sustain green product innovation are supported ($\beta = 0.32$, p < 0.001) and ($\beta = 0.25$, $p < 0.001$), respectively, thus supporting H3 and H5.

Third, the impact of sustainable green product innovation on both cost–leadership and differentiation strategies. It is hypothesized that there is a significant positive relationship between sustainable green product innovation and cost–leadership strategy. The result shows that the path coefficient is ($\beta = 0.24$), and it is significant at a *p*-value less than or equal 0.001 ($p < 0.001$), which supports H6a. The same is true for the hypothesized relationships between sustainable green product innovation and differentiation strategy, which is supported by ($\beta = 0.45$, $p < 0.001$), thus supporting H6b.

Four, SEM is used to test all paths coefficients with their related *p* values, which are used in this study to test mediation effects. It is argued that if only the indirect paths are significant then full mediation is supported, whereas if both direct and indirect paths are significant, then partial mediations are supported [49]. Table 8 and Figure 2 depict all path coefficients.

The results of Table 8 provide evidence that new product flexibility partially mediates the relationship between green customer integration and sustainable green product innovation. This result is reinforced by reviewing the standardized indirect effects in SEM output from green customer integration to sustainable green product innovation through the mediating effect of new product flexibility (H7a) as the direct effect increased from ($\beta = 0.12$, $p < 0.01$) to a total effect of ($\beta = 0.17$, $p < 0.001$). Likewise, new product flexibility partially mediates the relationship between green supplier integration and sustainable green product innovation (H7b), the direct effect increased from ($\beta = 0.16$, $p < 0.01$) to a total effect of ($\beta = 0.27$, $p < 0.001$).

In the same way, the results of Table 8 provide evidence to support the mediating effect of sustainable green product innovation on the direct path from green customer integration, green customer integration, and new product flexibility to a cost–leadership strategy (H8). The direct effect of green customer integration on cost–leadership strategy increased from ($\beta = 0.106$, $p < 0.01$) to a total effect of ($\beta = 0.276$, $p < 0.001$). Likewise, regarding the differentiation strategy path, the direct effect increased from ($\beta = 0.108$, $p < 0.01$) to a total effect of ($\beta = 0.198$, $p < 0.001$), supporting H8a. Moreover, the results provide evidence to support the mediating effect of sustainable green product innovation (H8b) on a direct path from green supplier integration to cost–leadership and differentiation strategies. The direct effect increased from ($\beta = 0.027$, $p < 0.01$) to a total effect of ($\beta = 0.107$, $p < 0.001$). Similarly to the differentiation strategy path, the direct effect increased from ($\beta = 0.113$, $p < 0.01$) to a total effect of ($\beta = 0.153$, $p < 0.001$), thus supporting H8b. Furthermore, the results provide evidence to support the mediating effect of sustainable green product innovation on the direct path from new product flexibility to cost–leadership strategy (H8c). The direct effect increased from ($\beta = 0.109$, $p < 0.01$) to a total effect of ($\beta = 0.219$, $p < 0.001$). Similarly to the differentiation strategy path, the direct effect increased from ($\beta = 0.115$, $p < 0.01$) to a total effect of ($\beta = 0.175$, $p < 0.001$), supporting H8c. These results provide evidence of the mediation effect of new product flexibility and sustainable green product innovation on the relationship between green customer and supplier integrations and cost–leadership and differentiation strategies.

Table 8. Mediation results.

Path	Total Effects					Direct Effects					Indirect Effects					Result
	Standardized Coefficients	SE	*p*-Value	Bootstrapping 95% CI		Standardized Coefficients	SE	*p*-Value	Bootstrapping 95% CI		Standardized Coefficients	SE	*p*-Value	Bootstrapping 95% CI		
				Lower	Upper				Lower	Upper				Lower	Upper	
GCI→ NPF→ SGI	0.170	0.083	5.987	0.033	0.660	0.120	0.065	2.923	0.014	1.321	0.050	0.051	5.345	0.027	0.149	Partial Supported
GSI→ NPF→ SGI	0.270	0.059	6.572	0.243	0.682	0.160	0.041	4.021	0.015	0.292	0.110	0.083	6.750	0.087	0.209	Partial Supported
GCI→ NPF→SGI → CLS	0.276	0.061	3.092	0.112	0.369	0.106	0.037	1.901	0.003	0.257	0.170	0.040	7.150	0.147	0.269	Supported
GCI→ NPF→SGI → DIFS	0.198	0.064	2.980	0.037	0.215	0.108	0.067	1.423	0.092	0.217	0.090	0.923	6.090	0.067	0.189	Supported
GSI→ NPF→ SGI → CLS	0.107	0.037	3.757	0.022	0.555	0.027	0.084	0.500	0.015	0.162	0.080	0.150	7.020	0.057	0.179	Supported
GSI→ NPF→ SGI → DIFS	0.153	0.113	3.487	0.130	0.544	0.113	0.044	0.907	0.032	0.226	0.040	0.615	6.000	0.017	0.139	Supported
NPF→ SCI → CLS	0.219	0.135	3.588	0.024	0.197	0.109	0.038	1.570	0.086	0.282	0.110	0.049	3.560	0.087	0.209	Supported
NPF→ SGI →DIFS	0.175	0.117	2.967	0.037	0.185	0.115	0.134	1.451	0.032	0.260	0.060	0.902	4.253	0.037	0.159	Supported

5. Discussion and Main Results

5.1. Discussion

This study provides an initial insight into the relationship between customer and supplier green integrations and new product development to predict both sustainable green product innovation and competitive advantage in terms of s cost–leadership strategy and differentiation strategy. In line with previous literature that widely acknowledged integration as one of the most critical predictors for the creation of successful new products [50], the result of this study highlights the importance of the integration of both supplier and customer to develop new products. Green new product development can be considered as a strategic tool [51] by which companies can increase and sustain their competitive advantage [50,52]. The previous literature suggested that a company's ability to integrate its supplier and customer could improve both new product and business performance [53,54].

The significant positive relationship between green customer integration and green new product development (H1) and sustainable green product innovation (H4) addresses the importance of customers' feedback to introduce new products and determine whether to limit or extend product diversity [55]. Although new product development is risky and costly, it is critical to the profitability and survival of any company [56,57]. Therefore, how a company engages with its customers is important to improve product specification [26].

Establishing a collaboration with the major customer could easily communicate the idea and the future product design [58]. Thus, customer integration into new product development process strengthens a company's competencies. This result is similar to previous research, such as [59,60], who conclude that integrating customers enables companies to obtain wide information from their customers, which manifests itself in real improvement suggestions or solution ideas.

Likewise, the result supports the hypothesized relationship between supplier integration and green new product development (H2) and sustainable green product innovation (H5). Integration or collaboration with suppliers is needed to enhance the development of new products, as all raw material and component requirements must be coordinated with suppliers. By working together, companies and suppliers can share information and make shared choices, which leads to green new product development. Studies have also indicated that integration with suppliers calls for a long-term arrangement [55,61]. Including suppliers in the product development process allows for better access to ideas early on, more efficient communication, the utilization of the benefit of existing knowledge and technology, and the continuous improvement of the existing technology combinations, which in turn can enhance productivity and speed [62,63]. The hypothesized combined impact of both customer and supplier integration on new product development (H3) was supported. The gathering of information from both customers and suppliers, regarding their desires and needs, are considered important for the success of new product, which is consistent with the previous literature [50,53,64,65].

The mediator role of both new product flexibility and sustainable green product innovation between green customer integration and green supplier integration in new product flexibility, H7, and competitive advantage (cost–leadership and differentiation strategies, H8) are supported. That is, green innovation provides an additional benefit in improving a company's competitive advantage. This result is in line with [66,67], who found a significant positive impact between sustainable green product innovation and company performance. It enhances company value, reduces production and operation costs, and increases market shares [68–70].

5.2. Main Results

Previous discussions revealed that green product innovation emerged as an important requirement today and in the future in business environments [70]. Green product innovations have been widely recognized as one of the most strategic tools for sustainable development while achieving a competitive advantage. This study proposes and tests a new conceptual model, where new product flexibility was proposed as a mediator for the

relationship between green customer and supplier integration. Likewise, new product flexibility and sustainable green product innovation was also proposed as a mediator between green customer integration and green supplier integration and new product flexibility and competitive advantage (cost–leadership and differentiation strategies). The results support the proposed hypothesis; green supplier and customer integration and new product flexibility work together to enhance sustainable green product innovation, which in turn improves the competitive advantage of any company.

5.3. Managerial Implications

- The results of data analysis reveal the following managerial implications that can benefit organizations in sustaining green product innovation and competitive advantage:
- Managers have to focus on what increases new product flexibility, which in turn improves and increases green product innovation performance. Therefore, customers value their integration in developing green products and this can increase the ability of a firm to launch new green products quickly to the target market at the right time, quality, and quantity.
- Managers should realize the critical role of green customer integration, green supplier integration, and new product development flexibility in sustaining green product innovation and improving the competitive advantage. Overall, a company's supplier and customer integration and green new product flexibility are important drivers for both sustaining green product innovation and improving competitive advantage.
- 'Go green' is not a slogan for improving a firm's reputation, but it should be viewed as the main concern for increasing the competitive advantage of the firm.
- Integrating both customers and suppliers into the creation of new green products is necessary to increase new product flexibility, which increases the ability of a firm to produce new green products efficiently and effectively.
- Green new product performance is a function of new product flexibility, green customer integration, and green supplier integration, which places a big emphasis on their contribution to the firm's competitive advantage.
- For a firm to increase its competitive advantage, managers should be aware of the antecedents and consequences of new product flexibility, green customer integration, green supplier integration, and green product innovation.
- To increase green product innovation performance, firms are advised to integrate new product flexibility, green customer integration, and green supplier integration into the development of green products, because this ultimately will increase the firm's competitive advantage.
- Managers should have a clear understanding of the relationship that links new product flexibility to green customer integration and green supplier integration and their integrated impact on sustainable product innovation and competitive advantage.
- The insight of the relationships among the research constructs (new product flexibility, green customer integration, green supplier integration, sustainable green product innovation, and competitive advantage) can assist managers in making better decisions and construct appropriate corporate, business, and functional strategies for effectively shaping a green culture that encourages the commitment of individuals to the philosophy of greenness and sustainability.

5.4. Limitation and Future Research

- This study has the following limitations that could represent avenues for future research:
- The present study is limited to one method of data collection (the cross-sectional survey). Therefore, the findings of this research must be treated with caution due to the limitations related to the positivistic paradigm. However, future research may apply other methods. Such case studies should investigate the impact of new product

flexibility, green customer integration, and green supplier integration on both green product innovation performance and competitive advantage.

- The present study employed only one type of flexibility (new product flexibility) in predicting green product innovation performance. Therefore, the study calls for future research to investigate the impact of other flexibilities, such as market flexibility, supply chain flexibility, operations flexibility, modification flexibility, etc., on green product innovation performance.
- This research did not take into consideration the effect of the moderating and intervening variables (such as company size, industry life cycle, organizational structure, industry type, stakeholders' interests, etc.) on the relationship between green product innovation and competitive advantage. Therefore, such variables should be addressed by future research.
- Finally, validating the findings of this study in different industries, sectors, and countries is another promising direction for future research.

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Appendix A

Questionnaire
Company Profile
Gender:

a. Male
b. Female

Age:

a. Less than 18 Years
b. 18–25 Years
c. 26–35 Years
d. 36–45 Years
e. Above 45 Years

How long have you been with your current employer?

a. less than one year
b. 1 to 5 years and 95
c. more than five years

What is your functional area?

a. Marketing
b. Operations
c. Sales
d. Accounting or Finance
e. Customer Service
f. Distribution and Warehousing
g. Information Technology
h. Legal or Regulatory
i. Research and Development

At what level are you within the organization?

a. supervisory/manager
b. senior management

c. employee
d. sales and service

Green customer integration Please indicate the extent of integration or information sharing between your organization and your major customer in the following areas (1 = not at all; 7 = extensive).
1. Our key customer often puts forward improving proposes for green product innovation
2. We often hear key customer's opinions on product prototypes when developing green products
3. We involve key customer into the green product design and development stage
4. Our key customer has major influence on the design of green products
5. There is a strong consensus in our firm that customer involvement is needed in green product innovation
6. We have continuous green product improvement programs that include our key customer
Green supplier integration Please indicate the extent of integration or information sharing between your organization and your major suppliers in the following areas (1 = not at all; 7 = extensive).
1. We involve key supplier into the green product design and development stage
2. Our key supplier has major influence on the design of green products
3. There is a strong consensus in our firm that supplier involvement is needed in green product innovation
4. We have continuous green product improvement programs that include our key supplier
Sustainable Green product innovation Please circle the appropriate number to indicate the extent to which you agree or disagree with each of the following statements that measure green product innovation in your company. The item scales are seven-point Likert type scales with 1 = strongly disagree, 2 = disagree, 3 = slightly disagree, 4 = neutral, 5 = slightly agree, 6 = agree, 7 = strongly agree. 1. Our company chooses the materials of the product that produce the least amount of pollution for conducting the product development or design
2. Our company chooses the materials of the product that consume the least amount of energy and resources for conducting the product development or design
3. Our company uses the fewest amount of materials to comprise the product for conducting the product development or design
4. Our company would circumspectly deliberate whether the product is easy to recycle, reuse, and decompose for conducting the product development or design
New product flexibility Please circle the appropriate number to indicate the extent to which you agree or disagree with each of the following statements that measure the new product flexibility in your company. The item scales are seven-point Likert type scales with 1 = strongly disagree, 2 = disagree, 3 = slightly disagree, 4 = neutral, 5 = slightly agree, 6 = agree, 7 = strongly agree.
1. Our company is able to introduce and manufacture new parts and products at a low cost
2. Our company is able to launch new products quickly in a short time
3. Our company is able to manage the time and cost to perform design activities concurrently
4. Our company is able to manage the time and cost to develop new products
5. Our company is able to handle a number of new products' designs at reasonable cost
6. Our company is able to involve and support design of suppliers in new product developments
Please select the number that accurately reflects the extent of your firm's competitive advantage on each of the following.
Competitive advantage: Differentiation strategy
1. As compared with our competitors' products, our products have superior benefits to customers
2. Our products are unique and nobody but our company can offer them
3. We take great efforts in building a strong brand name, and nobody can easily copy that
4. We successfully differentiate ourselves from others through effective advertising and promotion campaigns
Competitive advantage: Cost–leadership strategy
5. Our manufacturing costs are lower than our competitors'
6. Our efficient internal operation system decreases the cost of our products
7. Our economy of scale enabled us to achieve a cost advantage
8. We achieved a cost–leadership position in our industry

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