Nexus Between Green Innovation and Environmental Sustainability: The Role of Green Marketing as a Mediator

Alubel Kassaw Belete[1], Dr. K.V Ramana Murthy[2]

[1] Ethiopian Research Scholar, [2] Research Director

[1,2] Department of Commerce and Management Studies, College of Arts and Commerce, Andhra University, Visakhapatnam, India,

Correspondence: Alubel Kassaw Belete

Abstract: Nowadays, the sustainability issues are becoming the frontline concerns of the world. In light of this, the study examined how green innovation (GI) enables Ethiopian manufacturing companies to promote environmental sustainability (ES). In particular, the study aimed to evaluate the moderating role of green marketing in the relationship between green innovation and environmental sustainability. The study uses survey data from 350 carefully selected participants across various manufacturing industries. PLS-SEM was employed to analyse the data via Smart PLS 3. The findings demonstrate that GI and GM significantly enhance ES. Additionally, GM was found to partially mediate the link between GI and ES. This was confirmed by calculating the variance-accounted-for value. These findings highlight the need to integrate sustainable marketing practices into manufacturing companies' business strategies and invest in green innovation. In a competitive market, this strategy yields more resilient and lasting environmental outcomes.

Keywords: Green Innovation, Green Marketing, Mediating, Environmental Sustainability, PLS-SEM

1. INTRODUCTION

Most people agree that the primary causes of upcoming issues that will cut across national boundaries are global warming and the environmental problems it causes (Yurdakul & Kazan, 2020). As a result, companies face growing pressure to adopt sustainability-related procedures because of escalating environmental damage and climate change (Zhang *et al*., 2019). One sustainable practice that can help manage environmental problems is green innovation (Qiu et al., 2020). Given the urgency of the current climate issue, green innovation serves as an organizational strategy that is both timely and essential (Qin *et al*., 2025). According to Song & Yu (2018), green innovation involves actions related to creating eco-friendly goods, procedures, and management techniques. These help businesses lower their environmental impact and improve their market position. It has become a strategic response that enables businesses to reduce pollution and conserve energy, thereby managing environmental hazards (Cui & Wang, 2023). Additionally, by minimizing or preventing detrimental environmental harm, green innovation delivers value to enterprises and societies. It is novel (Qin *et al*., 2025) and enables businesses to achieve environmental sustainability.

Environmental sustainability refers to the measurable results of activities and actions aimed at reducing adverse environmental effects, conserving natural resources, and promoting ecological balance (Quartey & Nyamah, 2024). More specifically, it focuses on reducing hazardous substance use, waste production, energy consumption, material use, and adherence to environmental standards (Norddin *et al*., 2021). This reduction can be gained from employing green innovation practices. However, unless it is properly positioned and conveyed in the market, green innovation might not be enough alone to bring about significant environmental gains. Here is where green marketing comes into play. GM aims to produce, market, and dispose of products that are less detrimental to the environment. As people are becoming increasingly conscious about the potential impacts of global warming, the adverse effects of pollutants, and the importance of using biodegradable solid waste, GM helps to upgrade their interest to purchase environmentally friendly products (McConnell, 2021). In doing so, green marketing, like green innovation, will be essential for achieving environmental sustainability.

Considering these two green practices, this study examined how green marketing functions as a mediator in the link between the ES of Ethiopian manufacturing firms and their GI. In the manufacturing sector of Ethiopia, where sustainability practices are still in development and regulatory enforcement is scarce (Tilahun, 2019), green marketing can be an essential intermediary that helps businesses convert green innovation initiatives into tangible sustainability results. Bridging the gap between internal innovation initiatives and external stakeholder involvement helps improve businesses' environmental performance.

Although a conceptual connection was found between ES and GI, there is a lack of empirical data explaining how GM mediates this relationship, particularly in Ethiopia's manufacturing sector. Current research often treats these constructs separately, (Akude *et al*., 2025; Ara *et al*., 2019; Awasthi *et al*., 2022; Liao *et al*., 2022; Nzumile & Taifa, 2024; Srouji *et al*., 2023; Supaat *et al*., 2020), overlooking their dynamic interactions with one another. By utilizing information from Ethiopian manufacturing companies, this specific study intended to bridge this gap by probing the direct link between ES and GI, as well as the mediating role of

GM in this link. It is hoped that the findings will contribute fresh perspectives to the growing corpus of research on sustainable business practices in developing countries and provide practical guidance to industrial managers and policymakers who wish to integrate marketing and innovation to achieve sustainability goals.

This study offers a novel perspective by experimentally demonstrating that GM mediates the relationship between ES and GI in Ethiopia's industrial sector. Although GM and GI have been frequently studied independently in the past, this study demonstrates that combining the two enhances sustainability advantages. The data, which come from underdeveloped nations with limited resources and regulations, advance theoretical knowledge while offering useful insights to managers and policymakers. Managers and legislators can achieve significant environmental benefits by combining innovative and marketing strategies.

2. LITERATURE REVIEW

2.1 Green Innovation (GI)

It is challenging to provide a single definition of green innovation, as different researchers and authors disagree on a unified definition (Hojnik & Ruzzier, 2016). In the literature, the terms "green innovation" (innovation focused on reducing environmental impact), "eco-innovation" (innovation targeting ecological improvement), "environmental innovation" (innovation with environmental benefits), and "sustainable innovation" (innovation supporting long-term environmental and resource goals) are often used interchangeably, resulting in ambiguity (Liu *et al*., 2024). According to (Zhang *et al*., 2019), Braun and Wield were the first to define green innovation. For Garetti and Taisch (2012), GI encompasses a variety of products, technologies, and processes that aim to minimize environmental pollution, reduce raw material consumption, and decrease non-renewable energy use. (Kemp & Pearson, 2007) defined GI as the creation, integration, or use of a new product, service, production process, management approach, or business strategy unique to the organization. During its life, green innovation lessens the negative consequences of resource consumption, including energy, pollution, and environmental danger, compared with alternatives. According to Raheem *et al* (2023), GI involves process, services and products, that mitigate environmental damage and enhance natural resources. Although many academics and organizations have defined green innovation differently, they all emphasize on optimizing the use of natural resources while minimizing environmental harm (Liu *et al*., 2024).

2.2 Green Marketing (GM)

The term "green marketing" first appeared in 1975 during a seminar hosted by the American Marketing Association (AMA) on what it then referred to as "ecological marketing." Several related terms, "ecological marketing," "greener marketing," "environmental marketing," "enviropreneurial marketing," and "sustainable marketing," all focus on the integration of environmental considerations within marketing practice, although each emphasizes a slightly different aspect of environmental concern (Chamorro *et al*., 2009; Choudhary & Gokarn, 2019; Dangelico & Vocalelli, 2017; Pandey, 2020, 2020; Polonsky, 1994, 1994). When we see the meaning given to it, different but related descriptions are provided. According to (Polonsky, 1994), "green marketing" is any activity aimed at facilitating exchanges that satisfy human needs or desires with minimal adverse environmental impact. The AMA defines green marketing as the process of developing, promoting, and providing ecologically friendly products and services (Yazdanifard & Mercy, 2011). In general, GM aims to reduce the environmental damage caused by corporate marketing (Kinoti, 2011).

2.3 Environmental sustainability (ES)

Environmental sustainability refers to the capacity to maintain equilibrium in our global ecosystem and natural resources for the benefit of future generations (Shamsuzzoha & Fontell, 2024). It involves sustaining qualities that keep the natural and physical environment intact (Siddiqui, 2024), such as the health of humans and other species, as well as clean water, air, and other resources (Sutton, 2004). Additionally, environmental sustainability considers the impact of organizational activities, outputs, and resource usage on the environment while ensuring compliance with applicable environmental laws and regulations (Dubey *et al*., 2014). Consequently, businesses now regard environmental sustainability as a fundamental aspect of corporate social responsibility, rather than merely an optional consideration (Shamsuzzoha & Fontell, 2024).

2.4 Hypothesis Development

2.4 Green innovation and environmental sustainability

Green innovation can significantly enhance environmental performance, according to numerous empirical studies examining its relationship, (Batool & Mohsin, 2025; Chen and Chen, 2015; Cui and Wang, 2023; Kumar *et al*., 2020; Liu *et al*., 2024; Wu *et al*., 2025). As identified by (Yan & Zhang, 2021), GI significantly and favourably affects ES. This helps by reducing emissions, using fewer hazardous materials, and conserve energy (Jassim & Challoob, 2021). A meta-analysis of eco-innovation and SMEs' sustainable performance (Oduro, 2024), discovered a favourable and significant effect. Additionally, Asadi *et al*. (2020) examined the effect of GI on sustainability performance in the Malaysian hotel industry and reported a strong positive correlation. Thus, the following can be hypothesized:

H1: GI has a significant effect on ES.

2.5 Green Innovation and green marketing

Green innovation is crucial for increasing the value of green marketing. According to (Nuryakin & Maryati, 2022), a company's GI is linked to its achievement in GM performance. Similarly, Putri *et al*.(2023) discovered that GM is significantly impacted by GI when the relationships among green innovation, green competitive advantage, GM orientation, and GM performance are analysed in Indonesian SMEs. Focusing on product and service differentiation helps SMEs create environmentally friendly products that offer a competitive edge. Furthermore, (Nuryakin & Maryati, 2022) confirmed that GI has a favourable effect on the GM performance of SMEs. Hence, it can be said that:

H2: GI has a significant effect on GM

2.6. Green marketing and environmental sustainability

Green marketing enhances the integration of environmental factors into strategy development, planning, preparation, manufacturing, and client distribution, among other business activities (Setyawati *et al*., 2020). This incorporation enables the organization to perform well in terms of its environmental aspects of its operations. Using green marketing techniques also significantly enhances business performance in terms of GM and environmental commitment (Majid, 2024). In their study of green marketing and organizational performance, (Braik *et al*., 2023) noted that green marketing strategies are key for achieving environmental sustainability. They confirmed that these strategies have a significant positive effect on the ES of manufacturing firms. Furthermore, (Akude *et al*., 2025) studied GM practices, including green strategies, green products, green internal marketing, and green communication, and their impact on the sustainability of manufacturing companies in emerging markets. Each practice had a notably positive impact on the ES performance of these companies. Thus, the following hypothesis was proposed.

H3: GM has a significant effect on ES.

2.7 Green Marketing as a Mediator

Both GM and GI support ES, according to existing research; however, most studies examine them independently. This study fills this gap by examining their combined impact and using green marketing as a mediator in the link between ES and GI. Since it converts internal activities into a better ecological reputation and increased stakeholder participation, effective communication through green marketing is essential to reaping the benefits of green innovation (Qin *et al*., 2025). This mediating role is supported by empirical evidence, which shows that combining GM and GI greatly enhances organizational and environmental outcomes (De Souza Zampese *et al*., 2016; Sulaiman, 2025).

H4: GM mediates the relationship between GI and ES

2.8 Conceptual Framework

Considering the literature presented above, a conceptual framework that shows a mediating effect of GM on the relationship between GI and ES was developed. This suggests that while GI introduces eco-friendly products and processes that directly improve environmental sustainability, its full impact is realized only when businesses use GM to communicate effectively and promote these initiatives. GM, then, mediates the link between GI and ES by translating creative environmental initiatives into ecological consequences and wider stakeholder awareness.

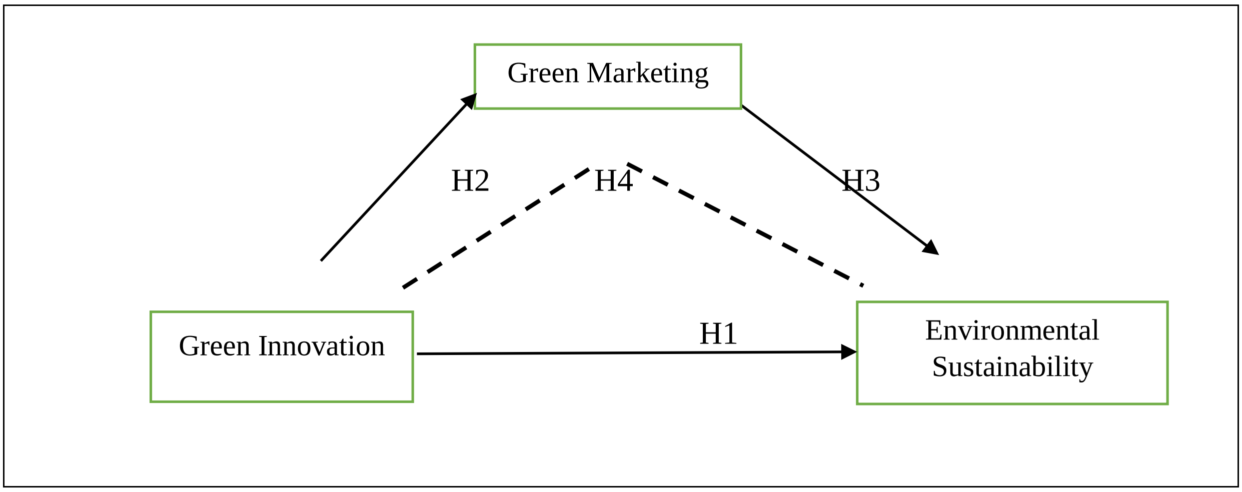

Figure 1: Conceptual framework of the study

3 METHODOLOGY

3.1 Sampling techniques

A non-probability sampling technique was used to select the respondents. First, manufacturing companies in Ethiopia's Sidama and South were readily chosen, totalling 189 businesses. Second, 2 respondents from each firm, were chosen for a sample size of 378 (189*2). Only senior officials were included because of their familiarity with company operations, tactics, and results. The sample size was based on the guideline that five to ten responses per item are sufficient (Hair *et al*., 2014). Of the 378 distributed questionnaires, 357 were collected; 21 were not returned. Seven incomplete surveys were excluded, leaving 350 for analysis.

3.2 Sources of data and collection methods

Primary data were collected from managers of Ethiopian manufacturing companies. To test the proposed hypotheses, data were collected through questionnaire. The questionnaire was organized in a seven-point Likert scale ranging from “strongly disagree” to “strongly agree” and was developed on the basis of the literature.

3.3. Method of data analysis

The data were assessed via PLS-SEM with Smart PLS 3 software. Because of its ability to convert nonnormal data and its efficacy with small samples, PLS-SEM was selected, and (Hair *et al*., 2014; Henseler *et al*., 2016; Ringle *et al*., 2012). Compared with factor-based SEM approaches, it allows researchers to estimate complex models with many components and indicator variables, (Guenther *et al*., 2023; Hair *et al*., 2017; Magno & Ringle, 2024; Sarstedt *et al*., 2021) than factor-based SEM methods. Additionally, PLS-SEM provides flexibility for examining higher-order models and other complex model interactions (Hair *et al*., 2019).

4 RESULTS

4.8 Measurement Model Assessment

The validity and reliability of constructs were assessed to continue with the structural model evaluation. First, the lower-order construct (LOC) measurement model was evaluated. Next, the validity and reliability of the higher-order constructs (HOCs) were examined. The lower-order constructs for green marketing were green product (GRPT), green promotion (GRPN), green price (GRPC), and green place (GRPL), whereas green innovation was measured through green process innovation (GRPI) and green organizational innovation (GROI).

4.8.1 Measurement model assessment for LOCs

The outer loadings of the reflective LOCs ranged between 0.668 and 0.859, with nine indicators (GRPN7, GRPL7, GRPL8, GRPI7, GRPI8, ES2, ES4, ES6, and ES8) falling below the 0.70 threshold. Indicator values below 0.40 were removed in line with the recommendations of (Hair *et al.*, 2017). For those with scores between 0.40 and 0.70, most were removed (except ES2, ES4, and ES8) after evaluating whether their removal improved the construct reliability and convergent validity, which was confirmed by subsequent tests. The indicators that were retained met the required reliability standards. The measurement model's internal consistency was then assessed via Cronbach's alpha and composite reliability, which, for all the constructs, exceeded 0.70, as (see Table 1). The average variance extracted (AVE) was used to assess convergent validity, and all the constructs had AVE values above 0.5, indicating sufficient convergent validity.

Table 1: Construct reliability and validity

Items	Cronbach's Alpha	Composite Reliability	AVE
GRPT	0.887	0.910	0.557
GRPC	0.867	0.905	0.656
GRPN	0.884	0.912	0.633
GRPL	0.893	0.914	0.571
GRPI	0.896	0.920	0.658
GROI	0.895	0.916	0.577
ES	0.888	0.909	0.527

The heterotrait-monotrait ratio (HTMT) and the Fornell-Larcker criterion are used to test the discriminant validity of the constructs when employing PLS-SEM. Since each construct's AVE was greater than the variance it shared with the other constructs (Fornell & Larcker, 1981) which is indicated in bold in Table 2, discriminant validity was achieved.

Table 2: Fornell & Larcker Criterion

	GRPT	GRPC	GRPN	GRPL	GRPI	GROI	ENVS
GRPT	**0.746**						
GRPC	0.278	**0.810**					
GRPN	0.074	0.149	**0.795**				
GRPL	0.230	0.202	0.189	**0.756**			
GRPI	0.174	0.132	0.245	0.728	**0.811**		
GROI	0.209	0.082	0.088	0.048	0.194	**0.760**	
ES	0.450	0.379	0.332	0.542	0.513	0.371	**0.726**

As forwarded by Henseler *et al*. (2015), HTMT evaluates the degree of similarity between two constructs. Accordingly, HTMT values below 0.85 can be considered indicative of discriminant validity. Since all values were below the recommended threshold, discriminant validity was met.

Table 3: Heterotrait-Monotrait (HTMT) ratio

	ES	GOI	GPC	GPI	GPL	GPN	GPT
ES							
GOI	0.422						
GPC	0.451	0.113					
GPI	0.346	0.198	0.216				
GPL	0.218	0.205	0.146	0.082			
GPN	0.379	0.099	0.181	0.242	0.155		
GPT	0.506	0.236	0.315	0.134	0.142	0.109	

4.1.2 Measurement Model Assessment of HOC

To assess the measurement model for formative higher-order constructs (HOCs), the statistical significance and relevance of indicator weights, as well as the relationships with convergent validity and indicator collinearity, were evaluated, as proposed by (Sarstedt *et al*., 2021). Assessing formative HOCs requires determining whether there is a strong link between the formatively measured construct and a reflective measure of the same construct (Hair *et al*., 2017). As part of redundancy analysis (Chin & Newsted, 1998) this assessment was suggested, which correlates each formatively stated construct with a different measure of it. According to Cheah et al. (2018), the outcome of the analysis was used to assess how strongly the formative indicators collectively characterize the relevant construct. While performing a redundancy analysis, researchers can assess the formative type of constructs' convergent validity via two methods (Tehseen *et al*., 2020). One approach involves the use of a single global item that encapsulates the formative construct, whereas the other approach involves the use of reflecting measures of the formative construct (multiple item) (Hair *et al*., 2017). The path coefficient quantifies the strength of the relationship between a formative measured construct (serving as an exogenous latent variable) and an endogenous latent variable defined by reflective indicators. This coefficient indicates how effectively the selected formative indicators represent the intended construct. The route coefficient between two latent variables should be at least 0.70. Moreover, the endogenous latent variable's R^2 values ought to be at least 0.50 (Cheah *et al*., 2018). Therefore, to assess the convergent validity of formative HOCs, this study employed a single-item measure. Two distinct single global items (one for green marketing and one for green innovation) were generated to evaluate the convergent validity of the HOCs in this study. Therefore, the path coefficient between the latent variables was 0.731 and 0.782 with 0.535 and 0.612 value of R^2 respectively, for green innovation and green marketing. Hence, the criterion for convergent validity was maintained.

The formative structures can also be assessed by checking for multicollinearity through the variance inflation factor (VIF). Accordingly, the VIF values for each construct were below the cutoff point recommended by (Diamantopoulos & Siguaw, 2006) (see Table 4).

Table 4: Multicollinearity

Indicator	VIF
ES1	2.354
ES10	1.981
ES2	2.381
ES3	2.182
ES4	1.732
ES5	1.935
ES6	2.458
ES7	1.685
ES8	1.718
ES9	2.136
GROI	1.034
GRPC	1.114
GRPI	1.034
GRPL	1.041
GRPN	1.041
GRPT	1.093

One can determine whether formative indicators help shape the construct by applying the bootstrapping technique to examine whether the outer weights in formative measurement models deviate considerably from zero *(Hair et al*., 2017). Additionally, Andreev *et al*. (2009) Andreev et al. (2009) recommends that the relevance and significance of outer weights be used to evaluate formative HOCs. Because this study's HOC components are formative, the researcher used bootstrapping to evaluate the outer weights' discriminant validity of the formative constructs. With a p-value of 0.000, the bootstrapping results in Table 5 show that the outer weights of each construction were significant and relevant.

Table 5: Outer weights

Indicators	Coefficient	Standard Deviation (SD)	T Statistics	P Values
ES1 <- ES	0.124	0.016	7.785	0.000
ES10 <- ES	0.140	0.016	8.873	0.000
ES2 <- ES	0.151	0.014	10.548	0.000
ES3 <- ES	0.129	0.013	9.704	0.000
ES4 <- ES	0.133	0.015	8.662	0.000
ES5 <- ES	0.139	0.013	10.372	0.000
ES6 <- ES	0.148	0.016	9.436	0.000
ES7 <- ES	0.145	0.015	9.437	0.000
ES8 <- ES	0.170	0.018	9.581	0.000
ES9 <- ES	0.126	0.012	10.609	0.000
GROI -> GI	0.709	0.091	7.769	0.000
GRPC -> GM	0.391	0.080	4.911	0.000
GRPI -> GI	0.589	0.098	6.003	0.000
GRPL -> GM	0.168	0.084	1.994	0.046
GRPN -> GM	0.451	0.084	5.381	0.000
GRPT -> GM	0.577	0.085	6.805	0.000

4.2 Structural Model Assessment of HOCs

In assessing the structural model of HOCs, path coefficients, explanatory power (R^2), predictive relevance (Q^2), and effect size (f^2) were evaluated. The path coefficient and its significance level were produced by the researcher by bootstrapping with 5,000 subsamples. The two-tailed test criterion (p-value < 0.05) was used to determine a specific association between variables (see Table 6 and Figure 1). GI was found to have a substantial influence on a firm's environmental sustainability, as indicated by direct relationships ($\beta = 0.681$). This suggests that a single unit change in GI will result in a 68.1% change in a firm's environmental sustainability. Additionally, green marketing (GM) (β = 0.524) had a positive and significant effect on a firm's environmental sustainability. This implies that a 52.5% change in firms' environmental sustainability will result from a single unit change in green marketing. Finally, the relationship between GI and ES was positive and significant (β = 0.205). With respect to the explanatory power, Chin & Newsted (1998) suggested that R^2 values of 0.19, 0.33, and 0.67 indicated a weak, medium, and substantial explanatory power, respectively. Therefore, since the R^2 values of this study were 0.464 (46.4%) for green marketing and 0.462 (46.2%) for environmental sustainability, the explanatory power of the independent variable was moderate (see Table 6).

The other crucial point in structural model assessment is the evaluation of predictive relevance. Therefore, it has been suggested that the value must be greater than zero to show predictive relevance (Hair *et al*., 2019). The predictive relevance value of this study for both green marketing and firms' environmental sustainability (0.451 and 0.299, respectively) exceeds the acceptable limit, encouraging researchers to conclude that our research has substantial predictive ability (Hair *et al*., 2019). Additionally, Cohen's (1988) criteria were taken into consideration when evaluating the effect size of latent variables. He states that an effect is considered small, moderate, or powerful if the effect size value is 0.02, 0.15, or 0.35, respectively. Accordingly, green innovation had a substantial effect on green marketing (f^2 = 0.867), a poor effect on environmental sustainability (f^2), and a comparatively medium effect on environmental sustainability (see Table 6).

Table 6: Explanatory power (R^2), predictive relevance (Q^2), and effect size (f^2)

Predictors	f^2	Outcome	R^2	Q^2
	0.867	Green Marketing	0.464	0.451
Green Innovation	0.042			
		Environmental sustainability	0.462	0.299

4.2.1 Hypothesis Testing: Direct relationships

As revealed by this study, the influence of GI on GM was positive and substantial (β = 0.0.681, t= 14.536, P < 0.000) (see table 7). H1 was approved. Additionally, the substantial impact of GI on ES (β = 0.205, t= 2.647, P < 0.008) led to the acceptance of H2. Furthermore, because

GM has a major effect on ES (β = 0.0.524, t = 8.774, P < 0.000), H3 was approved.

Table 7: Hypothesis testing

Path	Path Coefficient	Standard Deviation (SD)	T-value	P-Values	Decision
GI -> GM	0.681	0.047	14.536*	0.000	Accepted
GI -> ES	0.205	0.077	2.647*	0.008	Accepted
GM -> ES	0.524	0.060	8.774*	0.000	Accepted

4.2.2: Mediating Analysis Results

Mediation analysis was used to assess the indirect effects of GI on ES. It was discovered that GI significantly impacted ES indirectly (see Table 8; β = 0.357, P < 0.000). GI had a substantial overall influence on ES (β = 0.205, P < 0.008), and, when the mediator was included, the effect on ES remained significant (β = 0.562, P < 0.000). This finding demonstrates how GM (H4) mediates the relationship between ES and GI (see Table 8). The variance accounted for calculation findings indicated partial complementary mediation.

VAF = Indirect effect/total effect

VAF = 0.357/0.562 = 0.635 (63.5%)

VAF values of less than 20%, 20% to 80%, and more than 80% are considered to indicate no mediation, partial mediation, and full mediation, respectively, according to (Hair et al., 2014).

Table 8: result of Mediation

Total Effect (GI -> ES)		Direct Effect (GI -> ES)		Indirect Effect (GI -> ES)			
Coefficient	P-Values	Coefficient	P-Values	Hypothesis	Beta Coefficient	T Statistics	P-Values
0.205	0.008	0.562	0.000	H3: G I-> GM -> ENVS	0.357	7.850	0.000

5 DISCUSSION

This study examined four objectives. For the first objective, the researcher assessed the direct effect of GI on the ES of manufacturing firms. The results revealed a considerable influence of GI on firms' ecological sustainability. This result was consistent with the findings of previous studies (Asadi *et al*., 2020; Cui & Wang, 2023; Long *et al*., 2017; Wu *et a*l., 2025). Accordingly, it is acknowledged that the use of GI in the manufacturing process can help conserve resources and protect the environment (Ahmad et al., 2022). Additionally, it is becoming a strategic concern for businesses seeking to improve the environment while increasing profitability and actively addressing the ever-increasing demands on the environment (Hakim, 2020).

The second objective considered the effect of GI on GM, and the results revealed that green marketing was significantly influenced by green innovation. This finding was also consistent with the research outputs of various authors (Harini *et al*., 2020; Nuryakin & Maryati, 2022; Putri *et al*., 2023). GI in GM can manifest in several ways. Among them, creating or modifying a firm's eco-friendly products and services can be communicated through GM. By providing differentiated products, firms can enhance their market position, a strategy supported by GM strategies. GI can also lead firms to focus on innovations in GM strategies.

Evaluating the effect of GM on ES was the third objective of this study. The hypothetical relationship between them showed a significant positive result. Similar to the conclusions of previous researchers, (Akude *et al*., 2025; Alzghoul *et al*., 2024; Braik *et al*., 2023; Fotourehchi *et al*., 2020; Wang & Juo, 2024) the effect of GM on ES was significant. Through promoting and providing environmentally friendly products, firms can reduce pollution, waste, and environmental degradation, and climate change.

Finally, the impact of GM as a mediator between ES and GI was evaluated. The outcome showed that the stated link was partially mediated by GM. The VAF value, which ranged from 20% to 80% (63.5%), was used to identify this job. By employing GM techniques, this study also demonstrates the impact of GI on the ES of manufacturing companies.

Overall, these findings provide empirical evidence in favour of a mediation pathway, showing that GM serves as an essential channel for the ES benefits of green innovation. This relationship highlights how crucial it is for Ethiopian manufacturing companies to integrate marketing and innovation strategies to achieve sustainable industrial development, especially in emerging economies where institutional pressures and resource limitations are significant.

6 CONCLUSION

In the context of Ethiopian manufacturing companies, this study offers empirical support for the idea that GM partially mediates the relationship between ES and green innovation. The findings indicate that GM strategies indirectly improve sustainability performance, even though GI directly enhances ES. Therefore, GM techniques such as environmentally friendly product design, sustainable pricing, green promotion, and green distribution are crucial tools for enhancing the positive environmental effects of innovation initiatives.

The partial mediation implies that unless GI is successfully conveyed and provided through GM, it is insufficient on its own to attain the highest level of ES. As a result, businesses should not only make investments in environmentally friendly processes and technology but also coordinate their marketing plans to promote and showcase these developments. Stronger environmental performance and a business's improved reputation for sustainability in a competitive market can result from this combination.

7 LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

This study had several shortcomings. Hence, future researchers could consider this study's shortcomings to further advance the green literature. Since the primary focus of this study is on manufacturing firms in the Sidama and Southern Ethiopia regions, the researcher encouraged other researchers to test the suggested model in various sectors of the Ethiopian economy, including telecommunications, hospitality, education, and construction. Furthermore, the model could be replicated in subsequent research to conduct a comparative analysis across various subsectors. Another drawback can be reliance solely on quantitative methods. Therefore, it is recommended that future researchers use qualitative and mixed approaches to ascertain which green practices have the greatest effect on environmental sustainability performance, thereby gaining a deeper understanding of these issues. Finally, only one mediator was used in this investigation. However, many constructs could play a mediating role. Thus, future studies should include green organizational culture, environmental knowledge and awareness, green supply chain management, environmental management practices, and stakeholder engagement as mediators of the proposed relationships.

8. IMPLICATIONS

a. Implications for Managers

Managers are cautious in this study that improved environmental performance is not a guarantee of green innovation alone. Effective communication with stakeholders is just as important to success as eco-friendly designs and cleaner operations. Investing in ethical distribution, ecolabelling, sustainable advertising, and responsible pricing are examples of credible green marketing strategies that foster credibility, build trust, and benefit the environment. The results highlight the importance of collaboration among R&D, sustainability, and marketing teams to ensure that breakthroughs are both commercially and environmentally significant. In conclusion, integrating marketing and innovation enhances sustainability engagement and organizational success.

b. Implications for Manufacturing Firms

Industrial companies in developing countries, such as Ethiopia, face increasing pressure to adopt environmentally friendly practices. However, technical innovation alone is not enough; effective green marketing is also essential for genuine environmental progress. Manufacturing firms must take concrete steps to improve communication and promoting of their green initiatives to stakeholders. Investing in reporting, green branding, and certifications, and seeking out government support and incentives to help resource-limited businesses advance sustainability and remain competitive in global supply chains.

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