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Crafting Greener Future - Strengthening Sustainable Environmental Performance of SME Sector Through Green Practices: the Mediating Role of Green Innovation

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Abstract

A growing number of studies show that SMEs are becoming more conscious of the importance of environmental issues. This research delves into how green practices might help small and medium-sized enterprises (SMEs) in Bangladesh improve their environmental performance over the long term. To be more precise, this study intends to investigate the role of green innovation as a mediator between environmentally conscious activities and long-term environmental performance. For research purpose, a standardized questionnaire was circulated among people who belong to SME sector and 403 data were obtained. We have analyzed the acquired data using SmartPLS4 and SPSS. The relationship between the predictor and predicted variables was investigated using Partial Least Squares Structural Equation Modeling (PLS-SEM). Environmental sustainability strategy, green supply chain management, green human resource management, green information technology, all components of green practices—have an immediate effect on sustainable environmental performance, and green innovation both directly affects and mediates the relationship between these two concepts. Industries and government policymakers may learn a lot from this study, which shows that they need to work on methods to improve environmental performance in order to achieve sustainability. Acquiring environmental sustainability can help our nation attain economic prosperity and accomplish three SDGs.

Keywords: green practices; environmental sustainability strategy; green supply chain management; green human resource management; green information technology; sustainable environmental performance; sme sector; environmental sustainability

1. Introduction

In modern era, most countries are concentrating on economical proliferation while understating the environmental enhancement (Zheng et al., 2021). Bangladesh is not an anomaly from this pattern even though nature is both root and escort for the nation. Despite the boons from nature, distinct harms are made such as decimating plants, contaminating water or air for industrial revolution. Thereafter nature also takes vicious vengeance in form of several apocalypses which include inundation, droughts, extravagant heat etc. (Zhixia et al., 2018). As Bangladesh has some perilous environmental threats, firms should necessarily make themselves prepped to these perils. Pursuing green practices in the firms is pivotal for the nation to foster sustainable development and becoming a panoramic economic trajectory (Datta, 2024). In environmental context, "green" indicates those good-natured practices that facilitate protecting the environment and nurture natural assets. The SME sector can be a fitted sector for pursuing green practices. SMEs are the backbone of economy in

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emerging countries which can be portrayed by the employee numbers, operable assets, output sales (Yoshino et al., 2016). SMEs are significant economic strength in developing countries like Bangladesh, contributing more than 40% of the GDP. Its' contribution to economic progression is substantial but adverse environmental deterioration hinders it (Qamruzzaman & Kler, 2023). SMEs impose a direct influence on environment when it comes to the term like consume energy or climate change (Fawcett & Hampton, 2020; Rehman et al., 2022). As emerging nations are expanding their production, their available natural assets are getting downplayed and pollution are getting more widespread (Udoh et al., 2023). So the environmentalists recommended the organizations to adapt green thinking into their productivity. Same concerns have been incorporated into the environmental management literature (Shahzad et al., 2020). It's necessary for SMEs to entail sustainable environmental performance in their workforce to attain environmental sustainability. Awwad Al-Shammari et al. (2022) stated that, the adoption of green ideologies can treat the challenges. Nowadays firms are adopting several steps for improving congruence to attain environmental and financial goals (Perez et al., 2023). Green practices (environmental sustainability strategy, green supply chain management, green human resource management, green IT) may aid to boost the sustainable environmental performance of the firm. Furthermore, green innovation can be a crucial strategy for SMEs to acquire a distinctiveness for long term success (Le and Govindan, 2024).

As per recent data, it can be stated that SME generates 35.41% employment and 48.41% contribution to the GDP growth of Bangladesh (CIPE, 2022). The EPI (Environmental Performance Index) score of Bangladesh is 28.1 out of 100 and as a country it ranks 175 out of 180 countries which indicates the vulnerable condition (EPI, 2024). These findings accentuate the exigency of enhancing sustainable environmental performance in the firms for attaining environmental sustainability and economic progression. Besides that, SMEs stumble to shine because of the definite assets, awareness or conventional thought process. Also, many firms are still insouciant about green practices as they are not fully cognizant of this. However, the knowledge of green practices and green innovation can help them to expand their business by furthering environmental sustainability.

As ecological deterioration is a generic concern right now, stakeholders are cognizant of lessening climatic vulnerabilities through a sustainable model. The inclusion of green innovation can facilitate sustainable environmental performance of the firms. Green innovation can provide high grade results in form of electing green raw materials, using water, natural assets efficiently, settlement of the garbage etc. (Ullah et al., 2022). There are segregated studies where isolated green practices settle environmental outcomes but very few studies encompass all these green practices together with the mediation role of green innovation. The intention of the study is to acquaint; how to attain environmental sustainability and economic progression by improving environmental performance over the long-term.

In today's world, economic performance is not the only thing to be considered but attaining environmental performance is also vital (Qamruzzaman & Kler, 2023) . As global marketplace prefers eco-friendly initiatives, SMEs need to be foresighted for boosting productivity to remain dynamic. Green innovation for SMEs can elevate environmental performance by managing resources or alleviating pollution which facilitates environmental responsibility (Lutfi et al., 2023). This study can amplify environmental knowledge of firm owners as well as employees. Our study can pitch in accomplishing 3 Sustainable Development Goals (SDGs) among the 17 SDGs and they are: Industry, Innovation and Infrastructure (SDG9), Responsible Consumption and Production (SDG12) and also Climate Action (SDG13).

The elementary question of the research is how we may enhance sustainable environmental performance in SMEs through green practices so that Bangladesh can fulfill the commitment to SDG goals and the economy can progress.

Against the backdrop of research questions, the rudimentary objective of the study is to render an understanding how a firm can enrich sustainable environmental performance through green practices.

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2. Literature Review and Development of Constructs

2.1. Green Practices (GP)

Businesses across the globe implement green practices intentionally with a view to lessening environmental impacts for a sustainable universe (Miroshnychenko et al., 2017). The methods and applications which are implemented by businesses to protect environment can be denoted as green practices (Govindan et al., 2015). The concept of "Green Practices" is implemented in four domains:

Firstly, A firm's strategic orientation sets internal goals and formal policies that support environmental stewardship (Nijhof et al., 2019). Execution of those strategies that foster environmental sustainability can influence firm's overall performance positively (Good et al., 2023a).

Secondly, Green Supply Chain Management can be depicted as, assimilation of ecological consideration into supply chain management (Miroshnychenko et al., 2017). Green Supply Chain Management (GSCM) implements strategic intent from purchasing and design to production, packaging, distribution, and disposal (Younis et al., 2016). Managerial obligation to execute green practices may be attained by the enhancement of eco-practices and operational credentials which heaves economic performance (P. J. Singh et al., 2013).

Thirdly, Green HRM is one of those notion which transpose HRM exercises into green practices (Farzana, 2020). Green Human Resource Management (GHRM) incorporates environmental ideals into hiring, training, performance evaluation, and employee engagement (Leidner et al., 2019).

Fourthly, Green IT is one of the incarnations of green business practices (Brooks et al., 2012). Green Information Technology (Green IT or GIT) helps organizations use energy-efficient systems, sustainably manage e-waste, and optimize digital infrastructure to reduce resource consumption and carbon emissions (Dahmani, 2024).

2.1.1. Environmental Sustainability Strategy (ESS)

Environmental sustainability strategy can be defined as an enterprise's strategic adherence to carry out its business functions in a manner that reduce environmental harm, and foster environmental responsibility. This strategy includes specific functional behaviors, environmental consciousness, and organization's commitment to consolidating sustainability to its principles and long-term goals (Rehman et al., 2022). Further elaboration states that ESS encompasses strategies focused at pollution minimization, waste reduction, green technology incorporation, and eco-friendly product creations (Christmann, 2000). When firms enforce an ESS, they can minimize the negative consequences of their activities on nature. Moreover, they may reinforce their competitive situation as well (Good et al., 2023).

2.1.2. Green Supply Chain Management (GSCM)

The strategy that bring the stream of materials within production chain by diverse stages like procurement, manufacturing, final product promotion to safeguard environment through shielding natural possessions as well as decreasing climate change is Green Supply Chain Management (Sahoo & Vijayvargy, 2020). GSCM can be referred as gush of public along with accountable linkage between suppliers and allies (Khoury et al., 2022). GSCM turned into the epicenter of attention from SMEs to large ones for industrial compulsion and environmental guidelines (N. U. Khan et al., 2021). Multiple prospects are accessible for decoking inventions besides generating green products, for which GSCM might be the resolution.

2.1.3. Green Human Resource Management (GHRM)

Green Human Resource Management (GHRM) denotes incorporation of green principles into HR practices. It can be done by evolving workforces' ecological skills, inspiring active involvement in green practices, and harmonizing HR activities with enterprises sustainable environmental goals (Ahmad et al., 2023). Renwick et al. (2013) illustrated that GHRM describes the environmental dimension of HRM by focusing on sustainable practices within the enterprise. Niazi et al. (2023)

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stated that development of GHRM from HRM encompasses additional extension including green competencies, green possibilities towards workforce.

2.1.4. Green Information Technology (GIT)

Mallawarachchi and Karunasena (2012) illustrated that transmission of electronic waste happens almost in every countries, which marks organizational inadequate capability of handling e-wastes. GIT represents as sustainable solution of redesigning IT infrastructure (Energy-efficient IT setups, Cloud Computing, Virtualization, ERP Systems etc.) to curb firm's carbon footprint as well as environmental effect (Arulrajah & Senthilnathan, 2020; Gimenez et al., 2015). GIT denotes usage of technology driven offerings by means of different steps; planning, manufacturing, functioning and discarding. Such technology driven offerings had better aim to guard humankind as well as environment (Molla et al., 2011).

2.2. Green Innovation (GI)

Green innovation (GI) refers to such practices that embrace environmentally-friendly technique in product design and production to mitigate environmental harm. These practices purpose is to reduce emission, use resources efficiently, and promote sustainability goals (Owusu et al., 2024). Chen et al. (2006) describes GI as the innovation in technologies related to goods and processes that consists waste recycling, pollution reduction, and energy-efficiency. It is a system of doing things in organization in response of ecological degradation resulting from unethical business operations. GI practices are gaining admiration as a consequence of the interest towards businesses, shareholders as well as environment (Afridi et al., 2023). Ecological sustainability is considered as a leading policy to uplift GI which fulfills consumer demand (Albino et al., 2009).

2.3. Sustainable Environmental Performance

Sustainable environmental performance refers to firm's capability to lessen its ecological footprint through environmentally-responsible actions (Wang & Bian, 2022). Enterprises can minimize its environmental footprint by lowering emission and waste while strengthening business proficiency and financial success (Bhat et al., 2024). Sustainable environmental performance of SMEs in Bangladesh are usually assessed through parameters such as emission minimization, energy-saving, waste management, and pollution mitigation (Hasan et al., 2021). Tan et al. (2022) stated that Bangladeshi SMEs that harmonize their environmental strategies with green practices are likely to show noticeable progress in sustainable environmental performance.

3. Theory and Hypotheses Development

Nowadays sustainability concept is a precedence for the businesses as the consciousness of assimilating green into the corporate plan has acquired a big thrust (Aftab et al., 2023). Theoretical statements of the study denote that, presumed association between the variables in this study is pretty forthright and also positive. Our study encourages linkage between green practices and sustainable environmental performance of SME sector bolstered by various theoretical framework. One of the vital theory is Resource-Based-View (RBV) (Barney, 1991). This theory indicates that accession to the firm's resources and abilities has a great magnitude to attain competitive benefits which facilitate the firm's performance. Corresponding to RBV theory, distinct resources has varied proficiency which aid the firm to obtain improved outcomes (Khan et al., 2023). As SMEs of Bangladesh are mostly relied on natural resources, NRDT theory (Natural Resource Dependency Theory) can be suitable for this study. Enterprises depending on natural resources can cultivate environment friendly initiatives which will freeze out the declination of nature and assure permanence of the firm (Ali et al., 2024). In our study; we are employing AMO theory (Ability-Motivation-Opportunity) evolved by (Appelbaum, 2000). AMO theory aids workers by progressing environmental literacy which vouches firm's green goals (Wen et al., 2021). Beck and Ajzen (1991) proposed the TPB (Theory of Planned

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Behavior) that addresses the factors which affects the behavior of workers. Employees behavior is one of the most substantial factors as employees determination to adopt green practices can ameliorate sustainable environmental performance.

3.1. Green Practices and Sustainable Environmental Performance

3.1.1. Environmental Sustainability Strategy and Sustainable Environmental Performance

Environmental Sustainability Strategy (ESS) considerably improves ecological outcomes by incorporating sustainable practices, knowledge, commitment into organizational strategy. This affirms a direct positive relationship allowing enterprises to minimize waste, emissions, and resource usage (Rehman et al., 2022). Further study found that inclusion of environmental sustainable strategies in enterprises pave the way to substantial development on sustainable environmental performance (Al Doghan et al., 2022).

3.1.2. Green SCM and Sustainable Environmental Performance

The incorporation of green SCM initiatives allow manufacturing enterprises to reduce environmental footprint while adhering to regulatory and stakeholders' expectations. So, GSCM is vital for the enhancement of sustainable environmental performance by fostering environmentally friendly practices throughout supply chain (Abu Seman et al., 2019). Al-Sheyadi et al. (2019) demonstrated that when organizations adopt GSCM practices such as environmental management systems, eco-design, and external collaboration, they achieve greater reductions in emission and waste which mitigate ecological footprint.

3.1.3. Green HRM and Sustainable Environmental Performance

Wen et al. (2021) illustrated that green HRM practices positively influence ecological stewardship in SMEs by refining employee eco-friendly behavior, which in turn increases long-term environmental performance. Several studies show that GHRM practices meaningfully improve sustainable environmental performance by encouraging employee engagement and environmentally friendly behavior (Nisar et al., 2024). Kuo et al. (2022) suggested that GHRM initiatives (green recruitment and training, green performance appraisal, green compensation) positively impact the environmental performance of the enterprise for long-term.

3.1.4. Green IT and Sustainable Environmental Performance

Green IT delivers long-term environmental performance by improving energy efficiency and minimizing emissions through efficient IT system. Gimenez et al. (2015) discovered that GIT has a substantial positive impact on environmental outcomes. Hameed et al. (2023) stated that GIT plays significant role in improving environmental performance of SMEs by facilitating the adoption of eco-friendly technologies and sustainable practices. This engagement directly amplifies sustainable environmental performance via optimized, accountable IT usage and disposal (Ojo & Fauzi, 2020).

H1. *Green practices positively impact sustainable environmental performance of SME sector.*

3.2. Green Innovation and Sustainable Environmental Performance

Polas et al. (2023) illustrated that green innovation benefits the environmental sustainability through modern methods, procedures, mechanisms, and merchandises. Aftab et al. (2023) discovered that GI substantially boosts ecological outcome by fostering cleaner manufacturing processes and lowering harmful emissions. GI is increasingly viewed as a strategic driver of both sustainability and efficiency. It goes beyond compliance, integrating eco-friendly practices into core operations. This positions GI as a vital enabler of improved sustainable environmental performance (Kuo et al., 2022).

H2. *Green innovation positively impacts sustainable environmental performance of SME sector.*

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3.3. Mediating Effect of Green Innovation

ESS delivers a comprehensive framework that leads organizational efforts toward environmental responsibility. An explicit and forward looking ESS frequently promote culture that supports research, development, and GI (Walsh & Dodds, 2017). Albino et al. (2009) illustrated that this GI may serve as the mediator by which ESS contributes on long-term environmental performance. Empirical findings reveal that GI considerably mediates the relationship between GSCM and sustainable environmental performance. The study demonstrates GSCM enhance GI, which positively influence environmental outcome (Abu Seman et al., 2019). Aftab et al. (2023) stated that GI acts as an instrumental channel through which GHRM improves enterprises ecological performance. The mediating effect emphasizes that the impact of GHRM on environmental outcomes substantially strengthen when enterprises actively strive for GI. GIT consists of digital tools and platforms that support ecologically sustainable practices, such as energy-efficient data centers and monitoring systems. Several studies found that these technologies foster real-time data collection, process optimization, and innovation in resource consumption (Murugesan, 2008). Thus, GIT may stimulate sustainable environmental performance by mediating GI. Hence, an extensive inspection of the previous literature suggests that GI significantly mediates the enhancement of GP on EP. Therefore, the following hypothesis has been proposed:

H3. *Green innovation mediates the relationship between green practices and sustainable environmental performance of SME sector.*

On the basis of the literature review, a positive correlation between green practices (ESS, GSCM, GHRM, GIT) and sustainable environmental performance of SME sector can be expected which is accelerated by the mediating effect of GI. This study develops this following conceptual framework:

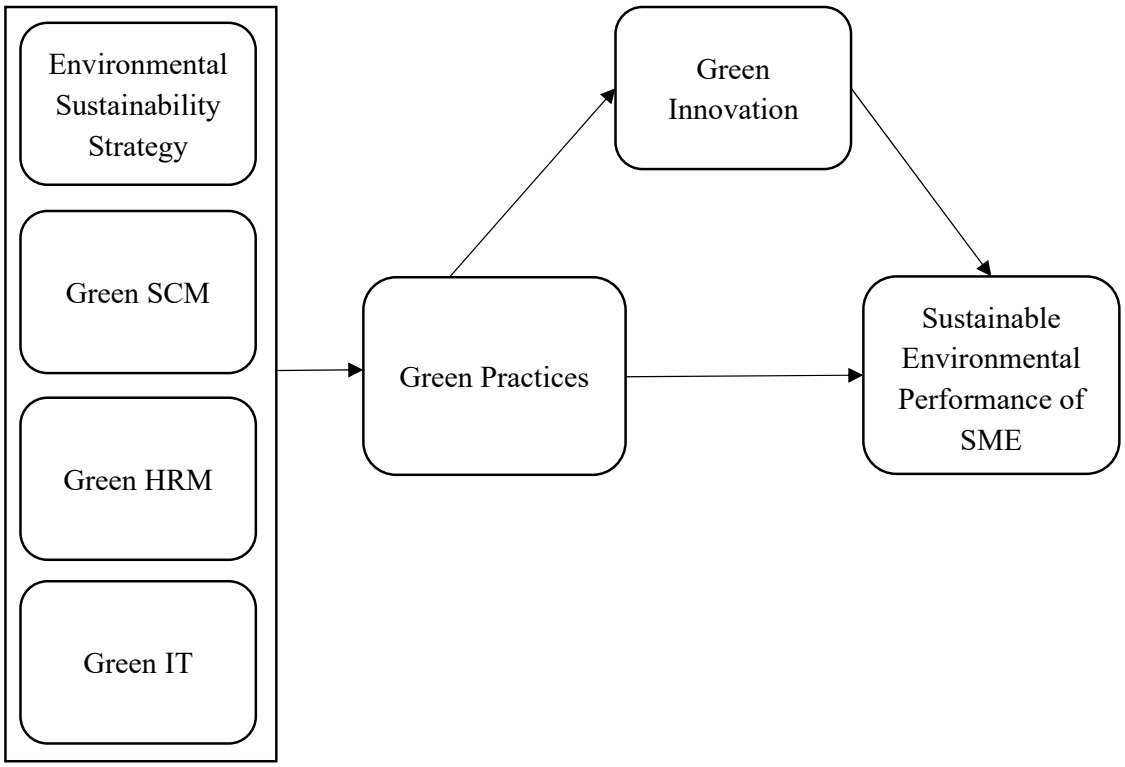

Figure 1. Conceptual Framework (Source(s): Authors' own work).

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4. Research Methodology

4.1. Research Design

With a view to get bias free, credible outcomes from the quantitative study which accumulate essentials of research plan in an organized manner can be stated as research design (Trochim et al., 2017). Research questions, objectives of the study, data collection methods, interpretation of results, expected findings should be aligned with research design. This study will follow quantitative research design.

4.2. Data Sampling

In order to get authentic perception regrading sustainable environmental performance of SME sector in Bangladesh, people associated with different types of SMEs were certainly selected as per study's sample frame. A well-planned questionnaire was circulated among SMEs of diverse industries (Textiles, Agro firms, Fish hatcheries, Boutiques, Handicrafts, IT firms, Solar panel manufacturers, Medium sized restaurants, Food carts, Travel agencies etc.) for data collection. Questionnaires has been disseminated amid respondents to utilize non-probability purposive sampling technique**.** Purposive sampling method is used as it entails collecting responses from individuals who are likely to yield the most relevant responses (Campbell et al., 2020). From 403 respondents of SME, responses were obtained. Black and Babin (2019) stated the ten times rule that the minutest sample size needs to be 10 fold of the items for the inquisition of the research. For our study, we harnessed 32 items; so our sample size should not be less than 320. From the SME sector, we managed 403 data that considers adequate grounded on the settled rule which assures a rational analysis of ensuring sustainable environmental performance.

4.3. Measurement Instrument

For executing the research objectives avowed in this study, a multi-item measuring approach was operated to accumulate data for distinct construct. Prior researches treated as a cornerstone for arranging structured survey questionnaire. In those researches, researchers used 5-point Likert scale where they calculated the response from "1= strongly disagree" to "5= strongly agree. In order to evaluate ESS, 5 items were chosen from prior studies (Rehman et al., 2022; Ullah et al., 2022)**.** With a view to evaluating GSCM, 5 items were chosen from prior studies (Umar et al., 2021). Then to evaluate GHRM, 5 items were chosen from prior studies (S. K. Singh et al., 2020; Wen et al., 2021). Additionally, to evaluate GIT, 5 items were chosen from prior studies (Arulrajah & Senthilnathan, 2020)**.** Furthermore, to evaluate the mediating construct, GI, 6 items were chosen from prior studies (Bhat et al., 2024; S. K. Singh et al., 2020). Last of all, to evaluate the outcome construct, sustainable environmental performance, 6 items were chosen from prior studies (Rehman et al., 2022; S. K. Singh et al., 2020; Zaid et al., 2018).

4.4. Data Analysis Techniques

To analyze the data accumulated from the elected entities, the aid of statistical tools: SmartPLS4 and SPSS25 has been taken. In order to transform data into descriptive statistics construction, SPSS has been considered (Hair et al., 2011). PLS-SEM has been used to estimate and analyze the credibility as well as reliability of the hypothesized relationships between independent and dependent variables depicted in conceptual framework. Data analysis part is divided into two steps by following the suggestion of (Anderson & Gerbing,1988). At first, measurement model was conducted to assess the credibility and reliability of constructs. Then the precision of the hypothesis was determined by harnessing a structural model (hypothesis testing) to administer factual evidence either to accept the theory or to generate contradiction.

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5. Data Analysis and Results

5.1. Respondent's Profile

Table 1 summarizes the demographic profile of surveyed respondents and the descriptions used in this research. The table represents that major respondents (47.9%) belong to the age group (25-34). Among the respondents of the study, male respondents (66.5%) are nearly two times higher than female ones (33.5%). From the demographic results it can be seen that most of the respondents have completed their graduation (31%), the second highest educational qualification is post-graduation (26.3%). In this study, major responses have come from job holders (38.5%) who work in different SMEs; service sector of SME (27.8%) has exhibited the second largest response; then third highest response is found from people who are involved in business (24.1%); after that a small amount of response has come from students (with part-time job and business) (9.7%). Out of all respondents, majority of respondents have more than 6 years of working experience (24.8%) in SME sector of Bangladesh.

Table 1. Demographic Profile of the Respondents.

Demographic Variable	Category	Frequency (n=403)	Percent (%)
Age	18–24	78	19.4
	25–34	193	47.9
	35–44	64	15.9
	45–54	40	9.9
	55 and above	28	6.9
Gender	Female	135	33.5
	Male	268	66.5
Education	SSC	20	5.0
	HSC	25	6.2
	Diploma	49	12.2
	Graduation	125	31.0
	Graduation with Professional Degree	38	9.4
	Post-Graduation	106	26.3
	Post-Graduation with Professional Degree	40	9.9
Occupational Status	Business	97	24.1
	Job Holder	155	38.5
	Service Sector of SME	112	27.8
	Student (with part-time job/business)	39	9.7
Years of Experience	Less than 1 year	63	15.6
	1–2 years	85	21.1
	2–3 years	68	16.9
	3–4 years	33	8.2
	4–5 years	28	6.9
	5–6 years	26	6.5
	More than 6 years	100	24.8

Source(s): Authors' own work.

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5.2. Measurement Model for First-Order Constructs

5.2.1. Item Loading, Composite Reliability, and Convergent Validity for First-Order Constructs

Factor loading indicates how strongly each item in the correlation matrix is associated with a specific principal component. Table 2 displays the factor loading, where the loading values are adequate for representing the respective constructs. To establish the construct reliability and convergent validity, several statistical measures were performed, including factor loading, composite reliability (CR), and average variance extract (AVE). Hair et al. (2011) illustrated that an AVE value above 0.50 points to the acceptable level of convergent validity. Since the AVE values for all the measurement constructs used in this study transcend 0.50 threshold, the constructs illustrate sufficient convergent validity (Hair et al., 2019; Henseler et al., 2014). The CR values for the constructs in this study, ranging from 0.818 to 0.862, are well above the baseline of 0.70, as recommended by Hair et al. (2019). This reflects that each latent construct is consistently represented by its corresponding measurement items.

Table 2. Item Loading Value, Composite Reliability, and Convergent Validity of First-Order Constructs.

Constructs	Items	Loading Value	CR	AVE
Environmental Sustainability Strategy	ESS1	0.789	0.862	0.610
	ESS2	0.759		
	ESS3	0.822		
	ESS5	0.753		
Green SCM	GSCM1	0.753	0.830	0.550
	GSCM2	0.716		
	GSCM3	0.764		
	GSCM5	0.732		
Green HRM	GHRM1	0.721	0.818	0.601
	GHRM2	0.827		
	GHRM4	0.775		
Green IT	GIT3	0.756	0.828	0.617
	GIT4	0.800		
	GIT5	0.800		
Green Innovation	GI1	0.751	0.856	0.597
	GI2	0.760		
	GI3	0.815		
	GI4	0.763		
Sustainable environmental performance of SME	EP2	0.769	0.853	0.592
	EP3	0.799		
	EP4	0.771		
	EP6	0.737		

Source(s): Authors' own work.

5.2.2. Discriminant Validity for First-Order Constructs

Following the evaluation of the convergent validity and reliability, the discriminant validity of the constructs was assessed. Discriminant validity examines the extent to which the constructs in the

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study are distinct from one another. To confirm that the latent variables are distinct and free from collinearity, we applied two approaches: the Fornell-Larcker Test and the HTMT ratio.

As shown in Table 3, the square root of AVE (diagonal values) is greater than the inter-construct correlations, suggesting no significant concerns regarding discriminant validity. This verifies that all latent variables are empirically distinct from one another (Fornell & Larcker, 1981).

Table 3. Fornell and Larcker Test for First-Order Constructs.

	ESS	GSCM	GHRM	GIT	GI	EP
ESS	**0.781**					
GSCM	0.585	**0.741**				
GHRM	0.505	0.605	**0.775**			
GIT	0.548	0.549	0.559	**0.785**		
GI	0.540	0.555	0.537	0.547	**0.773**	
EP	0.559	0.486	0.466	0.547	0.570	**0.769**

Source(s): Authors' own work.

Additionally, the study executed the HTMT ratio (Table 4), which is regarded as a more comprehensive method for measuring the discriminant validity (Henseler et al., 2014). In order to achieve HTMT values below the recommended threshold 0.90, as suggested by Henseler et al. (2015). Following this adjustment, the HTMT ratios for all measurement variables in the study were found to be below the recommended threshold of 0.90, it can be determined that the constructs demonstrate sufficient discriminant validity.

Table 4. Heterotrait-monotrait (HTMT) Ratio for First-Order Constructs.

	ESS	GSCM	GHRM	GIT	GI	EP
ESS						
GSCM	0.774					
GHRM	0.695	0.871				
GIT	0.745	0.776	0.819			
GI	0.686	0.738	0.740	0.746		
EP	0.710	0.645	0.641	0.743	0.725	

Source(s): Authors' own work.

5.3. Measurement Model for Second-Order Constructs

5.3.1. Composite Reliability and Convergent Validity for Second-Order Constructs

The second order construct, like the first order constructs, satisfies the requirements for convergent validity and reliability. Table 5 reflects that the CR value of 0.890 and AVE of 0.669 both surpass the acceptable thresholds, thereby affirming the construct's validity is rational.

Table 5. Composite Reliability and Convergent Validity of Second-Order Constructs.

	Constructs	Loading Value	CR	AVE
GP	ESS	0.823	0.890	0.669
	GSCM	0.808		
	GHRM	0.816		
	GIT	0.836		

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Source(s): Authors' own work.

5.3.2. Discriminant Validity for Second-Order Constructs.

Furthermore, the results displayed in Tables 6 and 7 show that the discriminant validity of GP fulfill the required threshold, affirming its adequacy as a higher order construct within the structural model.

Table 6. Fornell-Larcker Test of Second-Order Constructs.

	GP	GI	EP
GP	**0.818**		
GI	0.666	**0.773**	
EP	0.631	0.569	**0.770**

Source(s): Authors' own work.

Table 7. Heterotrait-monotrait (HTMT) Ratio of Second-Order Constructs.

	GP	GI	EP
GP			
GI	0.826		
EP	0.778	0.725	

Source(s): Authors' own work.

5.4. Explanatory Power of the Model

The R^2 value, or the coefficient of determination, expresses the proportion of variance in the endogenous variables that is considered by the exogenous variables in the model. Henseler et al. (2014) stated that R^2 values of 0.75, 0.50, and 0.25 point to substantial, moderate, and weak levels of predictive power, respectively. In the current study, the model generates an R^2 value of 0.438 (Table 8), indicating that GP with GI as a mediator, explain 43.8% of the variance in EP. This indicates a moderate level explanatory power of the model.

Table 8. Results of R^2.

	R-square	R-square adjusted
EP	0.438	0.435
GI	0.444	0.443

Source(s): Authors' own work.

5.5. Structural Model

5.5.1. Results of Direct Path Analysis

A structural model was developed based on the relationships outlined in the research framework of this study. The relationships between the exogenous and endogenous variables were examined through the path coefficients (β), T statistics, and *p* values. A bootstrap sample was performed, involving 403 cases and 5000 resamples. The significance of *p*-value influences whether the authors' proposed hypotheses are accepted or rejected. The hypotheses were tested at a significant level of $p < 0.05$. The findings show that all the hypotheses are statistically significant. H1 (GP → EP) exhibit a significant positive relationship between GP and EP, with $\beta = 0.452$, $t = 5.914$, and $p < .01$. Again, H2 (GI → EP) with $\beta = 0.268$, $t = 3.356$, and $p < .01$ reveals GI is positively related to EP and the result is statistically significant at $p < 0.01$ (Table 9).

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Table 9. Results of direct path analysis.

Hypotheses	Path	B	STDEV	T statistics	*p* values	Results
H1	GP → EP	0.452	0.076	5.914	0.000	Supported
H2	GI → EP	0.268	0.080	3.356	0.001	Supported

Source(s): Authors' own work.

5.5.2. Results of Indirect Path Analysis

The mediating role of GI was evaluated by analyzing the specific indirect effects within the model. The analysis examined whether GI acts as a mediator in the relationship between GP and EP. The results related to H3 (GP → GI → EP; β = 0.179, t = 3.105, p < .01) substantiate that GI plays a significant mediating role in the relationship between GP and EP. This indicates that GP enhances EP not only through a direct path but also indirectly via its positive impact on GI, which in turn contributes to EP (Table 10).

Table 10. Results of specific indirect effect.

Hypothesis	Path	B	STDEV	T statistics	P values	Result
H3	GP → GI → EP	0.179	0.058	3.105	0.002	Supported

Source(s): Authors' own work.

Figure 2 demonstrates the hypotheses results, indicating the path coefficient and significance level, alongside the explanatory power of the model.

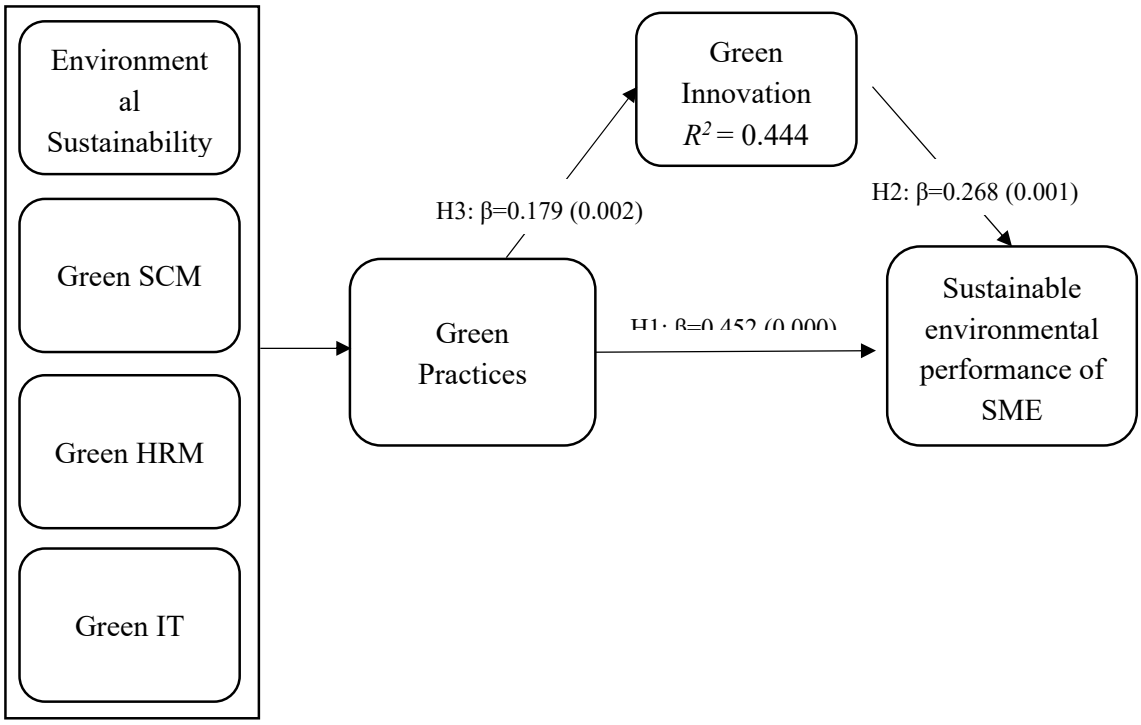

Figure 2. Results of path coefficient with *p*-value (Source(s): Authors' own work).

6. Discussion on Findings

Notwithstanding expansive research on the relationship between ESS, GSCM, GHRM, GIT and sustainable environmental performance; there are very few studies have incorporated all the green

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practices together. Extensive studies on segregated green practices yielded eclectic findings on sustainable environmental performance and missed to encompass a comprehensive outlook. Our findings portray that, the unification of GP is a combined competency and the influence on sustainable environmental performance is more grasped when distinct elements of GP are considered as a single construct. Shah and Ward (2003) stated that a package of resources (rather than a segregated resource) cultivated in a firm can make an organization more dynamic and provide competitive benefits. Intermingling of distinct environmental actions expand more value which surpass the total value acquired from cultivating these actions individually (Al-Sheyadi et al., 2019). This study probes the mechanism that SME sector can thrive sustainable environmental performance through GP. In H1; we can see that, there is a positive correlation between GP and EP (β value= 0.452, *p* value= 0.000). In some studies, ESS, GSCM, GHRM and GIT separately impacts environmental outcomes positively (Acquah et al., 2020; Lunardi et al., 2015; Rehman et al., 2022). Correspondingly in some other studies, we found that, isolated GP such as GHRM has an insignificant impact on environmental outcome (Niazi et al., 2023). This shows a varied outcome on sustainable environmental performance when isolated elements are counted. But as per our findings; when we consider all the elements as a single construct and amalgamate them in a firm, GP positively impact sustainable environmental performance and create more holistic view. As per our findings; if a firm prefers interconnection of all the environmental actions, they can attain robust advantages which may steer them to economic success as well as environmental sustainability. Besides that, it will encourage lessening of waste and efficient use of the resources which directly aligns with the SDG 12.

Regarding H2, GI favorably impacts EP (β value= 0.268, *p* value= 0.001). GI statistically impacts environmental performance significantly (Awwad Al-Shammari et al.,2022; Hussain et al.,2022). Today's customers lean towards those businesses which promote sustainability. Nonetheless, businesses which concentrate on GI can secure environmental performance for the long period and motivate customers (Yousaf, 2021). If GI gets encouraged; industry will be facilitated by technological enhancement and environmental infrastructure which aligns with SDG 9.

The study also ascertains that GI can be a vital mediator between GP and EP. According to H3, it can be stated that GI positively mediates the relation between GP and EP(β value = 0.179, *p* value = 0.002). This result is corresponding to previous result whereas GI works as a perfect mediator between GSCM, GHRM and environmental performance (Aftab et al., 2023; N. U. Khan et al., 2021). Green practices with the mediation of GI can downsize emissions like depleting carbon footprint which correspond to climate action mollification (SDG 13).

Integrating all the elements together, GP can play a pivotal role in adapting EP in the firms (Table 11).

Table 11. Summary of Hypothesis Outcomes and Behavioral Implications.

Construct	Direct Effect on EP	Mediated via GI	Implications
Green practices	✔ Significant	✔ Significant	Incorporating all the elements (ESS, GSCM, GHRM, GIT) together in firms propel EP forthrightly
Green Innovation	✔ Significant	-	Performs as it correlates between GP and EP

Source(s): Authors' own work.

7. Implications and Conclusions

7.1. Practical Implications

This study highlights incorporating green practices for long term success of organizations. Embracing green practices such as ESS, GSCM, GHRM, GIT; an organization can be more efficient in

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attaining sustainability. According to our research, assimilating ESS to organizational objectives can enrich firm's performance significantly. Thereafter, if SMEs want to do the part for environment, they can adopt GSCM practices such as environmental packaging, reducing use of hazardous materials etc.

Additionally, firms can assimilate GHRM practices and policies to the green practices to attain operational efficacy (Acquah et al., 2020). Also our findings from the research denotes that, employee's satisfaction and motivation are prominent to secure environmental success.

Furthermore, employees must be conscious of green technologies and services. The higher the firm modernizes their effort and search out green services, the higher GIT gets executed in the firm (Lunardi et al., 2015). In addition, a GI-based strategy can significantly increase sustainable environmental performance (Awwad Al-Shammari et al., 2022). Our finding denotes that, integration of GI as a mediator positively ameliorates sustainable environmental performance by linking green practices. This holistic approach can boost environmental sustainability, economic success and employee productivity of firms.

7.2. Policy Implications

The authority should make policies to accomplish organizational objectives. Thus the policies should be made by policy makers like this way; how they can lessen waste, deplete pollution etc. Adopting these policies will help to enrich the reputation of the firm. Government should take steps to assure environmental performance in the SMEs for long-term. The study's excellent result inspire researchers, organizations, and the government to analyze sustainable environmental performance using green practices and green innovation.

7.3. Conclusions

From our study, the correlation between green practices and sustainable environmental performance is very strong and green innovation positively mediates the relation between them. The established four theories explain how green practices enhance environmental outcomes and how green innovation acts as a mediator. The study encourages that SMEs of our country should engage themselves in green practices and should take green innovation in their strategy. By adopting multifaceted green strategies which include all these elements, SME sector of Bangladesh may be capable of building more vigorous and more eco-friendly stand for success which will elevate global market attraction and also local business credibility.

8. Limitations and Future Research Directions

Despite the contribution and implications, this study contains some limitation which can be completed in future studies. Firstly, it wasn't possible to cover all the SMEs as the sector is so large. Future researchers can acquire data from other industries rather than SMEs and compare diversity. Also this research didn't ascribe other probable mediators such as green capability. Researchers will be facilitated by more knowledge of the interrelated nature of the green practices and sustainability performance and firms will get benefit to become more environmentally aware.

Appendix A

Table A1. Measurement Items.

Items	**Constructs and Questionnaires**
Environmental Sustainability Strategy *(Rehman* et al.*, 2022; Ullah* et al.*, 2022)*	
ESS1	Our business should integrate environmental issues into strategic planning process.

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ESS2	Our business believes quality which includes reducing the environmental impact of products and processes.
ESS3	Sustainability is an integral part of our business plans and operations.
ESS4	Our business is knowledgeable about climate change.
ESS5	Our commitment to environment will allow us to gain more customers.
Green Supply Chain Management *(Umar* et al.*, 2021)*	
GSCM1	Our business should ensure suppliers meet their environmental objectives.
GSCM2	Suppliers should require utilizing environmental packaging, i.e., degradable and harmless.
GSCM3	Suppliers should design their products that lessens the utilization of materials or energy.
GSCM4	I believe, decreasing toxic and hazardous chemicals in manufacturing process is important.
GSCM5	Our business should encourage cross-function cooperation for environmental improvement.
Green Human Resource Management *(S. K. Singh* et al.*, 2020; Wen* et al.*, 2021)*	
GHRM1	Job positions of our business should demand employees who have knowledge about environmental management.
GHRM2	Our business would love to hire employees who have environmental knowledge.
GHRM3	Company should set green goals for employees.
GHRM4	Training should be provided to promote green values, knowledge and skills to improve understanding of environmental protection.
GHRM5	Employee should get reward for acquiring specific environmental competencies.
Green IT *(Arulrajah & Senthilnathan, 2020)*	
GIT1	Our business uses paperless systems (e.g: digital invoices) which reduce waste and cost.
GIT2	Our business should use energy efficient computers and devices for lower power consumption.
GIT3	I believe E-waste should be recycled to reduce environmental pressure.
GIT4	I believe IT systems improve service efficiency, reducing physical resource usage.
GIT5	Our business should use energy-efficient networks as there is high efficiency in energy utilization.
Green Innovation *(Bhat* et al.*, 2024; S. K. Singh* et al.*, 2020)*	
GI1	The company should select environment friendly materials that produce a lower amount of pollution and consume low energy.
GI2	I believe our company should invest more in R&D to produce quality eco-friendly

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	products.
GI3	Our company's manufacturing process should effectively reduce hazardous substance or waste.
GI4	The company's production process should be operationalized to reduce emissions and the negative effects on ecology.
GI5	The manufacturing process of the company should reduce the consumption of water, electricity, coal or oil.
GI6	Our business should recycle their waste before discharging it.
Sustainable environmental performance *(Rehman* et al.*, 2022; S. K. Singh* et al.*, 2020; Zaid* et al.*, 2018)*	
EP1	Our business should minimize its consumption of resources (raw materials, water, and energy).
EP2	Our business believes in protecting biodiversity and protected areas.
EP3	Our business should encourage lower discharge of noxious chemicals into the air and water.
EP4	Our business should minimize residual materials.
EP5	I believe environmental activities can significantly reduce overall costs of the business.
EP6	I believe sustainable environmental performance will improve reputation of my company.

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