

# **Challenges in Green Supply Chain Management Implementation in SMEs: An Empirical Analysis through Ecological Modernisation and Transaction Cost Economics**

## **Abstract**

**Purpose:** Small and medium enterprises (SMEs) in Bangladesh are vital to the economy but face pressure from buyers and regulators to adopt green supply chain management (GSCM) practices. Despite growing awareness, SMEs encounter significant challenges in implementation. This study identifies these challenges and offers recommendations for improvement using organisational theory.

**Design/Methodology/Approach:** Small and medium enterprises (SMEs) in Bangladesh are vital to the economy but face pressure from buyers and regulators to adopt Green Supply Chain Management (GSCM) practices. Despite rising awareness, many SMEs struggle with implementation. This study investigates these challenges using a positivist framework and a deductive approach, informed by Ecological Modernisation Theory (EMT) and Transaction Cost Economics (TCE). Data from 315 SMEs were collected through a pre-tested five-point Likert scale questionnaire and analysed using covariance-based Structural Equation Modelling (AMOS) to test the proposed hypotheses, offering insights and recommendations for improving GSCM practices.

**Findings:** The findings indicate that internal barriers, such as high costs and low perceived benefits, along with external market factors, hinder the adoption of Green Supply Chain Management (GSCM). Only commitment to GSCM practices, energy-efficient product design, and ISO 14001 certification had a significant impact, while Green Purchasing, customer cooperation, and investment recovery showed no notable effects. This study integrates Ecological Modernisation Theory and Transaction Cost Economics, emphasising a multifaceted approach.

**Originality/Value:** Bangladesh's small and medium-sized enterprises (SMEs) hesitate to adopt green supply chain practices mainly due to a knowledge gap. Existing barriers have been unhelpful amid economic instability. This study introduces a mixed-method approach based on Ecological Modernisation Theory (EMT) and Transaction Cost Economics (TCE).

**Keywords:** Green supply chain management, small enterprises, internal barriers, external barriers

**Paper type:** Research paper

## 1.0 Introduction

The environmental challenges facing our planet are escalating at an alarming rate, significantly driven by unsustainable manufacturing practices in several South Asian countries, particularly Bangladesh, Pakistan, and India (Dubey & Ali, 2015; Amin et al., 2023). In recent years, Bangladesh has emerged as a global powerhouse in garment production, renowned for its ability to deliver low-cost apparel at an unparalleled scale (Montero Bressán, 2023). Yet, this prestigious status comes with devastating consequences, not just for Bangladesh but for the entire world (Reza & Du Plessis, 2022). The rampant carbon emissions associated with the garment industry, alongside the overexploitation of critical natural resources such as freshwater and forests, present a dual threat to our ecosystems (Stone et al., 2020). These practices not only contribute to climate change but also jeopardise numerous species, pushing them closer to the brink of extinction (Colasante & D'Adamo, 2021). It is essential that we address these pressing crises directly. One promising approach to alleviating these environmental issues is through the implementation of Green Supply Chain Management (GSCM) (Hervani et al., 2005; Bai et al., 2010; Dubey et al., 2017; Rashid et al., 2025). This strategy serves as a framework to address the escalating ecological concerns while also tackling the persistent socioeconomic challenges faced by developing nations, such as Bangladesh, which have historically exploited their resources without fully understanding the long-term repercussions on both the environment and community welfare (Islam et al., 2018; Rahman et al., 2020).

Despite growing awareness, many companies continue to adopt GSCM practices primarily due to external pressures from global markets and government regulations (Dubey et al., 2015; Xie et al., 2024). However, the substantial benefits that these practices can offer often remain overlooked (Choudhary et al., 2018). A significant reason for this oversight is the lack of effective benchmarking practices among organisations (Sangwan & Choudhary, 2018). Benchmarking provides a critical lens through which companies can evaluate their performance by comparing it to industry standards, thereby gaining insights into their relative standing in relation to global competitors (Bhattacharya et al., 2020; Malhotra et al., 2025). Among the most valuable aspects of benchmarking is the identification of barriers that hinder the successful implementation of GSCM initiatives (Ahmed et al., 2020). By understanding these obstacles, organisations can formulate more robust strategies and ultimately enhance their operational performance, paving the way for sustainable growth in harmony with the planet's ecological limits (Rahman et al., 2020).

Many existing studies have primarily concentrated on identifying the key factors that contribute to the successful implementation of GSCM practices across various industries (Umar et al., 2022). However, there is a significant lack of research examining the internal and external barriers that impede the adoption of these practices. Understanding these barriers is crucial, as it can provide valuable insights for organisations aiming to benchmark and enhance their GSCM initiatives. By investigating the impact of factors such as organisational culture, employee resistance, regulatory challenges, and supply chain complexities on GSCM adoption, we aim to fill this research gap. To guide our investigation, we propose the following key research questions:

*RQ1: What are the internal and external barriers to GSCM practices in small and medium-sized enterprises (SMEs) in Bangladesh?*

*RQ2: How does overcoming these barriers facilitate the adoption of various GSCM practices?*

To effectively address the two research questions, we employ ecological modernisation theory (EMT) and transaction cost economics (TCE) as foundational frameworks for developing our research hypotheses (Sarkis et al., 2011). To validate these hypotheses, we take a positivistic approach that emphasises the importance of empirical data and statistical analysis in understanding complex phenomena. For our data collection, we focused on small and medium-sized enterprises (SMEs) throughout Bangladesh, recognising their essential role in the country's economy. We utilised a comprehensive survey instrument to reach a diverse range of SMEs across various sectors. After multiple follow-up efforts to increase response rates, we successfully collected 315 usable responses from participants, ensuring a robust dataset for analysis. The data were meticulously analysed using covariance-based structural equation modelling (CBSEM), a statistical technique that enables the examination of complex relationships between observed and latent variables. The results from our analyses provide significant theoretical contributions, enhancing the body of knowledge surrounding EMT. This approach enhances our understanding of how integrating ecological modernisation theory with transaction cost economics can effectively address the complex challenges associated with green supply chain management practices. Ecological modernisation theory highlights the importance of sustainable development and the role of technology in reducing environmental impact, while transaction cost economics focuses on the costs associated with economic exchanges and the efficiency of these transactions. By merging these two frameworks, we can better analyse and optimise supply chain practices that prioritise ecological sustainability, minimise costs, and improve operational efficiency, ultimately leading to a more responsible and effective green supply chain management

strategy. Furthermore, this study sheds light on how both internal and external barriers influence the implementation of green supply chain management (GSCM) practices within SMEs. This understanding may help policymakers and business leaders promote sustainability within the SME sector, ultimately contributing to a more environmentally conscious economic landscape in Bangladesh.

The draft is structured into six comprehensive sections, each serving a distinct purpose. The second section explores the foundational theories that underpin the research and elaborates on the hypotheses that inform the study. In this part, key concepts and frameworks relevant to the topic are examined in detail to set the stage for the subsequent analysis. The third section outlines the research design, detailing the methodologies employed to gather and analyse the data. This includes a description of the research sample, the data collection techniques used, and the rationale behind the chosen methods, ensuring a robust framework for the investigation. In the fourth section, the draft presents a thorough analysis of the statistical results obtained from the data, along with a clear narrative of the findings. This part highlights significant trends, patterns, and correlations revealed through the analysis, providing a solid evidence base for the study's conclusions. The fifth section presents an in-depth discussion of the study's results, examining their implications for both theoretical perspectives and practical applications in managerial contexts. This section also addresses the limitations encountered during the research process, discussing potential biases and the generalizability of the findings, as well as proposing avenues for future research that could build on this work. Finally, the concluding section synthesises the study's main insights, reiterates its contributions to the field, and emphasises the importance of the findings in advancing both academic understanding and practical implementation.

## **2. Underpinning Theory and Hypotheses Development**

In this section, we provide a comprehensive overview of the foundational theories that underpin the theoretical framework (Figure 1) of our study. Specifically, we have chosen to incorporate the ecological modernisation theory (EMT), which emphasises the potential for economic growth and environmental sustainability to coexist through innovative practices and policies. Additionally, we utilise transaction cost economics theory (TCE), which explores the costs associated with economic exchanges and the impacts of these costs on organisational decision-making and efficiency. Together, these theories offer valuable insights into the dynamics of environmental and economic interactions within the context of our research. Ecological modernisation is an influential school of thought that

emerged in the early 1970s, part of the modernisation of industrialisation practices at that time (Mol & Spaargaren, 2000). Proponents of ecological modernisation argue that institutional challenges should not involve a retreat from industry or a reversal to pre-industrial practices, commonly referred to as deindustrialisation or demodernisation (Mol & Spaargaren, 1993). Instead, EMT asserts that a synthesis of economic growth and environmental sustainability is possible (Bugden, 2022). It advocates for a collaborative approach, where both government entities and the private sector actively engage in innovative practices and policies aimed at environmental protection and sustainability (Sehnm et al., 2021). This perspective emphasises the importance of technological advancements, regulatory frameworks, and market incentives in creating an eco-friendly economy that can address environmental issues while supporting continued development (Huang & Huang, 2022). In Bangladesh, the implementation of GSCM practices among SMEs can significantly benefit from collaborative efforts between government entities and private organisations. This partnership is crucial, especially since SMEs often focus on producing low-cost goods that can have significant environmental impacts. By working together, governmental bodies can provide support in terms of policies, incentives, and resources, while private organisations can share their expertise and best practices in sustainable manufacturing. Moreover, the drive to adopt the ecological modernisation perspective, an approach that advocates for environmental protection through technological innovation and efficiency, can be further elucidated by applying TCE. This perspective highlights the importance of minimising costs associated with transactions, which can motivate SMEs to adopt GSCM practices. By reducing waste and improving process efficiency, these enterprises can not only lower their operational expenses but also enhance their overall competitiveness in the market while contributing to environmental sustainability.

## **2.1 Drivers of GSCM Practices**

Green Supply Chain Management (GSCM) encompasses Internal Environmental Management (IEM) activities such as total quality management, environmental audits, regulatory compliance, ISO certifications, and ecological investments, all of which require strong managerial commitment (Patil *et al.*, 2024; Namagembe, 2021; Zhu *et al.*, 2012). Green purchasing involves sourcing materials from certified suppliers to support sustainability goals (Namagembe, 2021; Banacian *et al.*, 2015), while investment recovery enables firms to repurpose surplus assets, thereby reducing waste and improving resource efficiency (Zhu *et al.*, 2012).

Customer cooperation and eco-design play a vital role in supporting waste reduction and enhancing the overall performance of Green Supply Chain Management (GSCM) (Namagembe, 2021; Zhu, *et al.*, 2012). SMEs with ISO 14001 certification are increasingly adopting green practices across design, production, distribution, and reverse logistics processes (Maqsood *et al.*, 2022). Moreover, green innovation and supply chain agility facilitated by big data, cloud analytics, and effective leadership enhance competitiveness and operational responsiveness, providing SMEs with opportunities to boost productivity while minimising environmental impact (Rahman *et al.*, 2024; Al-Shboul, 2023; Aldhaheeri & Ahmad, 2023; Naz *et al.*, 2024; Li *et al.*, 2022). Accordingly, this study focuses on the implementation of these GSCM practices in small enterprises in Bangladesh.

## **2.2 Internal Drivers**

Despite the cost efficiencies and environmental benefits associated with sustainable construction practices, developing countries demonstrate limited commitment to their adoption and implementation. This reluctance can be attributed to several barriers that hinder progress in this area (Iqbal *et al.*, 2021). The challenges are multifaceted, as organisations encounter both internal and external barriers, which can be systematically categorised into these two distinct groups (Ghadge *et al.*, 2017; Moran *et al.*, 2025).

### ***2.2.1 Firm's Capabilities and Resources and GSCM***

A review of the literature reveals several factors and pressures influencing the adoption of green supply chain management (GSCM) (Ghadge *et al.*, 2017). Regulatory pressures tend to be lower for small and medium-sized enterprises (SMEs) due to their limited organisational scale (Ghadge *et al.*, 2017), which poses a significant barrier to the implementation of GSCM. In particular, small firms face considerable challenges in adopting GSCM practices due to their constrained resources and capabilities (Mathiyazhagan *et al.*, 2014; Schrettle *et al.*, 2014).

Furthermore, research highlights the critical role of internal factors, such as firm-specific resources, in fostering adaptive environmental management. Similarly, sustainable innovation presents organisations with new opportunities while simultaneously increasing operational complexity. Naz *et al.* (2024) emphasise that addressing these complexities requires the development of specific organisational practices and competencies, alongside investments in internal absorptive capacities and

the ability to leverage external sources for green innovation effectively (Moran *et al.*, 2025 and Jaim, 2022). Based on the aforementioned arguments, the following hypothesis is proposed:

**H1a.** *A firm's capabilities and Resources affect IEM practices and adoption in small enterprises.*

### **2.2.2 Complexity of Green Process and GSCM**

Researchers have argued that the high initial costs associated with green technology implementation result in reduced revenue and extended repayment periods, thereby impeding the adoption of GSCM practices (Majumdar & Sinha, 2018; Govindan *et al.*, 2014). Technological advancements in SMEs, particularly the adoption of innovative cost-reduction strategies, are essential for process improvement. These advancements have been identified as critical for enhancing GSCM practices, with a strong correlation observed between these factors and business process performance (Ali, 2023).

Consumer behaviour in green purchasing is influenced by two primary factors: a heightened concern for social and environmental issues, and the perceived utility and eco-friendly attributes of products. However, the lengthy procurement process can lead to delays, complicating purchasing decisions (Joshi & Rahman, 2015). Recent studies further indicate that consumer values, environmental ideals, external environmental factors, and awareness of green products significantly impact green purchasing behaviour (Bhattacharyya *et al.*, 2023).

**H1b.** *The complexity of Green processes and system design affects GP practices and adoption in small enterprises.*

### **2.2.3 Unorganised Return Management and GSCM**

In Indian dairy firms, a lack of technological understanding creates significant pressure and results in inadequate awareness of materials management methods, transportation facilities, and return procedures (Sinha & Mishra, 2023). Additionally, the financial outlay required for systematic returns on assets and other economic benefits influences the implementation of GSCM practices (Mishra *et al.*, 2023; Qazi *et al.*, 2023). Other studies have highlighted that disorganised product return management policies within organisations can cause misunderstandings among customers, thereby reducing customer cooperation and posing a critical barrier to the adoption of sustainable systems.

**H1c.** *Unorganised return Management affects CC practices and adoption in small enterprises.*

#### **2.2.4 Stakeholders Inertia and GSCM**

External factors influencing GSCM practices are shaped by various stakeholders, including suppliers, market competitors, and government bodies. Organisations face pressures from regulatory authorities and increasing demands from customers for a cleaner, more transparent, and socially and environmentally responsible supply chain (Jaim, 2022 and Li *et al.*, 2022). However, Ghadge *et al.* (2017) contend that small enterprises experience significant pressure from their customers. Moreover, the limited awareness and recognition of green products among customers constrain demand, which, in turn, discourages businesses from adopting eco-friendly strategies (Giunipero *et al.*, 2012; Mathiyazhagan *et al.*, 2014).

*H1d. Stakeholders' Inertia affects ED practices and adoption in small enterprises.*

#### **2.2.5 High investment and low economic benefit and GSCM**

Moreover, the challenges associated with interpreting sustainability and the inherent complexity of GSCM negatively impact the effective implementation of sustainable practices (Ngouapegne *et al.*, 2024; Govindan *et al.*, 2014; Bhattacharyya *et al.*, 2023; Abbasi & Nilsson, 2012). Based on a comprehensive review of the literature, this study identifies five key internal barriers: the firm's capabilities and resources, the complexity of GSCM, high investment with low returns, unorganised return management, and lack of awareness. Consequently, the following hypotheses are proposed.

*H1e. High investment and low economic benefit affect the implementation and adoption of IR practices in small enterprises.*

### **2.3 External Drivers**

Despite facing internal barriers like high investment costs and a lack of knowledge, some SMEs in Bangladesh still adopt Green Supply Chain Management (GSCM) due to several key motivations and external drivers. Factors that drive SMEs to adopt GSCM in the face of these internal constraints include strategic motivations, leadership commitment, and regulatory pressures (Durrani *et al.*, 2024). These factors may provide insight into how SMEs overcome or mitigate internal barriers to successfully implement sustainable practices (Zayed & Yaseen, 2021). Previous studies have primarily focused on identifying the factors contributing to GSCM adoption among SMEs, such as regulatory

frameworks, external stakeholder support or pressures, and internal organisational capabilities. However, limited research has explicitly confirmed the role of customer pressures, including purchasing power, supplier capabilities, resource efficiency, and green initiatives by SME suppliers (Ngouapegne *et al.*, 2024; Ali, 2023; Mishra *et al.*, 2023). However, argued that small companies face significant pressures from their customers.

### ***2.3.1 Unwillingness to exchange Information and GSCM***

Several researchers (Govindan *et al.*, 2014; Majumdar & Sinha, 2018) have identified suppliers' hesitation and reluctance to share information as a critical external barrier to the implementation of green supply chain management (GSCM). Inaccurate or incomplete information exacerbates asymmetry in greening levels across the supply chain. This study highlights that the presence of an effective contracting mechanism, which facilitates communication integration and information sharing, has a substantial impact on the green performance of manufacturing firms (Zayed & Yaseen, 2021).

***H2a: Unwillingness to exchange information and affect IEM practices and adoption in small enterprises.***

### ***2.3.2 Suppliers' capabilities and resources and GSCM***

It has been established that end consumers significantly influence enterprises to enhance their environmental performance. Several researchers (Yu *et al.*, 2021; Ghadge *et al.*, 2017) have highlighted simulated pressure, a form of competitive pressure, as a key external factor. The environmental impact of SMEs is often overshadowed by that of large multinational corporations, as SMEs tend to underestimate the significance of sustainability and face supplier-related barriers that affect their purchasing capabilities (Durrani *et al.*, 2024). Increasingly, companies are encountering both internal and external challenges in integrating environmental sustainability into their business strategies (Seuring & Gold, 2013; Zhu *et al.*, 2012). Furthermore, SMEs face additional constraints, such as limited supplier availability, which directly affects production capacity. Therefore, understanding the external factors influencing the adoption of GSCM in small enterprises, as well as the proportional impact of resources and manpower, is critical. Bangladesh's SMEs possess robust internal management systems that drive sustainability initiatives without significant reliance on external suppliers or consumer support. Additionally, consumer unawareness regarding sustainability is considered non-significant in terms of supplier concerns. In some cases, suppliers may lack the

resources or capacity to support Green Supply Chain Management (GSCM) practices. When suppliers are small, resource-constrained, or not committed to sustainable practices, firms may opt to focus on internal solutions or seek alternative suppliers who align with green initiatives. Internal resources such as technology, processes, and organisational culture play a crucial role in integrating sustainability into supply chain operations, thereby reducing the need for extensive external supplier resources or direct consumer influence (Delgado-Verde *et al.*, 2024). Furthermore, internal capabilities, regulatory compliance, and technology-driven innovations often have a more substantial impact on shaping a company's adoption of sustainable practices (Jaim, 2022)

*H2b: Suppliers' capabilities and resources affect GP practices and adoption in small enterprises.*

### **2.3.3 Lack of support from the consumer and GSCM**

From a demand perspective, the limited eco-literacy of consumers, along with insufficient support and incentives for green products, hampers the adoption of GSCM practices. On the supply side, inadequate logistics infrastructure further slows down the implementation of GSCM (Majumdar & Sinha, 2018; Silvestre, 2015; Ghadge *et al.*, 2017). In the construction industry, which poses significant environmental risks, barriers such as lack of awareness have been identified as key obstacles to GSCM adoption, with many companies failing to respond positively to these challenges (Durrani *et al.*, 2024; Qazi *et al.*, 2023).

*H2c: Lack of support from consumers affects CC practices and adoption in small enterprises.*

### **2.3.4 Underdeveloped Environmental Regulations and Logistics, and Infrastructure, and GSCM**

Similarly, the lack of adequate environmental legislation and insufficient employee involvement hinder firms from adopting sustainable practices (Ghadge *et al.*, 2017). External pressures include regulatory requirements, competition, and customer expectations. Notably, higher levels of external pressure tend to increase a firm's likelihood of adopting GSCM practices (Li *et al.*, 2022; Testa & Iraldo, 2010; Zhu *et al.*, 2012). For example, to avoid regulatory complications and ensure compliance with existing laws, firms implement certain green practices in their operations, such as reducing CO<sub>2</sub> emissions, designing eco-friendly products, and minimising the use of environmentally hazardous materials during procurement and production (Bin Idrees *et al.*, 2024). Hoque and Clarke (2013) examined pollution prevention practices in the context of industrial greening in Bangladesh and found that,

compared to leading firms in developed countries, pollution prevention initiatives in Bangladesh remain relatively underdeveloped.

**H2d:** *Underdeveloped Environmental Regulations and Logistics and Infrastructure affect ED practices and adoption in small enterprises.*

### **2.3.5 Market Structure and GSCM**

Moreover, economic instability, technological barriers, governmental volatility, pricing challenges, competitive intensity, and market fragmentation pose significant obstacles for organisations in implementing GSCM practices (Durrani *et al.*, 2024; Schrettle *et al.*, 2014). Studies have shown that Big Data and other advanced technologies can have substantial and positive impacts on the development of incremental green supply chains (Al-Khatib, 2022). Therefore, this section highlights that weak market structures, inadequate logistics and infrastructure, underdeveloped environmental regulations, reluctance to share information, limited supplier capabilities and resources, and insufficient consumer support are the primary external barriers to GSCM adoption. Based on this review, the following hypothesis is proposed:

**H2e:** *Market Structure affects IR practices and adoption in small enterprises.*

### **Table I: Development of hypothesis from Literature Review**

The following **Figure 1** depicts the model where the arrows moving from the Barriers towards GSCM practices indicate the different hypotheses.

### **Figure 1: Hypothesised Relationship**

## **3. Methodology**

This study adopts a quantitative approach to examine the current state of GSCM practices in Bangladesh and identify barriers to their implementation. As Dwyer (2005) notes, industry stakeholders, including destination managers and government bodies, are increasingly relying on data-driven decisions for policy development and evaluation, highlighting the value of quantitative research (Singh & Kumar, 2017).

A survey of small enterprises in Bangladesh's manufacturing and service sectors was conducted to assess GSCM adoption and test the proposed hypotheses. While both quantitative and

qualitative methods have been used in past GSCM research, quantitative methods are more common in studies focused on adoption patterns, barriers, and performance impacts across specific regions or industries, depending on the objective (Omer *et al.*, 2024). Consistent with this approach, the present study utilises quantitative methods using *Measurement Item (Much Lower, Lower, Neutral, Higher and Much Higher from 1-5)* to meet its research goals effectively.

### **3.1 Sample**

This study integrates a literature review with in-depth interviews to develop a questionnaire for data collection, which was subsequently analysed using the EMT and TCE approaches (Touil *et al.*, 2024; Gupta *et al.*, 2020; Pidgeon & Henwood, 2004). Data were collected through factory visits and interviews conducted either via telephone or in person. An offline survey, administered between January 2022 and June 2023, involved 315 SME representatives from the Sylhet, Dhaka, and Rangpur divisions of Bangladesh. Purposive sampling was employed to target firms implementing Green Supply Chain Management (GSCM) practices (Namagembe, 2021; Gupta *et al.*, 2020). Of the surveyed SMEs, 36.2% were located in Dhaka, 15% in Rangpur, and 8.4% in Sylhet, with 60% of the sample drawn from the central region. The study encompassed 105 small firms (Maqsood *et al.*, 2022) and 125 SME accountants engaged in carbon management accounting (Nartey, 2018). The relatively small sample size is justified by the nascent stage of GSCM adoption in Bangladesh, particularly among small enterprises, as well as the inherent challenges in obtaining survey responses. Moreover, the sample size is consistent with comparable studies on Sustainable Supply Chain Management (SSCM) and GSCM (Gavronski *et al.*, 2011) and meets the minimum threshold of 50 for multivariate data analysis (Hair *et al.*, 2011).

### **3.2 Questionnaire and Measure**

Before designing the questionnaire, an extensive literature review was conducted to gain a deeper understanding of Green Supply Chain Management (GSCM) and to ensure that the questionnaire would be both comprehensive and relevant. This review helped identify key themes, variables, and practices associated with GSCM across various sectors. Drawing on these insights, the conceptual model (as presented in Table III and Figure 1) and the corresponding research hypotheses were formulated. The background of the study and the critical components of GSCM, such as internal environmental management, green purchasing, eco-design, and green innovation, were explicitly integrated into the questionnaire items. This approach was designed to elicit accurate, meaningful, and

context-specific responses from participants, thereby enhancing the overall validity of the collected data (Bag *et al.*, 2022).

### 3.3 Structural Equation Model

In this study, data analysis was conducted using a statistical technique known as structural equation modelling (SEM) with AMOS, following a methodology similar to that employed by Yousaf (2021). Additionally, partial least squares structural equation modelling (PLS-SEM) was used to evaluate the conceptual model empirically. This approach involved administering a structured survey questionnaire to 164 Sri Lankan apparel manufacturers, as documented by Huma *et al.* (2023). While previous studies have focused exclusively on specific manufacturing companies as representative of the SME industry, this study aims to encompass a broader range of industries to provide a more comprehensive understanding of the real-world scenario. Similarly, Covariance-based Structural Equation Modelling has been employed to examine intricate relationships between observed variables and latent constructs. In the context of Green Supply Chain Management (GSCM) and Small and Medium Enterprises (SMEs), evaluating the suitability of GSCM practices for SMEs and understanding the relationships between various factors involved in implementing GSCM can be beneficial (Afum *et al.*, 2020).

To perform path analysis in SEM, a model fit analysis was conducted as a preliminary test. First, principal component analysis (PCA) with Varimax rotation was employed to ensure that variables were significantly loaded onto single factors, and a rotated component matrix was generated. Second, the correlation matrix and inter-construct correlations were examined to test validity, ensuring that correlations between critical strategic components did not exceed 0.8. Absolute fit indices were used to assess the model's suitability for the sample data and to identify the best-fitting model among those proposed. The root mean square error of approximation (RMSEA) was applied to evaluate model fit (Afum *et al.*, 2020), with more recent guidelines suggesting a cut-off value close to 0.06 (Ullman & Bentler, 2012), while a maximum acceptable value of 0.08.

In addition to RMSEA, other fit indices such as the normed fit index (NFI), Tucker-Lewis index (TLI), and comparative fit index (CFI) were used, rather than relying solely on the chi-square statistic, to assess model fitness. These indices range from 0 to 1, with Bentler and Bonnet (1980)

indicating that values above 0.90 indicate a good fit. More recent criteria from Ullman and Bentler (2012) suggest that cut-off values should be  $\geq 0.95$  to indicate excellent model fit.

***Table II: Profile of Respondents and the Surveyed SMEs***

According to Table II, the SMEs included in this study comprised various industries, such as bakery, beverage, battery, brickfield, oil, flour, pharmaceuticals, printing, sweetmeats, and spice mills. The highest percentage of enterprises represented were from the bakery and sweetmeats industries, accounting for 23.8% and 19% of the sample, respectively. The remaining industries each constituted less than 10% of the sample. Among the 315 respondents, the majority were managers (55.2%), followed by chairpersons or deputy general managers (21%), senior employees (15.2%), and 8.6% who were knowledgeable individuals in other roles. Regarding educational qualifications, 48.6% of respondents had completed a bachelor's degree, 15.2% had a postgraduate degree, and 25.7% had completed their Higher Secondary Certificate (HSC). The remaining respondents had either passed the Secondary School Certificate (SSC) or possessed lower qualifications. In terms of professional experience, more than half of the participants (55.2%) reported having 2 to 10 years of work experience, 35.2% had over 10 years of experience, and 9.5% had less than 2 years of experience in the field.

**3.4 Validity, Reliability, and Factor Analysis**

***Table III: Measurement Items***

*Rotated Component Matrix:* the rotated component matrix (RCM) revealed a strong association between items and both barriers to and practices of GSCM. Table IV indicates that a firm's capability and the market structure of a particular region exhibit a strong correlation with both internal and external barriers, with correlation coefficients of 0.897 and 0.881, respectively. Similarly, commitment to GSCM practices, environmental design tailored to supplier requirements, and eco-friendly product manufacturing were identified as the most significant factors influencing GSCM adoption.

Conversely, factors such as investment, certification, and scrap were found to negatively impact GSCM practices, with correlation coefficients of 0.596, 0.864, and 0.892, respectively (Table V).

***Table IV: Rotated Component Matrix for Barriers of GSCM***  
***Table V: Rotated Component Matrix for GSCM Practices***

To confirm discriminant validity, the Heterotrait-Monotrait (HTMT) ratio of correlations between each pair of constructs is generally expected to fall below the threshold of 0.90, with some scholars suggesting a more stringent cut-off of 0.85. In this analysis, however, all constructs are below the recommended threshold, indicating a potential issue with discriminant validity. Again, in Table VII, all items VIF less than 3.36 are considered; there is no issue for common method bias (Hair, 2011).

***Table VI: Heterotrait-monotrait ratio (HTMT)***  
***Table VII: Collinearity statistics (VIF)***

## **4. Results**

### **4.1 Principal Component Analysis**

The factor analysis conducted in this study assessed the construct validity of the measurement model. As presented in Tables IV and V, the rotated component matrix for both barriers and practices demonstrates a clear factor structure, with all factor loadings (except for GP3 and EB6) exceeding 0.6. Each item is loaded onto a single factor, indicating good construct validity. Since GP3 and EB6 load onto multiple factors, these constructs were excluded from further analysis. Table VI confirms that, with a few exceptions, the model adhered to the rule. Most constructs exceeded the 0.8 threshold, thus ensuring appropriate reliability, convergent validity, and discriminant validity for the data. The reliability of all constructs was evaluated through internal consistency measures. A reliability test using SPSS revealed that the data related to barriers (internal and external) produced Cronbach's alpha (CA) values of 0.83 and 0.77, respectively, indicating strong reliability for these variables. Similarly, for GSCM practices (Table VII), Cronbach's alpha values were highest for GP, ED, and IME, with values near 0.80, while CC and IR exhibited marginal values of 0.73 and 0.70, respectively. According to Tariq et al. (2023), an alpha value above 0.7 is considered acceptable for reliability. Specific factor loadings also demonstrated strong associations with the respective items, including IEM1 and IEM5 (0.933 and 0.930), GP2 and GP1 (0.799 and 0.723), CC1 and CC2 (0.801 and 0.791), ED1 and ED3 (0.879 and 0.735), and IR1 and IR3 (0.864 and 0.813). These values further confirm the robustness and reliability of the data used in this study.

***Table VIII: Results of Factor Loading and Reliability and Validity of barriers of GSCM practices***

***Table IX: Results of Factor Loading, Reliability and Validity of GSCM Practices***

#### **4.2 Most Influential Partitions**

To reduce the number of factors in the descriptive study, the authors applied exploratory factor analysis with Varimax rotation in SPSS (Kline, 2013). As a result, table VIII. Shows that only two sub-factors explain almost 77% variance of the barriers, and their Eigenvalues are more than 1. From analysing the results of total variance explained and communalities, these high investments, low benefit, and market structure emerged as the most influential factors. In the context of GSCM practice, commitment to GSCM practices, Product design that consumes less material/energy, and ISO 14001 certification have been found to be incredibly influential variables of total variance explained and communalities.

***Table X: Most influential sub-factors based on Factor analysis***

#### **4.3 Correlation of Factors**

The estimation of variable relationships and their standard deviations indicates that the measures are empirically distinct. The correlation matrix reveals positive correlations among all five practices. In contrast, a negative relationship exists between practices and barriers, which is logically consistent, as barriers are expected to negatively impact practices. The analysis further shows that all variables are significant at the 0.01 level. Table IX illustrates that IEM has Pearson correlation coefficients of 0.782, 0.812, 0.592, and 0.598 with GP, CC, ED, and IR, respectively, suggesting moderate positive relationships. Additionally, IEM exhibits Pearson correlation coefficients of -0.796 and -0.379 with IB and EB, respectively, indicating moderate negative relationships. The negative correlation between IEM and IB is stronger than that between IEM and EB. Furthermore, ED shows a Pearson coefficient smaller than 0.6 with IEM, GP, and CC, indicating a weak positive relationship with these variables.

***Table XI: Summary of Correlations among Constructs***

#### **4.4 Result of the Hypothesised Relationship**

The study reveals that internal barriers exert direct and significant effects on GSCM practices. In contrast, among the external barriers, only green purchasing and customer cooperation do not have a significant impact on GSCM practices, while the other factors show notable influence (Table XIII).

*Table XIII: Results of path analysis*

### **5. Discussion**

#### **5.1 Theoretical contributions**

This study makes a significant theoretical contribution by examining the intricate interplay between internal and external barriers and the antecedents of Green Supply Chain Management (GSCM). By developing a mixed model and extended framework grounded in Environmental Modernisation Theory (EMT) and Transaction Cost Economics (TCE), the study evaluates the impact of these barriers on GSCM practices. The findings indicate that internal barriers, such as energy-efficient product design and the adoption of ISO 14001, significantly influence GSCM practices, whereas external barriers have a direct and negative impact on green purchasing and eco-design decisions.

The application of EMT and TCE in addressing these barriers highlights their value in offering a systematic approach to overcoming the challenges faced by SMEs in adopting GSCM practices. EMT integrates environmental management with business operations, facilitating the adoption of sustainable practices throughout the supply chain. For instance, SMEs can utilise EMT principles to progressively introduce green technologies, build internal capabilities, and effectively manage their environmental impact. EMT also promotes capacity building in emerging economies by emphasising human resource development, the integration of Environmental Management Systems (EMS), and the continuous improvement of operational processes.

Moreover, the findings demonstrate that integrating environmental activities into organisational strategy enables SMEs to achieve cost reductions and enhance operational efficiency, thereby addressing the barrier of limited knowledge and awareness. By applying the core constructs of EMT and TCE, SMEs can navigate the complexities of cost management and decision-making associated with implementing sustainable practices. Ultimately, this theoretical framework advances

the understanding of how SMEs can achieve long-term competitiveness and success in an increasingly sustainability-oriented market.

## **5.2 Practical Implementation**

The findings of this research highlight the pivotal role of small enterprises in addressing challenges related to the implementation of Green Supply Chain Management (GSCM). To foster green market orientation and enhance business performance, proprietors and executives of small and medium-sized enterprises (SMEs) in Bangladesh, particularly those operating under the purview of the Bangladesh Small and Cottage Industries Corporation (BSCIC), should prioritise developing energy-efficient product designs and preparing green human capital. This study highlights the importance of implementing Environmental Management Systems (EMS), such as ISO 14001, to guide SMEs in improving environmental performance across their supply chains. A proactive approach to sustainability can strengthen green supply chains and support broader ecological goals. To overcome adoption barriers, stakeholders, including government, industry bodies, and financial institutions, should offer support through green financing, tax incentives, and training programs. SMEs can move beyond general ESG concepts by applying practical tools such as self-assessment checklists and Key Performance Indicators (KPIs) to track progress in areas like carbon intensity, renewable energy share, recycling rates, and green product revenue (Naz et al., 2024; Saunila et al., 2024). Managers can further connect ESG adoption to observable results, such as cost reductions and market access, with the aid of a decision-support flowchart (Bag et al., 2022; Afum et al., 2020). The sectoral context is also crucial: while low-pollution sectors (like bakeries and packaging) may benefit from small steps like eco-friendly packaging and green marketing, high-pollution industries (like pharmaceuticals and brickfields) should prioritise emission monitoring and cleaner technologies (Hoque & Clarke, 2013; Habib et al., 2022). SMEs can transform ESG principles into actionable practices and measurable performance improvements (Rahaman, 2025).

## **5.3 Social Implications**

This research highlights the critical importance of overcoming internal barriers. SMEs play a crucial role in promoting green market orientation, and their commitment to sustainable practices has the potential to shape societal norms and expectations. This, in turn, can drive a positive shift in consumer behaviour, with communities increasingly favouring eco-friendly product designs. Such developments

align with the growing societal awareness and interest in green initiatives, making this topic both timely and relevant to community values.

#### **5.4 Limitations of Research**

This study, based on data from ten firm types within three Bangladeshi divisions, offers preliminary insights but has limited generalizability. Future research should employ probabilistic sampling and include a wider range of industries and regions to better represent SME diversity. Cross-country comparisons are also recommended to explore how contextual factors influence green practices more broadly.

#### **6. Conclusion**

A shift in strategic approaches may occur following the establishment of a market presence. The success of small and medium-sized enterprises (SMEs) with limited strategic clarity often hinges on their policies and interactions with governmental agencies. This study aimed to investigate the current state of Green Supply Chain Management (GSCM) practices and the barriers to their adoption among small enterprises in Bangladesh. The findings reveal that SMEs typically prioritise cost-based strategies when targeting local markets. However, adopting a differentiated market approach presents a significant challenge in most Bangladeshi economies, primarily due to the low wage levels associated with many occupations in a predominantly centrally planned economy (Iqbal *et al.*, 2021; Afum *et al.*, 2020).

Previous research highlights the influence of firm size (Jum'a *et al.*, 2022) and organisational and governmental factors (Bashar *et al.*, 2023; Maqsood *et al.*, 2022) on the implementation of GSCM. This study identified high investment costs and market structure as the two most significant barriers impeding the adoption of GSCM practices in small enterprises in Bangladesh. Factor analysis further indicated that internal barriers are more significant than external barriers in hindering the adoption of GSCM practices, aligning with the findings of (Abbasi and Nilsson, 2012).

Of the ten hypotheses tested, eight were accepted, and two were rejected. The results suggest that internal barriers significantly impede the adoption of all five GSCM practices. Additionally, this study supports a slight negative relationship between external barriers and Integrated Environmental

Management (IEM), Eco-Design (ED), and Internal Recycling (IR). However, the negative impact of external barriers on Green Purchasing (GP) and Carbon Collaboration (CC) was not supported.

This research offers several important implications for the GSCM field in Bangladesh. It represents one of the initial studies on GSCM in the context of Bangladesh, with a particular focus on small enterprises a relatively underexplored dimension. By establishing a foundational understanding of current GSCM practices and the barriers to their adoption, this study provides valuable insights for policymakers and practitioners. Moreover, it highlights opportunities for foreign investors to establish manufacturing zones that prioritise sustainability, thereby promoting environmentally responsible industrial development.

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