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The Effect of Green Strategy on Environmental Performance via Green Supply Chain Management Practices: Does Procurement Ethics Interact?

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ABSTRACT

Green supply chain management practices are gaining enormous attention from academics and practitioners. The global strategy to reduce the negative effect on the environment reinforces manufacturing industries to practice Green Supply Chain Management (GSCM) in their operations. This paper aimsto investigate the effect of GSCM practices on environmental performance. It futher examines the mediating effect of GSCM practices in the relationship between green strategy, environmental management, green procurement, and environmental performance. In addition, this study assesses the role of procurement ethics in GSCM practices and environmental performance. A structured questionnaire with a five-point Likert scale was used to gather data from the textile garments sector in Bangladesh. The PLS-SEM technique was adopted to analyze 238 survey data. The findings demonstrate the significant direct and indirect effects of GSCM practices on environmental performance. Further, procurement ethics determine the level of relationship between GSCM practices and environmental performance. The results add to the existing pool of knowledge relevant to GSCM practices and environmental performance, particularly concerning the mediating role played by GSCM practices. Besides, procurement ethics supplement the effect of GSCM on environmental performance, which significantly contributes to the literature. Believably, the findings will facilitate the manufacturing industry and can be used as a strategic instrument for adopting GSCM practices.

Keywords: *environmental performance, green strategy, green supply chain management (gscm), internal environmental management, textile and garment sector*

1. INTRODUCTION

Organizations in quest of improving their environmental performance must demonstrate a commitment to sustainability, and in particular to green supply chain management (GSCM), given the dire consequences that pollution is currently causing to our planet (Wiredu *et al*., 2024). Hence, GSCM practices are indispensable to accomplishing environmental objectives (Cahyono *et al*., 2020). Accordingly, organizations have been implementing a number of measures to enhance environmental and social performances over the years (Abbas *et al*., 2021). Organizations are eager to adopt GSCM practices in relation to the rapidly increasing environmental consciousness (Wiredu *et al*., 2024). These practices involve obtaining, manufacturing, and distributing goods and services in such a way that promotes sustainabilityto allay shareholder concerns (Singh *et al*., 2022). Literature suggests that the employment of GSCM is a key strategy to improve environmental performance (Fu *et al*., 2023; Samad *et al*., 2021; Wiredu *et al*., 2024) and receive a favourable position (Uddin *et al*., 2023). Furthermore, Luu *et al*. (2023) stated that IR 4.0 (Industry Revolution) can aid organizations in making a strategy shift by using a supply chain management system (SSCM) (Luu *et al*., 2023). Additionally, organizations with higher GSCM scores experience reduced financial loss during COVID-19's hostile effects (Eggert & Hartmann, 2023).

Nevertheless, GSCM scholarship indicates that a growing number of organizations from developing economies may have to deal with stern environmental issues in the future due to resource scarcity and environmental degradation (Ullah *et al*., 2021). Hence, organizations in several emerging nations are timid to implement GSCM practices due to the severe monetary costs that can result from it (Ahmed *et al*., 2019). The main source of competitive advantage for industries like Bangladesh's readymade garments (RMG) sector is the large pool of cheap labour. This allows the manufacturers to incredibly charge low prices for the range of clothing products they trade to international clothing brands and retailers with headquarters in developed economies (Uddin *et al*., 2023). Besides, the number and severity of extreme weather-related incidents in 2023 indicate that the climate catastrophe is becoming more widely acknowledged. This puts the fashion manufacturing process at particular risk (McKinsey & Company, 2024). Therefore, the garment sector needs to improve the durability of its supply chains and contribute to plummeting emissions proximately, as climate risks are scattered across all regions (McKinsey & Company, 2024).

Bangladesh, ranked as the second-largest global garments exporter after China, is utterly threatened by the rise of competing countries offering low-cost garments, including Vietnam, Ethiopia, Cambodia, and Myanmar (McKinsey & Company, 2024). Despite many obstacles, the number of green garment factories in Bangladesh's RMG sector has grown dramatically, and the industry is likely to undergo a paradigm shift (Hasan, 2024; Hassan, 2023). The RMG sector in Bangladesh is truly leading globally in environmental sustainability, a move that has never been witnessed previously (Hassan, 2023). It further demonstrates how determined Bangladeshi garment producers are to advance the industry and meet ESG standards despite what initially seems insurmountable challenges (Hassan, 2023). In light of this, the dynamic capabilities view (DCV) contends that firms must achieve a substantial competitive advantage in the sector in which they operate. The competencies require improvement to identify and capitalize on opportunities, fend off threats, and rapidly adjust their business models and strategies (Fainshmidt *et al*., 2019). The phase of industry transformation thus accelerates the conversion from an existing supply chain to a green supply chain (Karim *et al*., 2021). Given that the initial catalyst for this global change was a lack of information and a greater reliance on developing nations for resources, both the textile and apparel industries stood to benefit significantly from GSCM practices (Karim *et al.*, 2021).

The literature has attempted to elucidate the stimulus that GSCM practices have on the accomplishment of business objectives (Galdos-Urbizu *et al*., 2024). While most studies emphasize determining the influence on financial performance (Galdos-Urbizu *et al*., 2024; Sahoo & Vijayvargy, 2021). There has been an upward trend in interest in the social and environmental performance of organizations (with environmental performance being increasingly prevalent than social performance) (Galdos-Urbizu *et al*., 2024). Henceforth, previous studies considered the association between environmental performance and GSCM practices by including collaboration with suppliers (Fu *et al*., 2023; Large & Gimenez Thomsen, 2011), customers, eco-design, green purchasing, top management support, and green logistics (Luu *et al*., 2023; Nazir *et al*., 2024; Wiredu *et al*., 2024). Several studies were carried out concerning green/sustainable supply chains in Bangladesh's textile sector, including the outcome of sustainable supply chain management (SSCM) practices on viable advantage (Uddin *et al*., 2023). The GSCM on business and environmental performance (Rupa & Saif, 2022), green HRM and GSCM on sustainable performance (Ali *et al*., 2024; Habib *et al*., 2020; Habib *et al*., 2022), and strategic orientation on the enactment of GSCM attain sustainable outcomes *(*Habib *et al*., 2021).

In light of an extensive exploration of the GSCM effect on sustainable performance in the Bangladeshi textile sector, this study examines: (i) the effect of green strategy, internal environmental management, and green procurement on GSCM practices that result in environmental performance, and (ii) the moderating effect of procurement ethics between GSCM practices and environmental performance in the textile industry. The rationale for the selection of a green strategy is that organizations strategize their operational activities in a manner to achieve objectives. Therefore, organizations that aim to improve environmental performance adopt green strategies in their operations. Subsequently, internal environmental management monitors that their operations are aligned with environmental friendliness, thus guiding GSCM practices to lead to advanced environmental performance. Green procurement refers to the acquisition of products or materials with minimal inverse effect on the environment. Finally, procurement ethics refer to the moral principles of employees who purchase products or services.

The current study makes several contributions: firstly, it broadens the scope of the GSCM literature by evaluating how GSCM techniques affect environmental performance. Secondly, it expands on previous GSCM literature and stakeholder theory by investigating how green strategy supports the adoption, application, and continual enhancement of GSCM practices. It demonstrates how organizations utilize green strategy, internal environmental management, and green procurement to alter their supply chain processes and improve environmental performance. In addition, it demonstrates how procurement ethics e.g., moral principles, are crucial between environmental performance and GSCM practices. The current study broadens the insights of investors, managers, and governments on the effective employment of GSCM practices within organizations to enhance environmental performance. It shows how organizations might use their business strategy to implement GSCM practices to expand environmental performance. Lastly, the Bangladeshi textile sector as well as the policymakers may find the findings as a guideline to develop strategies and make decisions in order to enhance environmentally positive outcomes.

2. THEORETICAL BACKGROUND & HYPOTHESIS DEVELOPMENT

According to Singh *et al*. (2022), green supply chain management has become a focal topic due to greater anticipation of climate change concerns among stakeholders. It explains the GSCM with the goal of reducing waste and carbon emissions by integrating sustainable procedures into the production process (Ramli *et al*., 2022). Further, the GSCM is also denoted as SSCM, which assimilates supply chain and sustainability by the inclusion of sustainable practices in the firms' operations to lower the adverse impact on the environment (Beamon, 1999). Using GSCM practices, firms can lessen manufacturing expenses and negative environmental effects, and enhance competitiveness (Chu *et al*., 2017).

The resource-based view (RBV) posits the importance of firms' internal resources to attain competitive outcomes (Hasan *et al*., 2022). According to the Natural Resource Dependency Theory (NRDT), businesses that depend on natural resources like the textile industry are more likely to adopt eco-friendly practices in order to control risks and ensure long-term survival. Building long-lasting stakeholder connections and supporting a business in its success may be accomplished through the application of the resource-based viewpoint of the firm (Tantalo & Priem, 2016). Establishing sustainable relationships with stakeholders is critical for three reasons: first, they enable a firm to operate (Coase, 1937); second, they are essential to the survival and success of the firm (Freeman, 1984); and third, it is morally correct (Donaldson & Preston, 1995).

However, the dynamic capability view (DCV) is a vital strategy that is pertinent to a business, given the association amid competitive advantage and the responsiveness of a firm's resource stock to rapidly adapt to the environment (Singh *et al*., 2019). Consequently, a long-term ecological performance is improved by the DCV-formulated firm competencies connected to GSCM and suppliers' abilities (Kähkönen *et al*., 2018). Importantly, it was suggested that DCV is necessary for firms to remain competitive in a slowly changing market (Li & Srinivasan, 2019). Furthermore, a firm's GSCM practices are its dynamic capability features (Bernacki & Lis, 2021). Based on the DCV hypothesis, it is argued that GSCM practices influence a firm's environmental performance in one way or another (Wiredu *et al*., 2024). In recent times, scholars have adopted the DCV theory to elucidate the benefits of GSCM practices to attain environmentally positive outcomes (Bag *et al*., 2022). For instance, the GSCM practices help firms in the reduction of hazardous materials and waste, encouraging them to recycle and reuse materials, efficiently use resources, and follow environmental regulations (Ahmad & Khokhar, 2024). The subsequent hypothesis is developed.

H1: GSCM practices have a significant positive influence on environmental performance.

Besides, the DCV is the expansion of the conventional resource-based View (RBV) of firms (Eisenhardt & Martin, 2000), which helps firms move from static to uncertain or dynamic contexts by evolving from available resources (Díaz-Chao *et al*., 2021). Reshaping resources and capabilities is necessary for organizations to be competitive in the face of changing environments and challenges (Wiredu *et al*., 2024). Moreover, GSCM is necessary for businesses to fulfil the demands of their stakeholders and clients in order to accomplish environmental, social, and economic objectives (Seuring, 2011). The three features of the dynamic capability perspective are the acts of perceiving, seizing, and changing (Wiredu *et al*., 2024). Sensing skills recognize, create, and evaluate the technical options for meeting consumer demands (Teece, 2018). Capturing capabilities results in an action plan that mobilizes resources to meet the opportunities and demands of the present (Wiredu *et al*., 2024). In order to maximize market value, organizations must constantly update and rejuvenate their resources via transformation skills (Ilmudeen & Bao, 2018). Three types of organizational procedures – green strategies, practical action plans, and green procurement, which are linked to the ideas of dynamic capacities – lead to GSCM practices.

According to GSCM literature, managers and firms ought to consider strengthening the effectiveness and competency of their environmental initiatives (Al-Sheyadi *et al*., 2019). In order to handle strict organizational procedures coupled with an increase in consumer demand, firms must therefore improve their capacity to manage and control environmental performance (Wiredu *et al*., 2023). Thus, green strategies increase an organization's effectiveness and boost profitability by reducing waste (Upadhyay *et al*., 2021). In light of this, environmentally friendly operations and practices foster cooperation and competition, which boosts economic competitiveness and environmental performance (Karia, 2020). Thus, the hypotheses are developed as follows:

H2: Green strategy has a significant positive effect on environmental performance;

H3: GSCM practices mediate the association between green strategy and environmental performance.

According to Zhu *et al.* (2005), the manager of the organization is the main force in developing plans and goals to apply green policies, which regulate procedures to lessen risk, and creating an evaluation system to detect environmental impacts. Senior management commitment is the most important of all the strategies used to implement GSCM in Chinese firms (Zhu *et al*., 2010). Therefore, internal environmental management (IEM) is another crucial factor in GSCM practices. In reference to internal GSCM practices, Zhao *et al*. (2011) stated that IEM entails the establishment of environmental departments, information sharing about the environment, and information system integration. Based on Huma *et al*. (2024), IEM is a crucial factor in boosting corporate environmental performance, while it is also necessary to effectively adopt GSCM practices (Habib *et al*., 2022). Therefore, the succeeding hypotheses are developed:

H4: Internal environmental management posits a significant positive impact on environmental performance;

H5: GSCM practices mediate the association between internal environmental management and environmental performance.

While green procurement (GP) is an aspect of GSCM practices, it should be more accurately considered as a strategic catalyst since it profoundly impacts the implementation of comprehensive GSCM practices. Green procurement, as the preliminary phase of integrating environmental factors into the supply chain, signicantly influences subsequent operations, including eco-design, manufacturing, logistics, and reverse logistics (Asuah *et al*., 2024). According to Zhu and Sarkis (2006), green procurement correlates positively with the implementation of IEM and eco-design efforts, indicating that procurement choices can stimulate wider environmental integration throughout the supply chain. Furthermore, green procurement imposes environmental criteria on suppliers, resulting in a cascade effect that necessitates alignment with green requirements (Bai & Sarkis, 2010). Zailani *et al.*

(2012) emphasized green purchasing to reduce hazardous materials and carbon emissions through eco-friendly purchasing. Besides, Khoiruman and Haryanto (2017) postulated green procurement shapes suppliers' behaviour.

Therefore, its pivotal role in influencing supplier behaviour, product design, and regulatory compliance establishes it as a significant determinant of GSCM practices. With green procurement techniques, firms can manage their procurement department, and its benefits in limiting material disposal and contributing to environmental positive outcomes (Le, 2020). Lee (2015) confirmed that by guaranteeing the acquisition of environmentally friendly products, green procurement promotes long-term sustainability. Chakraborty *et al*. (2022) unveiled a significant positive impact of green procurement on manufacturing organizations' performance, particularly on eco-technological revolution and environmental strategy. According to Zhao *et al*. (2017), green procurement upsurges environmental performance through resource efficiency, and it boosts corporate competitiveness in the industrial sector. This offers credibility to the idea that green procurement enhance environmental performance and also GSCM effectiveness. The hypotheses are as follows:

H6: Green procurement has a direct positive effect on environmental performance;

H7: Green procurement and environmental performance relationship is mediated by GSCM practices.

Literature suggestsed that adopting GSCM practices is positively related to environmental performance (Nazir *et al*., 2024; Wiredu *et al*., 2024), but the outcomes of this correlation do not necessarily come across proportionately (Prajogo *et al*., 2014). According to Carter *et al*. (2000), the green procurement concept is emerging, and in order to carry it out effectively, the supply chain process must be reinforced by a number of supporting measures. Procurement ethics might be added as a supporting role (Carter *et al*., 2000) as it could indicate whether the organization is greenwashing by presenting green practices throughout their SCM practices. Some studies showed that the performance of sustainable manufacturing is impacted by a greater level of procurement ethics (Jusoh *et al*., 2023; Torelli, 2021). Since moral priciples are considered important when making a practicing GSCM, thereby, the following hypothesis is developed:

H8: Procurement ethics moderate the rapport between the practices of GSCM and environmental performance.

2.1 Theoretical Framework

The above discussion, hypotheses, and theoretical background enable this study to construct the research framework. The deefinitive objective is to assess the influence of GSCM practices on environmental performance (EP). The following is an illustration of the research model, which is displayed in Figure 1.

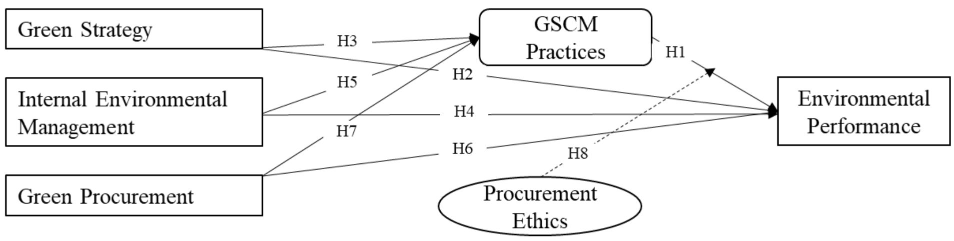


Figure 1 Theoretical framework

3. METHODOLOGY

This study espoused a quantitative methodology to achieve research objectives and test hypotheses. It is appropriate for answering the research questions and proficient in analyzing hefty amounts of data by means of statistical approaches. Moreover, it enables inspecting and grasping the link between two or more variables (Saunders *et al*., 2019).

3.1 Data Collection

The primary data was gathered from the target respondents via survey instruments. Questionnaires were distributed among supply chain managers, operation managers, environmental or waste management managers, and supervisors to receive their feedback. This is because these respondents possess sufficient knowledge about green business concerns, specifically the supply chain and environmental concerns in their manufacturing plants. Using a purposive sampling procedure, the steps were critically carried out to identify appropriate respondents for a comprehensive survey from Bangladeshi textile organizations. In the first step, textile companies were selected based on LEED-certified green garment factories located in the areas of Dhaka and Chattogram. Subsequently, a well-crafted questionnaire was used as the survey instrument, and HR departments were used to find qualified respondents, guaranteeing an accurate assessment of Bangladeshi green garment factories. This study distributed survey questions via personal contact as well as online platforms such as LinkedIn, WhatsApp, and Messenger. The researcher designed the questionnaire as a data collection instrument to collect respondents' information over four weeks. Ethical issues were observed during the data collection process from both secondary and primary sources. According to Memon *et al.* (2020), a sample size between 150 to 500 is sufficient for multivariate analysis. This study collected a total of 238 survey data points for statistical analysis (PLS-SEM).

3.2 Measurements & Statistical Analysis

This study employed a structured questionnaire set of 26 items which are adapted from previous studies, including five items for environmental performance (EP), four items for internal environmental management (Zhu *et al*., 2008), four items for GSCM (Wu *et al*., 2012), four items for green strategy (Masoumik & Abdul-Rashid, 2021), four items for green procurement (Wang *et al.*, 2018) and five items for procurement ethics (Goebel *et al.*, 2012). A five-point Likert scale with various measurement scales is used to measure these items. For instance, environmental performance was assessed by means of a scale ranging, from (v) noteworthy, (iv) relatively noteworthy, (iii) to some degree, (ii) a little bit, and (i) not at all; the GSCM measurement scale ranged to (5) implementing effectively, (4) initiating implementation, (3) considering it presently, (2) planning to adopt it, and (1) not considering. Following an extensive review, the reflective constructs and reflective indicators were used to determine the path model. This includes environmental performance, GSCM practices, green strategy, internal environmental management, green procurement, and procurement ethics. The reflecting measurement approach fundamentally presupposes that the indicators or measurements function as a likeness of the theoretical concept (Hulland, 1999).

The study employed SmartPLS (version 4) to perform partial least square-structural equation modelling (PLS-SEM) in order to assess the hypotheses. Due to the smaller sample size and the exploratory character of the study, the PLS-SEM was carried out (Hair *et al.*, 2012). The current study also followed the two-step process suggested by Chin (1998) in order to analyze and construe the PLS-SEM outcomes in relation to the hypotheses: (1) evaluating the validity and reliability (measurement model), and (2) testing the structural model (inner). The validity analysis included convergent validity and discriminant validity, while the reliability analysis incorporated composite reliability and Cronbach's alpha coefficients. The mediating analysis was assessed using the bootstrapping results to determine the direct and indirect path coefficients, which were obtained with 5000 subsamples, 238 observations per subsample, and no sign changes. Additionally, the product indicator method (PIM) (Rigdon *et al.*, 2019) was applied to assess the moderating effect since the variable is continuous (Chin, 2010).

4. RESULTS

4.1 Demographic Information of Respondents

Based on the analysis, the respondents' background profile includes 140 respondents working in Dhaka and 98 respondents in Chattogram, as displayed in Table 1. The analysis unveiled that 31.1% (N=74) of the respondents had completed diplomas, 40.8% (N=97) were bachelor's degree holders, and 28.2% (N=67) had attained master's degrees. Concerning the years of experience, 22 respondents had less than five years' experience, 119 respondents had 5-10 years' experience, 41 respondents had 11-15 years' experience, and 56 respondents had more than 15 years' experience. Related to the position in the firm, 17.2% (N=41) of respondents were senior managers, 23.9% (N=57) were holding manager posts, 33.6% (N=80) were assistant managers, and 25.2% (N=60) were senior officers. The study included 30 respondents from the spinning category, 43 respondents from the fabric category, 63 respondents from the apparel segment, 20 respondents from dyeing, 37 respondents from the printing and packaging sector, 13 respondents from washing, 12 respondents from home textile, 10 respondents from sweater, and 10 respondents specified to deal with accessories.

Table 1 Demographic profile of respondents.

Variable		N	%	Variable		N	%
Education	Diploma	74	31.1		Assistant Manager	80	33.6
	Bachelor	97	40.8		Senior officer	60	25.2
	Masters	67	28.2		Officer	0	0
Experience in years	<5	22	9.2	Industry type	Spinning	30	12.6
	5-10	119	50		Fabric	43	18.1
	11-15	41	17.2		Apparel	63	26.5
	>15	56	23.5		Dyeing	20	8.4
	<200	34	14.3		Printing & Packaging	37	15.5
Number of employees	200-500	24	10.1		Washing	13	5.5
	501-1000	102	42.9		Home textile	12	5.0
	1001-2000	67	28.2		Sweater	10	4.2
	>2000	11	4.6		Accessories	10	4.2
Role in the company	Senior manager	41	17.2	Location	Dhaka	140	58.8
	Manager	57	23.9		Chittagong	98	41.2

4.2 Measurement Model

Before assessing the measurement model, the reliability (internal consistency reliability) and the validity (discriminant validity and convergent validity) for each construct were assessed, as indicated in Table 1. Reliability is the degree to which a measurement scale is error-free and produces consistent outcomes (Hair *et al.*, 2019). To determine whether the measurement model was adequate, the internal consistency reliability, which considered both Cronbach's alpha coefficients and composite reliability, was the first criterion taken into consideration. The Cronbach's alpha coefficients (which ranged from 0.798 to 0.954) were above the required value of 0.70, signifying high internal consistency, as proposed by Nunnally (1978). Furthermore, the composite reliability values showed a high level of reliability, ranging from 0.804 to 0.959 (beyond the required threshold of 0.70) (Fornell & Larcker, 1981). Meanwhile, factor loadings should be at least 0.50, with 0.70 loadings being satisfactory (Henseler *et al.*, 2015), and loadings below 0.50 should be omitted (Chin, 1998). The loadings are considered to be appropriate in this study. More so, the average variance extracted (AVE) values were considered to evaluate the convergent validity of this study. This study's AVE values, which varied from 0.57 to 0.846, were all above the 0.50 criterion, indicating a high degree of convergent validity (Fornell & Larcker, 1981).

Table 2 Results of reliability, validity, multicollinearity

Construct	Items	Loading	α	CR	AVE	VIF	SRMR
Environmental Performance	EP1	0.773	0.808	0.824	0.57	1.56	0.065
	EP2	0.83				2.142	
	EP3	0.764				1.714	
	EP4	0.794				1.771	
	EP5	0.591				1.272	
Internal Environmental Management	IEM1	0.904	0.934	0.948	0.834	3.779	
	IEM2	0.91				3.604	
	IEM3	0.915				3.237	
	IEM4	0.923				3.827	
Green strategy	GS1	0.745	0.855	0.892	0.691	1.95	
	GS2	0.861				2.621	
	GS3	0.87				1.979	
	GS4	0.842				1.88	
Green Procurement	GP1	0.819	0.798	0.804	0.626	2.311	
	GP2	0.857				2.318	
	GP3	0.782				1.615	
	GP4	0.698				1.415	
Green Supply Chain Management	GSCM1	0.819	0.851	0.865	0.687	1.918	
	GSCM2	0.838				3.304	
	GSCM3	0.858				2.071	
	GSCM4	0.8				3.083	
Procurement Ethics	PE1	0.913	0.954	0.959	0.846	4.409	
	PE2	0.942				6.288	
	PE3	0.924				4.647	
	PE4	0.946				6.285	
	PE5	0.873				2.929	

Table 3 Discriminant validity (HTMT ratio)

Construct	EP	ESS	EST	GP	GSCM	PE
EP						
ESS	0.188					
EST	0.076	0.056				
GP	0.835	0.188	0.092			
GSCM	0.561	0.268	0.161	0.662		
PE	0.313	0.033	0.069	0.207	0.096	
PE x GSCM	0.184	0.039	0.104	0.142	0.098	0.058

Similarly, validity refers to how well a measurement scale assesses the anticipated assessment variable (Sahoo & Vijayvargy, 2021). The current study evaluated the measurement model's discriminant validity using the cross-loading and HTMT ratio methods. Based on Hair *et al*. (2016), cross-loading is defined as the outer loading of an indicator on the linked construct that exceeds all outer loadings of the other constructs. In contrast, an issue with discriminant validity is indicated when cross-loading surpasses the indicator's outer loading. The loadings of the indicators in relation to the cross-loadings of other variables were used to assess the discriminant validity. The outcomes confirmed no issue of discriminant validity in the scale as presented in Appendix A2. Another crucial method for assessing the multicollinearity and validity of a model is the Heterotrait-Monotrait ratio (HTMT). The HTMT ratio assesses the attribute of associations in the model, and the HTMT ratio cannot be higher than 0.90 (Hair *et al*., 2019). Since all of the HTMT ratio values are less than 0.9, the HTMT discriminant level is accepted. As a result, it concluded that the measurement model is valid and reliable.

4.3 Structural Model

The accuracy of the structural model is evaluated using the following metrics after the measurement model has been validated: coefficient of determination (R^2), overall goodness of fit (GoF), multicollinearity issue (VIF), standardized root mean square residual (SRMR), effect size (f^2), and predictive relevance (Q^2). The model's fitness is evaluated using SRMR and GoF statistics. The GoF is calculated by the following Tenenhaus *et al*. (2005) formula:

$$\begin{aligned} \text{GoF} &= \sqrt{\text{Average value of AVEs} * \text{Average values of R}^2} \\ &= \sqrt{.709 * .441} \\ &= 0.559. \end{aligned}$$

Based on Wetzels *et al*. (2009), the computed GoF of 0.559 is greater than the required value of GoF>0.36. Meanwhile, Hu and Bentler (1998) indicated that a satisfactory model fit reaches an SRMR<0.08. According to Table 1, the study model's SRMR of 0.065 attained the cutoff value.

Subsequently, the variance inflation factor (VIF) assesses the probability of multicollinearity problems between variables. According to Hall and Sammons (2013), a VIF value (Table 1) of less than 10 indicates that there are no significant problems with multi-collinearity among the variables. The explanatory power of independent variables over dependent variables is thus shown by R^2. Based on Hair *et al*. (2019), an R^2 value should fall between 0.25 and 0.75. Environmental performance and GSCM exhibit R^2 values of 0.523 and 0.358, respectively (Table 3). These values indicate a modest level of explanatory power for the dependent variables by the independent variables.

In addition to R^2, Hair *et al.* (2017) recommended observing Q^2 to measure the model's predictive significance. Table 3 displays the measured Q^2 scores for environmental performance and GSCM practices, which are 0.468 and 0.332, respectively. According to Shmueli *et al.* (2019), these predictive relevance values meet the recommended threshold because they are positive and greater than zero. In order to validate the structural model, this study additionally looks into the effect size (f^2) into account. Hair *et al.* (2019) stated that f^2 shows how the model's R^2 value changes when a specific exogenous variable is overlooked. The computed effect sizes for environmental performance and GSCM are 1.1 and 0.558, respectively, as shown in Table 3. Accordingly, the results suggest that the model has a substantial and medium influence (Cohen, 1988). Thus, the structural model is fit for path analysis. The formula (Eq. 1) is used to compute the effect size:

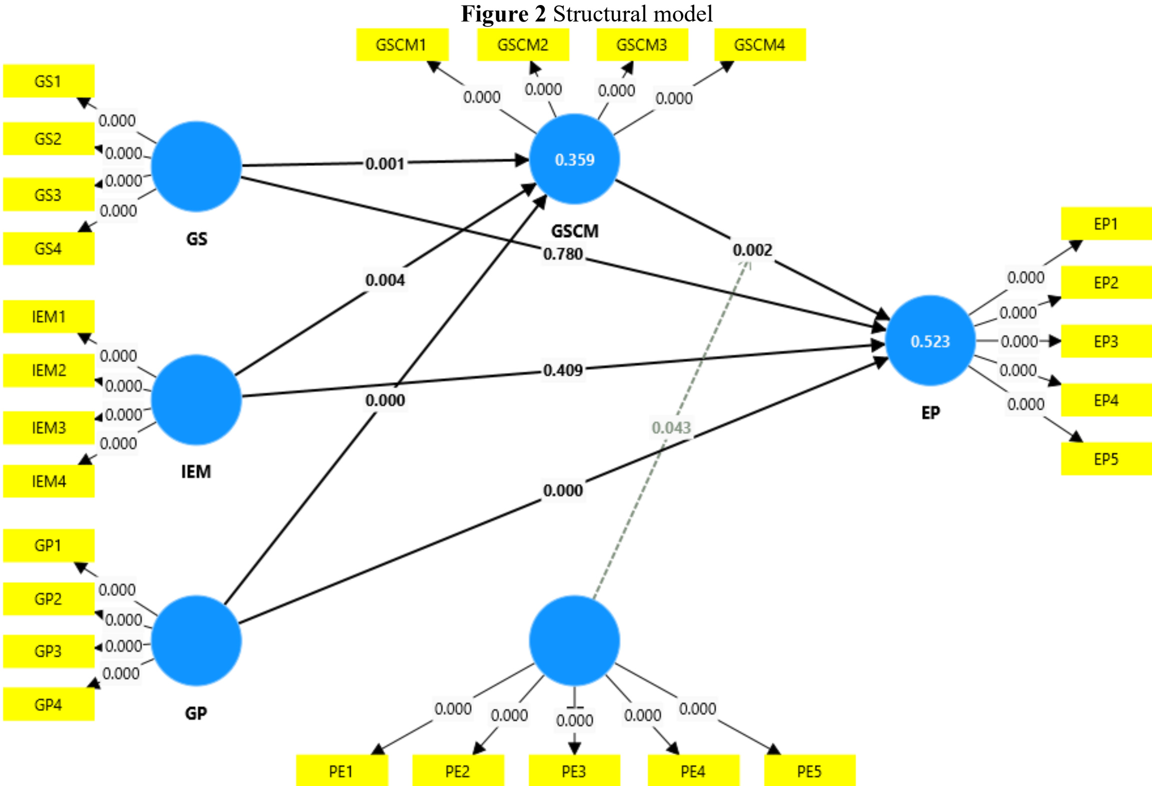
$$f^2 = \frac{R^2}{1-R^2}. \quad (1)$$

In order to confirm and deepen the interpretation of the findings for every hypothesis, this study precisely looked at the magnitude of the path coefficient (Figure 2 and Table 4). For a relationship to be considered significant, t-values greater than 1.96 were required for the path (Chin, 1998). As proposed by Hair *et al.* (2019), the significance of the coefficients was determined using a non-parametric bootstrap approach. To reduce bias, this required forming 5000 bootstrap samples and generating correct spans for bootstrap at a 95% confidence level (Hair *et al.*, 2012). Based on the confidence intervals, hypotheses were supported or not supported; a projected coefficient was deemed to have a significant impact if its confidence interval was not equal to zero (Nazir *et al.*, 2024).

Table 4 Coefficient of determination (R^2), factor effects (f^2), and predictability score (Q^2)

Construct	R^2	f^2	Q^2
Environmental Performance	0.523	1.1	0.468
GSCM	0.358	0.558	0.332

Figure 2 Structural model



4.4 Hypothesis Testing Results

The results show that GSCM is positively correlated with environmental performance (H1; β=0.189; p<0.05, t=3.172), and it is statistically significant. Furthermore, H2 is not supported (H2; β=0.013; p>0.05, t=0.28) amid green strategy and environmental performance. Additionally, H4 is also not supported (H4; β=0.035; p>0.05, t=0.826) amid internal environmental management and environmental performance. However, H6 is supported which is statistically significant (H6; β=0.525; p<0.05, t=8.317) amid green procurement and environmental performance. Regarding the mediating effects of GSCM on the relationship amid GS and EP, IEM and EP, and GP and EP, three hypotheses underlie this study. The observed results are displayed in Table 4. H3 is supported, which shows that GSCM (H3: β=0.033; t-value=2.115; p=0.034) mediates the association between GS and EP. Subsequently, H5 also confirmed the mediation outcome of GSCM on the relationship between IEM and EP (H5; β=0.029; t-value=2.096; p=0.036). Thus, the association between GP and EP is also substantially intermediated by GSCM, thereby, H7 is supported (H7; β=0.101; t-value=2.805; p=0.005).

The last hypothesis (H8), which acknowledges the impact of moral principles, presents the moderating role of procurement ethics on the rapport between the GSCM practices and environmental performance. The degree of procurement ethics determines whether or not this notion is valid. Thus, the hypothesis is supported, which implies that the level of procurement ethics on GSCM practices determines the environmental performance (H8; β=0.109; t-value=2.023; p=0.043). Figure 3 additionally demonstrates the interaction diagram of procurement ethics (PE) amid GSCM and EP. Hence, the graph verifies that an advanced level of procurement ethics can strengthen the interaction amid GSCM and lead to a greater EP level.

Table 5 Hypothesis results and decision

H	Path	β	t statistics	p-value	Decision
Direct relationship					
H1	GSCM-> EP	0.189	3.172	0.002	Supported
H2	GS -> EP	0.013	0.28	0.78	Not Supported
H4	IEM -> EP	0.035	0.826	0.409	Not supported
H6	GP -> EP	0.525	8.317	0.0001	Supported
Meditating relationship					
Supported					
H3	GS -> GSCM-> EP	0.033	2.115	0.034	
H5	IEM -> GSCM-> EP	0.029	2.096	0.036	Supported
H7	GP -> GSCM-> EP	0.101	2.805	0.005	Supported
H8	PE x GSCM -> EP	0.109	2.023	0.043	Supported

Figure 3 Moderation effect of procurement ethics between GSCM and environmental performance.

4.5 Discussion

Due to increased public knowledge of GSCM practices, organizations are under pressure from competitors, customers, and governments to operate with less negative environmental impact (Wiredu *et al*., 2024). Therefore, the RMG manufacturers in Bangladesh posit initiatives and activities to prevent financial losses, regulations, and criteria set by foreign buyers and the government based on environmental pollution. According to DCV theory, manufacturers are prepared to embrace GSCM practices in order to protect themselves from undesired loss and improve environmental performance throughout their commercial manoeuvres (Sampene *et al*., 2024; Uddin *et al*., 2023). Particularly, the current study intended to determine the relationships of green strategy, internal environmental management, green procurement, and GSCM practices on the enhancement of organizational environmental performance. Furthermore, the proposed model presented in this study was verified, proving that effective GSCM practices driven by green strategy, internal environmental management, and green procurement improve the environmental performance of the organization.

The findings demonstrated a positive and statistically substantial association between GSCM practices and environmental performance. This outcome is consistent with prior literature that evidenced a similar link (Ali *et al*., 2024; Rupa & Saif, 2022). This study emphasized the influence of GSCM practices on Bangladeshi textile manufacturing firms, aiming to boost their environmental performance, become more competitive, and support customers' demands. The direct, substantial, and significant influence of GSCM practices on environmental performance showed how important GSCM practices are to these firms' efforts to enhance their environmental benefits.

According to stakeholder theory, businesses may also be influenced by stakeholders who promote company success and survival strategies (Freeman *et al*., 2021). The adoption of green strategies is driven by environmental concerns and strong client relationships, internal environmental management, and green procurement. These will lower inventory material costs and finance more efficient manufacturing facilities (Nazir *et al*., 2024). The results indicate that, especially regarding internal factors such as operational efforts, including strategies, environmental objectives, and green procurement, environmental performance plays a crucial role in how GSCM enhances firms' overall environmental performance. Meanwhile, the enhancement of environmental performance is shaped by GSCM practices when the level of procurement ethics is high. It suggests that GSCM practices are required to be responsible toward organizations' goals to increase environmental performance through practical actions. Previous studies on GSCM practices have identified the basic components and the impact of various institutional pressures (Fu *et al*., 2023; Wiredu *et al*., 2024). Thus, the empirically confirmed findings – that is, green strategy, internal environmental management, and green procurement – are necessary internal factors to adopt GSCM practices. These will fulfil the need for research to recognize the firm-level factors of GSCM practices that fill the research gap. Besides, this study advocates that the levels of procurement ethics should be high in order to effectively practice GSCM that shapes environmental performance.

4.6 Theoretical Implications

The literature on GSCM practices and the dynamic capability view (DCV) is conceptually enhanced by the current study. First, the dynamic capability view (DCV) theory's theoretical underpinnings provide a strong framework for comprehending the reasons for firms' adoption of GSCM practices. The empirical result confirms that the dynamic capacity concept in the context of GSM practices is one of its distinctive theoretical contributions. This study shows how firms may improve their environmental performance by developing dynamic skills, such as by the demand from clients through a green strategy. Correspondingly, the outcomes support the DCV theory by offering new information on how these factors affect environmental performance. In addition, this study determines particular contextual factors that affect how well GSCM practices mediate environmental performance. This helps to make GSCM more context-aware by recognizing that the effects of these practices might differ based on regulatory, industry, and organizational settings. Secondly, this study confirmed the theoretical model based on an incoproated framework of green strategy, internal environmental management, green procurement, procurement ethics and GSCM practices. These contribute to the body of literature relevant to environmental performance. The results demonstrate how firms may improve environmental performance through GSCM practices by means of procurement ethics. Finally, this study demonstrates that in order to align firms' operations for enhanced environmental performance, manufacturers need to understand the organizational internal factors of implementing effective GSCM practices.

4.7 Managerial Implications

Besides theoretical implications, this study aids practitioners in the textile sector in tracking and comprehending green strategies and GSCM practices in the operations to take competitive advantages through improved environmental performance. Secondly, the firm's internal environmental management determines the firm's ability to adopt and practice GSCM to enhance environmental performance. In order to fulfil client demands for eco-friendliness and seize potential market possibilities, firms can ensure green procurement to lead both GSCM practices and improve environmental performance. Internal factors drive firms to achieve particular sustainable goals by strengthening their strategy and decision-making abilities. Thirdly, by seizing competitive advantages, managers and owners who are striving for increased productivity and effectiveness may use the findings to develop a green strategy, and internal environmental management to ensure buyers' criteria to generate profitable revenue. In response to internal and external forces, firms can lessen environmental effects and also expand firms' economic performance through the execution of GSCM practices. The practitioners in the textile industry in Bangladesh may gain a thorough understanding of the interaction between contextual factors and strategic orientation. Fourthly, the results will assist practitioners in the textile and RMG sectors in identifying implementation methods for GSCM practices, procurement ethical gaps, and intrinsic changes to the organization's production, product system, culture, and structure. All these will aid in improving sustainable firm performance. Lastly, the results can help the developing nations' textile industries (such as Bangladesh, India, Pakistan, and Sri Lanka) enhance their GSCM practices while reducing the negative environmental effects.

5. CONCLUSIONS & LIMITATIONS

This study has investigated the influence of internal factors leading to GSCM practices that improve environmental performance. The findings demonstrated a substantial influence of internal factors, namely green strategy, internal environmental management, and green procurement, on GSCM practices. These will lead to an enhanced environmental performance Bangladeshi textile industry. In addition, procurement ethics play a noteworthy role in shaping the association between GSCM practices and environmental performance. An emerging nation like Bangladesh will guarantee the longevity of its RMG business if the RMG manufacturers consider global demand driven by both Mother Nature and customers to reduce negative environmental effects (SDG 13) throughout their production and delivery processes.

Nevertheless, several limitations should be considered for future studies. First, the study's generalizability may be hampered by the fact that data were only gathered from a single nation and one segment of the textile manufacturing industry. Subsequent studies may encompass many industries from diverse nations such as India, Pakistan, China, Indonesia, and Vietnam. Secondly, this study looks into only internal factors that shape the GSCM practices. Further studies may consider both internal and external factors. Finally, procurement ethics have been taken as a moderating variable. Future studies should investigate the factors such as resource capability, environmental orientation, and environmental commitment as moderators in the association between GSCM and environmental performance.

5.1 Recommendations

Among 4,500 (approximately) garment factories (Mordor Intelligence, 2023), only 217 factories are LEED-certified green factories in Bangladesh (Hasan, 2024). In accordance, only a small number of firms are assumed to have implement GSCM practices. The majority of firms are striving to put GSCM practices into effect (Rupa & Saif, 2022). The following suggestions are given to address these issues with GSCM practice implementation in the Bangladeshi textile sector:

- Enforcing the legislation pertaining to the practices of GSCM, particularly in textile and RMG factories, can subsidize the conservation of the environment.
- Increasing knowledge of green strategies and operations, and green organizations will encourage manufacturers to adopt GSCM practices.
- All supply chain actors must be integrated and coordinated for businesses to fully benefit from GSCM practices.
- Internal management concerns can improve the success of GSCM practices.

CONFLICT OF INTEREST

There is no conflict of interest

DATA AVAILABILITY STATEMENTS

The data will be made available on request.

ETHICAL STATEMENT

Not applicable as stated in the survey questionnaire.

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APPENDIX

Table A1 Measurement items

Construct	Measurement Items	Adapted from
Environmental performance	• Effluent waste has been reduced • Air emissions have been reduced • Consumption of materials and resources has been reduced • The frequency of environmental accidents is reduced • The environmental situation has improved in our firm	(Zhu et al., 2008)
GSCM practices	• The firm selects the product materials that produce the least pollution for product development or design. • The firm's manufacturing process can recycle waste and waste so that it can be treated and reused. • The firm optimizes supply chain management processes and systems to meet green needs. • Cooperate with customers to realize green packaging	(Wu et al., 2012)
Internal Environmental Management	• Commitment of GSCM from senior managers. • Support for GSCM from mid-level managers. • Cross-functional cooperation for environmental improvements. • Environmental compliance and auditing programs.	(Zhu et al., 2008)
Green Strategy	• Improved technical skills of purchasing professionals • Improved detailed purchasing policies and procedures • Improved the effort to minimize environmental pollution • Achieving environmental goals with suppliers	(Masoumik & Abdul-Rashid, 2021)
Green procurement	• The importance of incorporating sustainability into its supply chain management? • The positive influence of green procurement is perceived within firms • The importance of firms adopting green procurement practices • Green procurement practices contribute to enhancing the competitiveness of firms.	(Wang et al., 2018)

Table A2 Cross loadings

Items	EP	GP	GS	GSCM	IEM	PE
EP1	**0.773**	0.616	0.037	0.459	0.110	0.179
EP2	**0.830**	0.481	0.039	0.362	0.129	0.273
EP3	**0.764**	0.506	0.011	0.325	0.138	0.244
EP4	**0.794**	0.558	-0.058	0.417	0.191	0.152
EP5	**0.591**	0.368	-0.024	0.270	0.028	0.189
GP1	0.494	**0.819**	-0.089	0.406	0.130	0.099
GP2	0.607	**0.857**	-0.057	0.467	0.152	0.167
GP3	0.532	**0.782**	-0.020	0.472	0.113	0.193
GP4	0.512	**0.698**	0.041	0.393	0.124	0.113
GS1	-0.021	-0.097	**0.745**	0.078	-0.058	-0.043
GS2	-0.011	-0.038	**0.861**	0.110	-0.030	-0.093
GS3	-0.007	-0.029	**0.870**	0.156	0.033	-0.009
GS4	0.037	-0.002	**0.842**	0.142	0.046	-0.013
GSCM1	0.501	0.472	0.085	**0.819**	0.235	-0.046
GSCM2	0.299	0.439	0.039	**0.838**	0.209	0.106
GSCM3	0.521	0.489	0.240	**0.858**	0.161	0.032
GSCM4	0.249	0.417	0.119	**0.800**	0.203	0.101
IEM1	0.122	0.125	-0.005	0.179	**0.904**	0.010
IEM2	0.124	0.140	0.022	0.212	**0.910**	0.009
IEM3	0.160	0.180	0.017	0.262	**0.915**	-0.034
IEM4	0.185	0.148	-0.002	0.217	**0.923**	0.033
PE1	0.226	0.160	-0.070	0.045	0.006	**0.913**
PE2	0.241	0.186	-0.057	0.034	0.006	**0.942**
PE3	0.261	0.175	-0.066	0.034	-0.015	**0.924**
PE4	0.277	0.175	-0.023	0.054	0.046	**0.946**
PE5	0.237	0.147	0.026	0.055	-0.034	**0.873**

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