DOCTORAL (PHD) DISSERTATION

GREEN SUPPLY CHAIN MANAGEMENT, CIRCULAR ECONOMY, AND SUSTAINABLE ORGANIZATIONAL PERFORMANCE

MOHAMMAD BIN AMIN

Supervisor:

PROF. DR. JUDIT OLÁH

University Professor, Doctor of the Hungarian Academy of Sciences (DSc)

UNIVERSITY OF DEBRECEN

Doctoral School of Management and Business

Debrecen

2026

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The aim of this dissertation is to obtain a doctoral (PhD) degree in the scientific field of "**Management**".

Written by: …. Mohammad Bin Amin....…certified ……

Supervisor: ……Prof. Dr. Judit Oláh……

Doctoral final exam committee:

	name	academic degree
Chair:	.....	.....
Members:	.....	.....
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Date of the doctoral final exam: …. .....

Reviewers of the Dissertation:

name, academic degree	signature
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Review committee:

	name, academic degree	signature
Chair:	.....	.....
Secretary:	.....	.....
Members:	.....	…….
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Date of doctoral theses defense: 2026

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1. INTRODUCTION

1.1. Background

Measuring performance at the organizational level is complicated because of the nature of outcomes that are required to represent a specific entity within the organizational chain (MEHMOOD ET AL., 2025). Several challenges render performance measurement because it is inherently complex. Additionally, these difficulties are encountered when attempting to evaluate performance inside companies, and even further obstacles are experienced regarding quantifying environmental performance across enterprises (SIDDIQI ET AL., 2025). The lack of systems that can measure performance across the organizational level can be attributed to a variety of factors, such as the absence of standardized data, inadequate technological integration, geographical and socioeconomic disparities, differences in corporate policy, the absence of metrics that are agreed upon, or a lack of knowledge, and understanding the necessity of inter-organizational performance measurement (HAVERILA ET AL., 2025).

However, measuring performance in a supply chain system is more challenging, and this mainly happens when considering the multiple organizational levels that are included within the supply chain. Specifically, performance measurement in green supply chain management (GSCM) is required for various reasons. It regulates marketing and competitiveness aspects, considering the obstacles and challenges mentioned for this performance measurement in GSCM (OYEFUSI ET AL., 2025). Although overcoming these obstacles is not an effortless task, the sustainable organizational performance and competitiveness of enterprises may be contingent on the practical implementation of a good GSCM system. Business operations may provide a substantial risk to the environment due to the release of carbon monoxide, discarding packaging materials, disposal of hazardous substances, traffic congestion, and other types of industrial pollution (BAGHERPASANDI ET AL., 2025).

The present research acknowledges GSCM as an imperative approach to safeguard the environment in the organizational context. GSCM aims to include environmental considerations in the management of supply chains. The goal of GSCM is to reduce or eliminate inefficiencies, such as the use of hazardous chemicals, emissions, energy, and solid waste, across the whole supply chain (WANG ET AL., 2025). Moreover, the GSCM includes activities, i.e., product design, material sourcing and selection, manufacturing processes,

product distribution, and end-of-life product management. GSCM is crucial in determining the overall environmental effect of a company engaged in supply chain operations. It plays a significant role as an integral component in improving the sustainability performance of corporations (RASHID ET AL., 2025a).

Notably, circular economy is another process that generates significant revenue growth for organizations by prioritizing environmental consciousness, energy saving, and the global competitive landscape (MAGDALENA ET AL., 2025). These reasons make it clear that the accountability for addressing this sort of problem could not be just with one organization but also with each organization involved in a particular supply chain system. Climate change, environmental degradation, and consumer expectations are now the key factors that determine the degree of sustainable performance that can be accomplished by organizations. Previously, the concept of a circular economy was only discussed in theoretical terms (NWAOGU ET AL., 2025); nevertheless, companies have recently begun to actively explore the potential for their practical implementation. The emphasis is on the favorable consequences of this notion in a sustainable supply chain, which yields environmental, economic, and social advantages for the company. In this regard, organizations are motivated to prioritize green supply chain processes with the additional adaptation of a circular economy due to global rivalry and government legislation that emphasizes the production of environmentally friendly goods (SANTIAGO ET AL., 2025).

However, GSCM, which pertains to environmental and resource concerns, is a unique way to improve operational efficiency and might establish a precedent for the subsequent strategic development of the organization. On the other hand, the concept of circular economy has been identified as a novel approach to assist GSCM and achieve sustainability at the organizational level. The circular economy is primarily concerned with efficiently using resources, saving energy, and properly regulating the physical movement of commodities in green supply chain structures among stakeholders (SINGH ET AL., 2025). In recent times, there has been an increase in studies on GSCM such as, SHAHZAD ET AL. (2025), KHARAT ET AL. (2025), AFROOZI ET AL. (2025), and SINGH ET AL. (2025) that investigate its connection with a circular economy model. Simultaneously, those scholars were also endorsing this pattern by consistently emphasizing the enhancement of sustainable performance through the integration of GSCM to facilitate the transition towards a circular economy, ultimately aiming to improve sustainable performance at the organizational level.

The abovementioned scholars additionally indicated that GSCM plays an indispensable role in managing resources and opportunities for individuals to engage in environmental management. Thus, the GSCM, including the circular economy system, encourages managers to adjust their mindsets and actions towards facilitating pollution prevention and recognizing environmental prospects (JU ET AL., 2025). The current study highlights a significant issue associated with GSCM and circular economy is the sustainable organizational performance that encompasses economic, social, and environmental aspects. Sustainable performance has emerged as a crucial metric, i.e., triple bottom line aspects for businesses aspiring to measure their excellence in performance experts (ANDERSON ET AL., 2025; NOGUEIRA ET AL., 2025). It represents both a measure and a goal for achieving outstanding results. The environmental component comprises the actions and obligations carried out by an organization to promote a more sustainable globe. The social component incorporates the organization's initiatives and endeavors intended to promote the welfare of its personnel. The economic aspect primarily strives to optimize profitability by minimizing the consumption of raw materials, efficiently managing inventories, and reducing manufacturing expenses (OPOKU ET AL., 2025; VUKOVIC ET AL., 2025).

Several prior studies (ABDALLAH ET AL., 2024; MARTÍNEZ-FALCÓ ET AL., 2024; SHAHZAD ET AL., 2025; AFROOZI ET AL., 2025; SINGH ET AL., 2025; SANTIAGO ET AL., 2025) explained a framework combining GSCM with circular economy business approaches. This framework encompasses the supply chain system that is integrated with a circular economy model. In a similar study, KHARAT ET AL. (2025) found that research on the circular economy is increasing; however, GSCM and circular economy as a potential combination has not been well explored. That is why the present study argues for the novel scholarly insight as it intends to contribute to the existing realm of literature on GSCM and circular economy by addressing the shortcomings of earlier studies, especially the lack of research on the emerging South Asian region.

The green industry movement also plays a crucial role in promoting sustainable organizational development globally. A practical approach to combat environmental degradation in the garment sector is implementing a green manufacturing culture. Bangladesh, the second largest exporter of garment products in the global market, is at the forefront of sustainable green industrialization, boasting numerous top-ranked green factories worldwide (AL AMIN ET AL., 2025). Given the significant use of energy, water, and

resources in the clothing business, it is imperative to adopt a greening strategy in the garment sector to promote sustainability and preserve the finite resources of our world.

According to a report by The Financial Express, a well-regarded local newspaper, over 500 garment manufacturers in Bangladesh are achieving certifications on green or ecologically friendly Ready-Made Garment (RMG) organization to promote long-term sustainability (CHAITY ET AL., 2025). Currently, more than 150 RMG organizations in Bangladesh are working as Leadership in Energy and Environmental Design (LEED) green factories (AMIN ET AL., 2024). These factories have been accredited by the US Green Building Council (USGBC), with the highest-level being platinum, which is held by 26 units. Thus, this sector offers an outstanding opportunity to pursue a position in the green supply chain within a worldwide initiative to promote environmentally friendly practices among managers and enterprises.

The objective of the current study is to fill the existing void in empirical research by undertaking a quantitative investigation in the ready-made garment industry in Bangladesh, which serves as a representative sample of emerging countries in South Asia. Additionally, this research aims to construct and analyze a conceptual model that explores the connections between GSCM and sustainable performance. It also includes the incorporation of another relevant element, i.e., circular economy, as a mediating and managers' green concern as a moderating factor. Thus, the present study intends to explore an extended examination between the relationship of GSCM and sustainable organizational performance.

1.2. Problem Statement and Gap of the Research

In spite of the fact that managers have had considerable discussions about the relevance of green supply chain management (GSCM) and circular economy to improve company performance, there has been relatively limited research on this framework, notably in the context of developing and emerging countries, South-Asian research (AHMED ET AL., 2022; KARMAKER ET AL., 2023; ABDALLAH ET AL., 2024), and potential research areas such as the garment sector (ISLAM ET AL., 2024; AMIN ET AL., 2025; CHAITY ET AL., 2025). On the other hand, the convergence of GSCM and the circular economy has not been well addressed in existing literature, particularly in South-Asian emerging nations. That is why the present study considers GSCM a crucial independent component in enhancing the integrated impact of GSCM and the circular economy on sustainable performance.

As Bangladesh is contributing greatly to the global ready-made garment sector, there is an urgent need for a significant number of scientific studies to assess the current state of the environment, evaluate the implementation of GSCM practices, and explore the applicability of the circular economy model to meet the Sustainable Development Goals (SDGs) in Bangladesh. The quantity of research publications available on the research area of circular economy and GSCM in the specific context of emerging nations, particularly Bangladesh, is notably limited (KARMAKER ET AL., 2023; ISLAM ET AL., 2024). Several publications in the context of developing nations mainly focus on green logistics (ZHOU ET AL., 2023); digital capability (LIU ET AL., 2023); eco-innovation (BAG ET AL., 2022); however, a few explored only bibliometric and systematic literature-based study (THEERAWORAWIT ET AL., 2022; AROONSRIMORAKOT ET AL., 2024; LU ET AL., 2024) and a few researches explored only the conceptual discussion (ALLEN ET AL., 2022).

In the context of Bangladesh, AHMED ET AL. (2022), KARMAKER ET AL. (2023), and ISLAM ET AL. (2024) especially concentrated on the green supply chain and circular economy business model in clothing, textile, and ready-made garment (RMG) sectors. In addition, some other research (AHMED ET AL., 2022; CHAITY ET AL., 2025) has also examined the potential risks associated with implementing all techniques related to the circular economy in the context of GSCM practices. However, there is a lack of studies that aim to emphasize the whole scenario of circular economy implementation and GSCM in the present-day context across different sectors in an emerging South Asian nation, such as Bangladesh.

Although the concept of firm performance has been investigated in the past, scholars and professionals have demanded further advanced study to examine this subject in the context of sustainable organizational performance. In earlier investigations, most researchers applied either financial or environmental indicators to assess the performance of the company (BAG ET AL., 2022; LIU ET AL., 2023; KARMAKER ET AL., 2023; AMIR ET AL., 2024; ABDALLAH ET AL., 2024). However, more recent researchers have been focusing on the exploration of the firm in terms of environmental, financial, and social factors (AMIN ET AL., 2024; ISLAM ET AL., 2024; AMIN ET AL., 2025). As a result, the purpose of this research is to investigate the impact that green supply chain management and circular economy contribute to the environmental, financial, and social performance of a company.

Several prior research studies such as MARTÍNEZ-FALCÓ ET AL. (2024), SHAHZAD ET AL. (2025), and RASHID ET AL. (2025) focused on employing unidimensional components to assess green supply chain management and circular economy. However, regarding these two concepts, it is essential to note that they include a wide range of activities and encompass a broad scope. The green supply chain management has taken into consideration in this research using a higher-order model. This study intends to address a methodological loophole that has been identified in previous research in this respect. There have been no previous studies, as far as the researcher is aware, that have explored the combined impact of green supply chain management and circular economy on total company performance from the perspective of a multidimensional concept of sustainable organizational performance, i.e., environmental, financial, and social perspective. The present study intends to fill the empirical gap of the above-discussed literature and methodology, as well as construct relationships in the context of industry and country.

1.3. Research Questions

To address the present research gap, this study intended to investigate the following five research questions:

- ***RQ-1:*** Does green supply chain management positively influence sustainable organizational performance?
- ***RQ-2:*** Does green supply chain management positively influence circular economy?
- ***RQ-3:*** Does circular economy have a positive effect on sustainable organizational performance?
- ***RQ-4:*** Does circular economy have a mediating effect between green supply chain management practices and sustainable organizational performance?
- ***RQ-5:*** Does managers' green concern have a moderating effect between green supply chain management and sustainable organizational performance?

1.4. Research Objectives

The general objective of this study is to evaluate the effects of green supply chain management on sustainable organizational performance including the mediating effect of circular economy and moderating effect of manager's green concern. However, this study indicates the following specific objectives:

RO-1: To measure the effects of green supply chain management on sustainable organizational performance.

RO-2: To evaluate the relationship between green supply chain management and circular economy.

RO-3: To assess the relationship between circular economy and sustainable organizational performance.

RO-4: To examine the mediating effect of circular economy between green supply chain management practices and sustainable organizational performance.

RO-5: To evaluate the moderating effect of managers' green concern between green supply chain management and sustainable organizational performance.

1.5. Conceptual Definition of the Key Variables

The dependent, independent, and mediating variables used in this study are defined in the following Table 1 to make the research easier, explainable and understandable to prospective readers:

Table 1: Definition of the Key Variables and Constructs

Variables	Construct	Conceptual Definitions	Source
Green Supply Chain Management		Green supply chain management incorporates environmental considerations into managing supply chain activities. Green supply chain management focuses on minimizing or eliminating inefficiencies in resource use, such as the use of hazardous chemicals, emissions, energy, and solid waste, throughout the entire supply chain. Additionally, this process includes aspects such as product design, raw material sourcing and selecting, manufacturing processes, product delivery, and end-of-life product management.	WANG ET AL., 2025
	Eco-design	Eco-design refers to the environmentally concerned design of a product and its packaging, aiming at minimizing adverse environmental consequences throughout the product's lifecycle while supporting environmentally conscious measures for the design and packaging of the goods or services.	AHMAD ET AL., (2022)
	Green Purchasing	Green purchasing represents the adoption of environmentally conscious procurement practices that minimize waste generation and encourage recycling and restoration of acquired materials, while maintaining the performance	LERMAN ET AL., 2022

		standards of such products.	
	Green Manufacturing	The term "green manufacturing" refers to a manufacturing process that eliminates harmful compounds, enhances energy efficiency in lighting and heating; implements re-use principles, reduce waste, and actively design and redesign environmentally friendly processes. Green manufacturing transforms harmful compounds into outputs.	LERMAN ET AL., 2022
	Green Distribution & Packaging	Green distribution and packaging encompass activities aimed at minimizing container size, utilizing eco-friendly packaging materials, advocating for recycling and reuse initiatives, collaborating with vendors to standardize packaging, promoting the adoption of returnable packaging methods, decreasing material usage and unpacking time, implementing a recyclable pallet system, and reducing energy consumption in warehouses.	UDDIN, (2021)
	Internal Environment Management	Internal environmental management pertains to the regulations and objectives established by organizations to safeguard the environment and ensure its safety for human habitation. Internal environmental management processes guarantee support by integrating all managerial actions with practices related to environmental management.	UDDIN, (2021)
Circular Economy		The term "circular economy" refers to a model of economics in which the processes of resourcing, manufacturing, reusing resources, re-producing a new product, and reprocessing a	NWAOGU ET AL., 2025

		product's new life are carefully structured to consider both the well-being of humans and the environmental performance.	
Sustainable Performance		Elkington initially defined the sustainable performance of an organization as the triple bottom line concept, which encompasses the organizational level of performance based on the natural environment, economy, and society. From this perspective, economic performance refers only to financial success, while environmental performance pertains to mitigating environmental harm and safeguarding against resource depletion. Finally, social performance focuses on the welfare of workers, consumers, and all other stakeholders.	AMIN ET AL., 2025
	Environmental Performance	Sustainable environmental performance is an organization's capacity to meet its goals to promote ecological well-being and minimize negative environmental consequences. It entails ensuring ecosystems are healthy today and, in the future, while also effectively using resources and lessening pollution levels. The basic concept of sustainable environmental performance is proactively reducing operations' environmental impact, rather than only reacting to ecological requirements. The current study focuses on environmental performance at the organizational level, based on the perceptions of each corporation's representatives (managers).	AMIN ET AL., 2024

	Financial Performance	In sustainable financial performance, a company aims to achieve its long-term economic success while simultaneously minimizing its negative impact on the environment and the organization and maximizing its positive effects. If the company is to achieve sustainable financial success, managerial decisions and strategy development should center on environmental and governmental regulatory considerations. The present research concentrates on the perceptions of the representatives (managers) of the financial performance of each corporation.	AMIN ET AL., 2024
	Social Performance	Sustainable social performance is an organization's capacity to improve people's lives and the world at large in a way that doesn't deplete resources or harm future generations. All behaviors that strengthen communities, advance human rights and fairness, and keep social systems strong and stable throughout time are part of it. The present research intends to examine social performance at the organizational level, focusing on the perception of its representatives, i.e., managers.	AMIN ET AL., 2024

1.6. Conceptual Framework

The objective of the present research is to empirically investigate the influences of green supply chain management on sustainable organizational performance. The dependent or influenced variable in this current research is sustainable organizational performance, which has three dimensions, i.e., environmental, financial, and social. The independent variable green supply chain management has five components (eco-design, green purchasing, green manufacturing, green distribution and packaging, and internal environment management), which are all independent or controlled variables. Additionally, this research intends to examine the mediating effect of the circular economy and the moderating effect of managers' green concern between green supply chain management and sustainable organizational performance. The following framework, shown in Figure 1, is proposes for the current study to empirically investigate based on the study objectives and research questions:

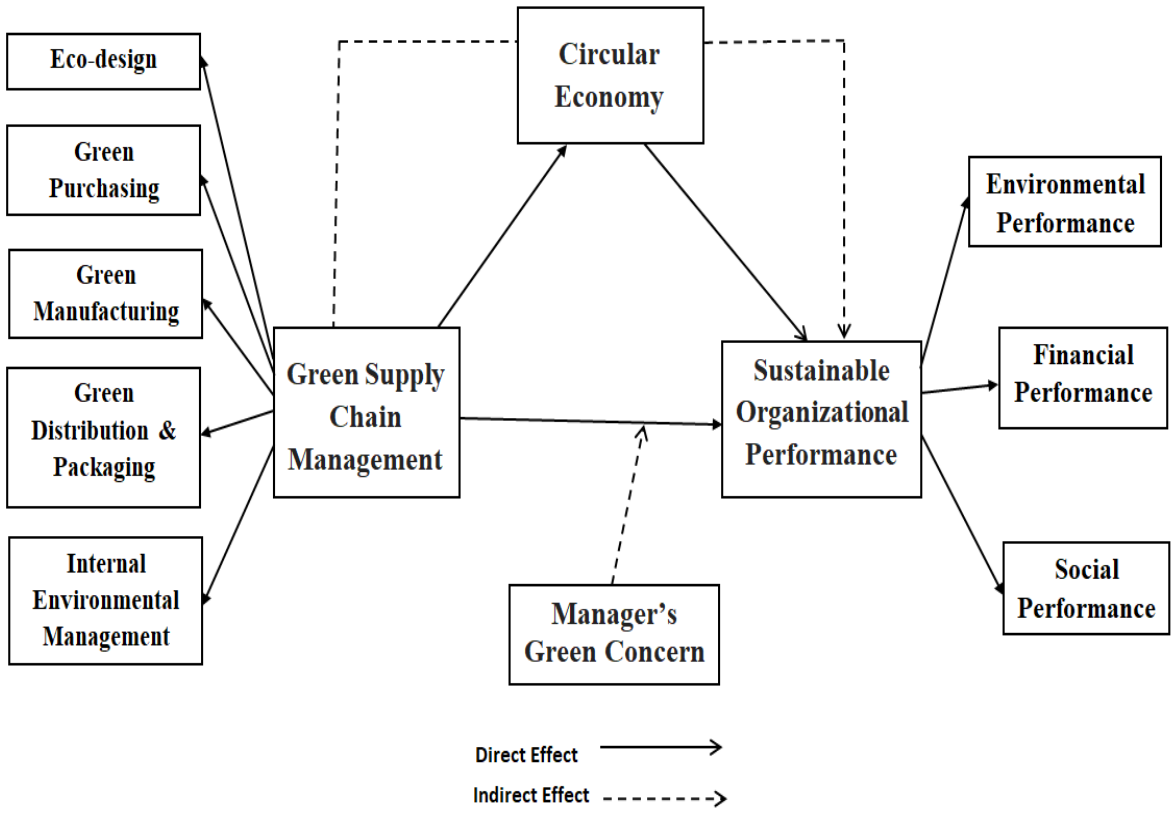

Figure 1: Conceptual Framework for this Study

2. CONTEMPORARY LITERATURE REVIEW

2.1. Overview

This chapter focuses on discussing relevant literature about green supply chain management and circular economy approaches to attain sustainable organizational performance, specifically in the context of garment organizations in Bangladesh, and very specifically green garment factories. This study presents a comprehensive evaluation of literature and related contemporary issues, which further includes a literature matrix related to the present variables. Additionally, the current research demonstrates bibliometric literature from the Web of Science (WoS) core collection. Besides, the present study includes government data, regulatory agency archives, and news reports pertaining to the operations of ready-made garment organizations in Bangladesh.

2.2. Green Garments in Bangladesh

Sustainable business refers to a firm that is economically viable and operates within the capacity to contribute to the continued functions related to the environment, economy, and social perspective. As Bangladesh is the second biggest exporter of Ready-Made Garments (RMG) worldwide and has numerous highly rated green factories, the RMG industry in Bangladesh has the potential to engage in sustainable business practices, therefore making a significant contribution to the sustainable development on a larger scale. The worldwide garment business is experiencing significant growth due to a surge in demand for fibers, wool, textiles, and clothing (DAS ET AL., 2025). Developing countries are putting forth significant efforts to achieve substantial growth in the garment industry to enhance their economic development. The garment manufacturing business is known for its resource-intensive structure and high energy consumption. It requires a significant number of natural resources to achieve the desired level of production (RASHID ET AL., 2025c).

Notably, the challenges of maintaining the explosive development of the ready-made garment sector while minimizing harm to the ecosystem can be addressed by implementing green structures, procedures, and strategies that consider the financial system, society, and the ecology (SAIF & ISLAM, 2025). Many Asian clothing companies increasingly embrace the opportunity to participate in the green revolution and actively appeal to environmentally conscious consumers (RAHMAN ET AL., 2025). Developing nations have been paying increasing attention to the concept of a sustainable production system, as their governments

have implemented long-term development plans that include sustainable development goals (CHAITY ET AL., 2025). Bangladesh, an emerging nation, has successfully prioritized sustainability in its long-term objectives, leading to economic progress. The government has committed to spread awareness and implementing the Sustainable Development Goals (SDGs) outlined in the 2030 Agenda (HOSSAIN ET AL., 2025). The government of Bangladesh assured to promoting sustainability in its infrastructure and operations and aims to participate in global sustainability efforts and assess competitive advantages promptly.

Green supply chain activities significantly contribute to the advancement of sustainable performance in organizations (MUSTAFI ET AL., 2025). Bangladesh attracts attention for its exploration of the effects of green supply chain activities on its manufacturing sectors, particularly the green garment business. Consequently, it has the potential to contribute to the literature on green supply chain management within the context of a labor-intensive emerging nation in Asia. Notably, Bangladesh achieves remarkable economic growth by providing manufacturing outcomes that offer high-quality products at low costs. This growth is driven by the country's vibrant garment industry, which has positioned Bangladesh as a leading contributor in the global garment marketplace (AMIN ET AL., 2024). Moreover, the garment sector in Bangladesh has been the subject of sustainability research due to the adoption of environmentally friendly sustainable practices that have completely transformed the structure of this industry (ISLAM ET AL., 2024). Indeed, this industry has the world's leading environmentally friendly clothing factories located in Bangladesh.

Promoting sustainable organizational growth on a worldwide scale is another important aspect of the green industrial movement. As the apparel industry cannot avoid polluting the environmental, green manufacturing culture is the best realistic way to safeguard the environment from the destruction. Several of the world's best green garment factories are located in Bangladesh, which puts the country in the vanguard of sustainable green industrialization and makes it the number two garment exporter globally (AL AMIN ET AL., 2025). Adopting a greening strategy in the garment industry is vital to promote sustainability and protect the limited resources of our earth, given the large usage of energy, water, and resources in the textile industry. A highly recognized local newspaper, the Financial Express, reported in 2025 that more than 500 garment factories in Bangladesh are promoting long-term sustainability through the implementation of green or environmentally friendly Ready-Made Garment (RMG) certification. Around 150 Bangladeshi RMG companies have

achieved the LEED-certification as green manufacturers (AMIN ET AL., 2024). An impressive 26 organizations have achieved the highest level of accreditation in the category of green factory from the US Green Building Council (USGBC). Thus, this sector presents a unique opportunity to engage in the green supply chain as part of a global initiative to advance sustainable practices among individuals and organizations.

2.3. Underlying Theories

Resource-Based View (RBV) Theory

The concept of Resource-Based View (RBV), which can be applied at the organizational level, was introduced by Jay B. Barney in his seminal article published in the Journal of Management in 1991. In his research, Barney discovers that organizations can achieve a competitive advantage by proper utilization of their rare, non-imitable, and valuable resources, which can ultimately lead to overall sustainable company performance. Thus, the RBV theory provides a strong theoretical foundation for explaining the relationships represented in the present research model, as it emphasizes that firms achieve sustainable performance through the maximum utilization of their resources. In the current framework, green supply chain management (GSCM) practices, i.e., eco-design, green purchasing, green manufacturing, green distribution and packaging, and internal environmental management, along with circular economy, are considered the strategic resources for the company. These practices are strategically not only valuable in maximizing resource utilization but also in reducing waste and improving efficiency (ZHOU ET AL., 2023). Additionally, these resources are rare and difficult for competitors to imitate (NANDI ET AL., 2021). Thus, GSCM practices and circular economy can ensure the maximum utilization of resources that can directly enhance sustainable organizational performance across environmental, financial, and social dimensions (MARTÍNEZ-FALCÓ ET AL, 2024).

Additionally, the role of managerial green concern, which can function as an intangible human capital resource, is another crucial element in the present model. The present study indicates that the successful implementation of green practices can be influenced by the organization's managers' concerns, awareness, and approaches towards environmental responsibility, which subsequently affects the company's strategic decisions, resource allocation, and overall organizational success. This managerial leadership and green concerned responsibility orientation are profoundly embedded in the company, resulting in a

unique and irreplaceable circumstance (NUREEN ET AL, 2023). Administrative concern underscores the Resource-Based View's focus on the significance of intangible, knowledge-driven resources to attain competitive advantage that drives the company's sustainable performance (KHAN ET AL, 2023A). Thus, RBV supports the present concept that GSCM practices, circular economy, and managers' green concern can contribute to achieving sustainable organizational performance.

Natural-Resource-Based View Theory

The present research model has been further strengthened by incorporating the Natural-Resource-Based View (NRBV), which extends the competitiveness concept of resource-based view (RBV) theory to three dimensions of sustainability, i.e., environmental, economic, and social contexts. The NRBV theory is applicable from an organizational perspective, which was introduced by S.L. Hart in his publication in 1995. NRBV theory is a prominent academic model, emerging with particular significance in sustainable operations literature (MCDOUGALL ET AL, 2022; COPPOLA ET AL, 2023; LAU & WONG, 2024). Comprising all organizational resources intended to maximize competitiveness and ensure sustainability; the NRBV explores the growing need for ecological, economic, and societal development in business operations (SEHNEM ET AL, 2022).

However, prior scholars (ANDERSÉN, 2021; LAU & WONG, 2024; ALKARAAN ET AL, 2024) highlighted a lack of explanation of competitive resources in operations of the RBV theory, which has been extensively explained later with particular significance by the NRBV theory. According to NRBV, eco-design and pollution prevention represent pollution prevention capabilities, circular economy practices reflect product stewardship, and internal environmental management supports sustainable development capabilities (ISLAM ET AL, 2024). These capabilities further reinforce that environmental and green practices are not simply compliance activities but core strategic resources (SAMADHIYA ET AL, 2023). Thus, combining RBV and NRBV perspectives, the model demonstrates that GSCM, circular economy, and managerial concern altogether provide unique and dynamic resources that drive sustainable organizational performance in a holistic manner (SEHNEM ET AL, 2022; COPPOLA ET AL, 2023).

Dynamic Capabilities Theory

The present model also integrates the GSCM and circular economy, which aligns with RBV's extension toward the theory of dynamic capabilities. The Dynamic Capabilities Theory (DCT) was introduced by D.J. Teece and his research team in an article published in the Strategic Management Journal in 1997. Unlike static resources, both GSCM and circular economy practices reflect a firm's ability to reconfigure and renew resources through its green supply chain continuously, and additionally, the reuse, recycling, and closed-loop systems (LU ET AL, 2024). This dynamic capability enables firms to adapt to regulatory changes, meet growing consumer demand for sustainability, and differentiate themselves in competitive markets (MONDAL ET AL, 2025).

According to DCT, the circular economy ensures long-term competitiveness in changing environmental regulations and consumer demands (BAG & RAHMAN, 2023). Additionally, circular economic practices allow firms to differentiate themselves in markets increasingly concerned with sustainability (XU ET AL, 2025). In support of DCT, previously several studies (for example, MALHOTRA, 2024; LU ET AL, 2024; MARTÍNEZ-FALCÓ ET AL, 2024) indicated RBV and NRBV perspectives, where the scholars explained that such adaptability and transformation of GSCM, along with circular economy, are a sustainable source of competitive advantage, thereby justifying the mediating role of the circular economy in the present model.

2.4. Sustainable Performance

The Brundtland Report, published in 1987, was the first formal discussion that introduced the notion of sustainability. In that report, the scholars drew extensive attention to the theme of sustainability and sustainable performance at the organizational level. Corporate managers are more concerned about environmental difficulties and the drastic and changeable nature of external environment-related factors. The reason is that all the stakeholders put forward these ecological factors to consider while accomplishing company restructuring to address the challenges (CIVERA ET AL., 2025). Nevertheless, the prevailing definition of sustainability was given by KEMPSTON ET AL. (2025) in the context of supply chain, the pursuit of progress that fulfils the requirements of the current generation without sacrificing the capacity of future generations to comply with their own requirements. On the other hand, several researchers (for example, AKASH ET AL., 2025; NICA ET AL., 2025) highlighted

the triple-bottom-line approach of sustainable performance or sustainability at the organizational level. This perception addresses sustainability as the practice of implementing business plans and actions that fulfil the current requirements of the firm and its stakeholders while also safeguarding, maintaining, and improving both natural and human capital that will be necessary in the future (NICA ET AL., 2025).

The conceptualization of the triple-bottom-line for "sustainable performance" was introduced by Elkington in his paper published in 1994, which is well recognized in academia for a scientific explanation of measuring sustainability. Besides, this concept represents the performance of the corporation in three dimensions: environment, economy, and society. Thus, Elkington indicates the sustainable organizational performance approach in accordance with the notion of the "triple bottom line," which indicates three pillars of sustainability. The present study explains the above term that economic performance primarily concerns monetary outcomes, while environmental performance focuses on minimizing adverse impacts and safeguarding against the depletion of resources. The third dimension, social performance, focuses on the welfare of personnel, customers, investors, management, and other stakeholders. In this regard, DÍAZ ET AL. (2025) highlighted that in growing economies such as China, Malaysia, India, Indonesia, and Bangladesh, the attention to sustainable performance is increasing among their companies.

Prior research has demonstrated the importance of incorporating sustainability into various aspects of company operations, such as managing the supply chain activities (AHMAD ET AL., 2022; MEHMOOD ET AL., 2025; KHARAT ET AL., 2025), new product design and development (MENGISTU ET AL., 2025), innovation and development (ABDALLAH ET AL., 2024; SIDDIQI ET AL., 2025; WANG ET AL., 2025), holistic management systems (ONAT ET AL., 2025), operations supervision (BONESSO ET AL., 2025), technological advances through IT (ISLAM, 2025), and project administration (BICK, 2025). These investigations confirmed that integrating sustainability and business operations is crucial for achieving successful outcomes. The findings regarding the optimal and productive use of resources in organizational production processes were analyzed in their studies.

Additionally, the abovementioned studies indicated that sustainable performance by the organizations represents achieving favorable outcomes in terms of resources and the environment, i.e., a decrease in pollution and wastage of natural resources. The studies also

emphasized that the strategies of organizations must be redesigned to optimize energy use and minimize the adverse effects of carbon to attain sustainable performance. Nevertheless, substantial challenges have compelled organizations to reconsider and restructure their approaches to ensure sustainability in their performance (OBEIDAT ET AL., 2023; CHEN ET AL., 2023; RASHID ET AL., 2025a). In this pertinent, SHAHZAD ET AL. (2025) emphasized the significance of the corporate role and the need for its management team to exhibit social responsibility rather than just focusing on environmental responsibility to achieve its economic goals. Likewise, organizations must effectively use their workforce to achieve sustainability targets, which are intricately connected to sustainable performance.

Moreover, prior studies (for instance, VITALE ET AL., 2025; LIN ET AL., 2025; LE ET AL., 2025) have emphasized the paucity of research endeavors that have examined each component that contributes to sustainability. Besides, the scholars emphasized the conceptualization of social and environmental sustainability as a micro-level dimension based on individual perception and psychological foundations. Similar supportive views were represented by the abovementioned prior scholars, such as NOGUEIRA ET AL. (2025) emphasized the need to include non-monetary metrics in evaluating company success rather than just relying on economic data. In addition, the authors emphasized the need to use intangible assets, such as customer reaction, employee engagement, and perception of other stakeholders, when evaluating business success. However, based on the above contemporary discussion and recent literature support, the following Table 2 shows the literature matrix on sustainable performance:

Table 2: Literature Matrix on Sustainable Performance

SL	Author(s)	Variables	Underlying Theories	Methods Used	Findings
1	HALBUSI ET AL. (2025)	AI capability, innovation, big data, Knowledge sharing, and Sustainable corporate performance	TAM and KBV theory	PLS-SEM and ANN	The research revealed that the capabilities of AI and innovation contribute to sustainable performance through the intervention of big data and knowledge sharing
2	KUMAR ET AL. (2025)	AI capability, Innovation, Knowledge sharing, and Sustainable company performance	RBVT and KBV theory	PLS-SEM	The study found that AI capability and innovation foster the company sustainable performance based on the environmental context.
3	LIN ET AL. (2025)	Nation level sustainable performance, and Sustainable performance in the organization level	Institutional pressures theory	OLS regression	This research found that national level sustainable performance accelerates organizational level sustainable performance
4	NOGUEIRA ET AL. (2025)	Labor practices and Sustainable corporate performance	Stakeholder theory	PLS-SEM, SPSS	Labor practices maximize sustainable performance of the company emphasizing social sustainability
5	ALKARAAN ET AL. (2025)	Green supply chain, Governance, Innovation, Industry 4, Sustainable performance	RBV theory	Regression analysis	Green supply chain, governance, innovation, and industry 4, altogether have significant contribution to Sustainable corporate performance

6	VITALE ET AL. (2025)	Corporate sustainable performance, and Performance measurement	RBV theory	SLR and bibliometric	This research found knowledge gap the literature on corporate sustainable performance and performance measurement
7	BERETTA ET AL. (2025)	Sustainable corporate performance, financial performance, SDG disclosure	VDT and Legitimacy theory	Regressio n analysis	Positive relationships between sustainable corporate performance, financial performance, SDG disclosure
8	LE ET AL. (2025)	Green Innovation, CSR, Transformational Leadership, Sustainable performance	RBV and Stakeholder theory	PLS-SEM	Green Innovation, CSR, Transformational leadership, have a positive effect on sustainable performance
9	KHAN (2025)	Artificial intelligence, Organizational agility, and Sustainable performance	TAM and Grounded theory	PLS-SEM	Both Artificial intelligence and organizational agility have significant positive influence on sustainable performance
10	SHAHZA D ET AL. (2025)	Green supply chain, Industry 4, Circular economy, Technological readiness, and Sustainable performance	NRBV theory	PLS-SEM	Green supply chain, Industry 4, circular economy, and technological readiness, all have significant positive contributions to sustainable performance

2.5. Green Supply Chain Management

The concept of green supply chain management (GSCM) has emerged from the basic functions of supply chain management (SCM). As the performance competition among corporations increased in the 1990s, corporations were compelled to adopt ethical and socially concerned practices in their supply chain activities due to the growing recognition of environment-safety-focused approaches (HOSAIN & MUSTAFI, 2025). Since its emerging adaptation by the corporations, GSCM has also garnered significant academic attention, reaching its peak in popularity in 2010 (GALDOS-URBIZU ET AL., 2024). By considering green supply chain practices (GSCP), companies formulate environmental management plans to address the evolving environmental regulations and their effects on supply chain activities. A supply chain is a sophisticated system or process that includes all the parties involved in producing and delivering products or services to the end customers. This system encompasses suppliers, manufacturers, distributors, wholesalers, retailers, and customers. It involves the physical distribution of goods, the flow of information, and the management of financial transactions.

Supply chain expert scholars (for example, RAUSCH-PHAN & SIEGFRIED, 2022; ISLAM ET AL., 2024) indicated that the conventional supply chain consists of five key stages: suppliers, manufacturers, distributors, retailers, and consumers. These five phases are interconnected by the conveyance of commodities, information, and finance. The supply chain management (SCM) system is intricate and challenging due to the involvement of several sub-systems, activities, connections, and processes. Moreover, the SCM procedures include a range of strategies and actions used by a company to efficiently coordinate the distribution of goods and services, to ensure the smooth functioning of the overall process. Thus, GSCM strategies include incorporating environmentally friendly activities into procurement, production, distribution, and reverse logistics processes (SHAHZAD ET AL., 2025). The primary objective of SCM is to ensure the precise supply of the appropriate product to the correct consumers at an optimal cost, within the specified timeframe, with the desired level of quality, in the appropriate format, and the required amount (RAUSCH-PHAN & SIEGFRIED, 2022).

Moreover, the primary objective of SCM in the near term is to decrease cycle time and inventory, hence boosting productivity. Meanwhile, its long-term objective is to maximize

profits by expanding market share and ensuring customer satisfaction (SAAD ET AL., 2024). The advantages that may be obtained from SCM have been well acknowledged in supply chain research. For instance, the measurable advantages of SCM include decreased supply chain expenses, enhanced overall productivity, reduced inventory, improved forecast accuracy, better delivery performance, faster fulfilment cycle time, and higher demand for goods. SCM may result in a 60% improvement, with a range of increases between 10% and 60%. The fulfilment cycle time has significantly improved, increasing from 30% to 60%. Cost-effective SCM is crucial for the survival and expansion of all categories, i.e., small, medium, or large-sized enterprises. The reason is that the cost of procuring materials accounts for the greatest portion of their sales income, roughly 80 per cent (SAAD ET AL., 2024). SCM offers numerous advantages, such as increased client satisfaction and responsiveness, better communication within the supply chain, risk mitigation, shortened product development cycles, elimination of redundant inter-organizational processes, less inventory, and enhanced electronic commerce.

However, regarding GSCM, NING ET AL. (2025) revealed that using SCM strategies may result in several advantages, such as decreased inventory levels, shorter production lead times, enhanced flexibility, improved forecasting accuracy, cost savings, and more precise resource planning. As SCM techniques advance, governments, corporations, and their SCM partners are working together to mitigate environmental issues. This collaboration aims to decrease waste, energy consumption, and pollution while additionally minimizing environmental hazards and enhancing community and stakeholder acceptance. Collaboration may facilitate reciprocal learning about environmental issues (ELTALHI ET AL., 2025). Companies that adopt GSCM techniques experience cost savings through the conservation of resources and reduced energy and water usage. Additionally, they enjoy improved public perception and reduced environmental responsibility. Inadequate environmental performance may have substantial environmental consequences and lead to financial losses for firms, such as decreased stock prices. In this regard, WANG ET AL. (2024) identified a strong correlation between businesses' environmentally conscious activities and substantial rises in their stock prices. On the other hand, companies those engage in environmentally destructive behavior witness declines in their share prices. Thus, companies that are conscious of their environmental impact have the potential to attract investments from socially responsible investors.

Notably, the growing global awareness and acceptance of ecologically sustainable business practices and the mitigation of global warming might motivate companies to demonstrate a noteworthy dedication to green initiatives, such as saving energy, minimizing resource usage, and reducing carbon emissions. Corporations that actively respond to social values may establish social values and legitimacy, which is crucial for their future survival and competitive advantages. In this pertinent, WIREDU ET AL. (2024) revealed that when enterprises integrate environmental and organizational principles, they may achieve a competitive advantage that improves profitability, expands market access, strengthens customer connections, and enhances their competitive edge. Therefore, several companies may imitate the environmental measures that successful leading companies have implemented. The emphasis on business performance has shifted in response to the current global environmental requirements. Previously, the notable focus was on generating wealth by excelling in economic performance, including success in assets, liabilities, and overall market strength. However, the current focus has shifted towards environmental and social performance while still aiming for high economic performance to achieve optimal levels of sustainability performance. Sustainable performance is a company strategy intricately linked to corporate social responsibility.

In particular, the company, environment, community, and society form a mutually supportive commitment to seeking shared values or a win-win solution for all parties. Organizational sustainability necessitates the convergence of economic, environmental, and societal excellence to attain a durable competitive advantage (ZHANG, 2024). Businesses should prioritize long-term profitability to mitigate environmental and socioeconomic hazards effectively. Thus, the practice of GSCM is well-positioned for achieving sustainable performance related to environmental, financial, and social aspects. A fundamental principle of supply chain activities is effectively synchronizing the movement of raw materials and components from many suppliers to manufacturing enterprises. In this regard, organizational sustainable performance can be achieved through GSCM with the end goal of transforming raw materials into completed goods and meeting the value requirements of consumers. The organization's ability to manufacture a product of greater quality and lower prices while maintaining its delivery commitments relies entirely on the skills of its suppliers.

Nevertheless, companies must prioritize supply-side processes to attain sustainability at the corporate level. In this pertinent, MEHMOOD ET AL. (2025) contended that GSCM requires

cooperation with suppliers in developing sustainable products, conducting informative workshops, and assisting manufacturers in establishing their own environmental initiatives. Similarly, SHAHZAD ET AL. (2025) revealed further information indicating that a growing number of organizations are incorporating environmental collaborative practices into their strategic goals and operations. The key component of GSCM is the cooperative effort between the focal firm and its suppliers to promote ecologically and socially responsible actions on the supply chain side. Collaboration in the context of the environment refers to a technique that assists companies in enhancing and promoting the environmental capabilities of their supplier partners (UDDIN, 2021). In another similar research, DEBNATH & SARKAR (2023) describe environmental collaborative activities that involve partnering with suppliers to accomplish ecological goals and enhance waste reduction efforts.

However, the present concept of green supply chain management (GSCM) involves sharing design specifications with suppliers that incorporate environmental criteria for purchased items, promoting the development of innovative source reduction strategies among suppliers, collaborating on cleaner production practices, and assisting suppliers in providing components, machinery, parts, and other supplies that align with company goals. However, the role of senior management is crucial in influencing the extent of an organization's sustainability practices. Environmental cooperation is a program that addresses ecological challenges, emphasizing protecting the environment and promoting the coordinated development of economic and environmental views (NASEER ET AL., 2023). Based on the above contemporary discussion and recent literature support, the following Table 3 shows the literature matrix on green supply chain management:

Table 3: Literature Matrix on Green Supply Chain Management

SL	Author(s)	Variables	Underlying Theories	Methods Used	Findings
1	NING ET AL. (2025)	Green supply chain management, Innovation, Sustainable performance	RBV theory	PLS-SEM, SPSS	Green supply chain management and innovation have made significant contribution to sustainable organizational performance.
2	HOSAIN & MUSTAFI (2025)	Green supply chain management, Environmental performance	Stakeholder theory	PLS-SEM, SPSS	Green supply chain management has a positive effect on environmental performance.
3	ELTALHI ET AL. (2025)	Government support, green market orientation, Environmental commitment, Adaptation of green supply chain management		PLS-SEM	Government support through the intervention of green market orientation and environmental commitment have contributed to the adaptation of green supply chain management
4	AL AMIN ET AL. (2025)	Industry 5, Green supply chain management, Sustainable development	RBV theory	MICMAC analysis, SPSS	Industry 5 and green supply chain management have positive influence on sustainable development
5	OYEFUSI ET AL. (2025)	Green supply chain management, Sustainability	Fuzzy set theory	SLR analysis	Green supply chain management has positive effects on sustainability
6	MAHAR ET AL. (2025)	Green supply chain management,	RBV, Institutional	PLS-SEM	Green supply chain management through the intervention of innovation

		Innovation, Company culture, Sustainable performance	theory		and company green culture have significant contribution to sustainable organizational performance
7	GUPTA ET AL. (2025)	Green supply chain management, Low carbon-based performance	RBV, Stakeholder theory	PLS-SEM	Green supply chain management has a positive effect on low carbon-based performance
8	JUNEJO ET AL. (2025)	Green supply chain management, Innovation, Knowledge sharing, big data, Sustainable performance	RBV theory	PLS-SEM	Green supply chain management through the mediation of green innovation, knowledge sharing, and big data-based supply chain system have positive impacts on sustainable performance
9	TETTEH ET AL. (2025)	Supply chain leadership, green competency, green supply chain management	RBV, Resource-advantage theory	SLR, bibliometric analysis	Supply chain leadership and green competency accelerate the transformation of green supply chain management
10	MUSTAFI ET AL. (2024)	Green supply chain management, Perceived competitiveness, Supply chain leadership, Sustainable performance	RBV theory	PLS-SEM	Green supply chain management through the intervention of perceived competitiveness and supply chain leadership have significant contribution to sustainable company performance

Comparison between Traditional and Green Supply Chain Management

The present research highlights to compare conventional supply chain management with green supply chain management and to investigate the significance of green supply chain management within the existing context of the RMG industry in Bangladesh. The objective is to clarify the distinction between traditional and contemporary green supply chain practices for managers, emphasizing their significance in the current demanding business environment. The following Table 4 delineates the points and discussions concerning the distinctions between conventional and green supply chain management:

Table 4: Differences between Conventional and Green Supply Chain Management

Subject	Conventional supply chain management	Green supply chain management
Study scope	Conventional supply chain management typically does not address environmental preservation and the efficient use of resources.	GSCM involves the combination and incorporation of three components: supply chain activities, environmental conservation, and resource optimization.
Gained benefits	Generally, the primary goal of enterprises is to attain maximum economic gains. The organization will prioritize its own objectives without compromising external interests.	Green supply chain management considers the integration of economic rewards, environmental preservation, and conserving natural resources.
Information transmitted	The information transmission system in conventional supply chain management is widely practiced and commonly used.	The GSCM enhances the dissemination of environmental impact information and resource conservation and integrates and optimizes the information, logistics, and energy flow of supply chain management in a systematic manner.

Management process	Traditional supply chain management operates only as a unidirectional flow from suppliers to customers. The process may be conceptualized as spanning from birth to death	GSCM includes the entire closed-loop process of design, purchasing, manufacturing, packaging, sales, utilization, and recycling. It comprises every stage of the product life cycle.
Pursuit of the goal	The primary objectives of typical supply chain management concentrate on four factors: accomplishment on time, superior quality, cost minimization, and best services.	Conversely, GSCM encompasses six factors: accomplishing on time, superior quality, cost minimization, and best services, environment, and resources.

2.6. Components of Green Supply Chain Management

Green supply chain management (GSCM) embraces several aspects and is integrated into every stage of the supply chain system in an organization. GSCM practice is a multidimensional and complicated concept that can be evaluated from several perspectives. Prior literature has emphasized various components of GSCM approaches (UDDIN, 2021; LERMAN ET AL., 2022; AHMAD ET AL., 2022). In similar research, GAWUSU ET AL. (2022) introduced a comprehensive framework for GSCM practices, consisting of five dimensions: green manufacturing, green procurement, green distribution, eco-design, and green logistics. Besides, UDDIN (2021) proposed that green purchasing, green manufacturing, green design, green distribution and packaging, and internal environment management are crucial activities in the field of GSCM. However, LERMAN ET AL. (2022) asserted that green purchasing, green manufacturing, green supplier relationships, green customer relationships, and green packaging is the critical aspects of GSCM. According to AHMAD ET AL. (2022), GSCM techniques should encompass green purchasing, green manufacturing, and cooperation with customers, eco design, and green information systems. Similarly, ABDALLAH & AL-GHWAYEEN (2020) indicated that GSCM practices include Green Purchasing, Customer management, Eco-design, and Internal Environment

management to enhance organizational sustainability. However, the following Table 5 represents the components of green supply chain management indicated by various scholars:

Table 5: Components of Green Supply Chain Management by various Scholars

Authors	Components
LERMAN ET AL. (2022)	a. Green Purchasing b. Green Manufacturing c. Green Supplier Relationship d. Green Customer Relationship e. Green Packaging
AHMAD ET AL. (2022)	a. Green Purchasing b. Green Manufacturing c. Cooperation with Customers d. Eco Design e. Green Information System
GAWUSU ET AL. (2022)	a. Green Manufacturing b. Green Procurement c. Green Distribution d. Eco-design e. Green Logistics
UDDIN (2021)	a. Green Purchasing b. Green manufacturing c. Green Design d. Green Distribution & Packaging e. Internal Environment management
ABDALLAH & AL-GHWAYEEN (2020)	a. Green Purchasing b. Customer management c. Eco-design d. Internal Environment management
HABIB ET AL. (2020)	a. Green production b. Customer management c. Eco-design d. Internal Environment Management

Based on the above literature support, this study adapted five components of GSCM: eco-design, green purchasing, green manufacturing, green distribution & packaging, and internal environment management as the independent variables to explore and investigate.

i. Eco Design

Eco-design refers to the integration of environmental considerations into product design and development (LI & SARKIS, 2022). Besides, eco-design provides the necessary product design which ultimately can attain customer support (DAHMANI ET AL. 2022). For the implementation of appropriate eco-design, organizations need to collect and analyze responsive data on the consequences of their activities on suppliers and elaborate on suppliers' assumptions to devise new products that meet satisfaction expectations and influence customer behavior (BASHAR ET AL. 2023). The integration of eco-design has been shown to facilitate a decrease in consumer waste (LI ET AL. 2024). In addition to that, LI ET AL. (2024) indicated eco-design as a collaborative effort of organizations, suppliers, and other stakeholders throughout the supply chain to create environmentally sustainable goods and materials with recyclable components. The result not only fulfilled the stakeholders' expectations regarding the selected materials, packaging, and product functioning but also instigated changes in their business strategies. Client assistance in an eco-plan that addresses their demands enhances value via increased sales or customer loyalty (LIU ET AL. 2021). Its collaborative business functions may lead to a more advanced stage of development, facilitating the introduction of new products. Eco-design encompasses two primary perspectives: (a) "the impact of design on the climate, whether beneficial or detrimental," and (b) "the intent behind the innovator's initiation of a development (product/service), considering its environmental implications" (DAHMANI ET AL. 2022). In the long term, eco-friendly innovation facilitates a business's growth and ensures its financial, environmental, and social sustainability, along with competitive advantages; therefore, eco-friendly innovation is a crucial tool for achieving sustainable business contributions (BASHAR ET AL. 2023).

ii. Green Purchasing

The term "green purchasing" refers to the implementation of environmentally aware procurement techniques that not only reduce the amount of waste produced but also stimulate recycling and restoration of materials that have been obtained, all while ensuring that the performance criteria of the items in question are maintained (HAZAEA ET AL. 2022). Green purchasing incorporates environmental considerations throughout all processes and departments of the organization (KHAN ET AL. 2023B). Moreover, it displays the organization's contributions to environmental effects. Mitigation, enhancement of financial

performance through increased competitiveness, compliance with regulatory agency standards, and fulfillment of the increasingly stringent are the demands of stakeholders (MAJEED ET AL. 2022). This necessitates incorporating environmental standards in supplier selection, mandating that active suppliers adhere to specific minimum requirements in their environmental management and performance (AHMED ET AL. 2023). Consequently, this establishes a consortium of suppliers dedicated to sustainable environmental practices in green supply chain management, which has intensified due to new regulations aimed at enhancing business operations' ecological sustainability.

iii. Green Manufacturing

The organization must comply with ISO14001 requirements in its manufacturing and processing operations and establish a production process design and route that prioritizes low energy consumption, minimal wastage, and minimal environmental contamination (KHANFAR ET AL. 2021). A green supply chain necessitates a production system that prioritizes environmental protection and not harming the well-being of the customers (SINGH ET AL. 2025). Additionally, it demands manufacturing processes that are safe for workers as well as minimizing energy consumption and pollution. However, green manufacturing is a manufacturing procedure that transforms inputs into outputs by eliminating the presence of harmful compounds, enhancing energy efficiency in lighting and heating, using the principles of resource maximization, minimizing wastage (AKASH ET AL. 2025), and actively designing and redesigning environmentally friendly processes (UDDIN, 2021; BASHAR ET AL., 2023; WIREDU ET AL., 2024; SHAHZAD ET AL., 2025). Other scholars, such as LERMAN ET AL (2022) and GAWUSU ET AL. (2022), and AHMAD ET AL. (2022) stated that green manufacturing necessitates manufacturers to create products that enable the efficient usage of resources and material components. It also involves avoiding or minimizing the use of hazardous substances in the production process and reducing material and energy consumption.

iv. Green Distribution and Packaging

Green distribution is comprised of green packaging, with the objectives of firstly, reducing the size of the container; secondly, using "green" packaging materials; thirdly, promoting recycling and reuse programs; fourthly, working together with the vendor to standardize packaging; fifthly, encouraging and adopting returnable packaging techniques; sixthly,

reduce the amount of material used and the amount of time it takes to unpack; seventhly, make use of a pallet system that is recyclable; and eighthly, reduce the amount of energy used in warehouses (UDDIN, 2021). When it comes to green logistics and transportation, it involves delivering items directly to the user site, utilizing cars that run on alternative fuels, combining orders rather than delivering them in smaller batches (GAWUSU ET AL., 2022), investing in vehicles that are intended to lessen the adverse effects on the environment, and arranging vehicle routes (SAADA, 2021). According to LERMAN ET AL. (2022), green distribution and packaging are about reverse logistics, which involves collecting old goods and packaging from consumers for recycling, returning packaging and products to suppliers for reuse, and mandating suppliers to collect their packaging materials. In addition, green logistics also covers the collection of recycling materials.

v. Internal Environment Management

Internal environmental management pertains to the regulations and objectives established by enterprises to safeguard the environment and ensure its safety for human habitation (FENG ET AL., 2022). All these policies and objectives are set by the organizations. By aligning all managerial activities with environmental management practices, internal environment management procedures ensure their support (WANG & OZTURK, 2023). In addition, it guarantees that the various divisions cooperate cohesively to develop a system and improve the environment. All previously stated strategies are included under the management of the internal environment. Similarly, DADDI ET AL. (2021) indicated the terminology of green internal management as a system which has been used to conceptualize the management system that pertains to the operations of an organization aimed primarily at mitigating its environmental impact. These operations include the firm's policies, internal expertise, and regulatory compliance pertaining to the environment (HABIB ET AL., 2020). Besides, the authors additionally recommended that GSCM strategies need enhanced coordination; for instance, building a new product aligned with environmental principles necessitates engagement with consumers to include their expectations in the design phase. Comprehensive internal environmental management requires substantial collaboration. This might be ascribed to the management of the internal environment. Total Quality Management (TQM) and Just-In-Time (JIT) are components of the internal environment. RASHID ET AL. (2025b) indicated that JIT and TQM are strongly associated with GSCM techniques, both of which enhance an organization's environmental initiatives.

2.7. Circular Economy

The term "circular economy" refers to an economic system intended to replace the concept of "end-of-life" while simultaneously emphasizing renewable energy sources (AHMED ET AL., 2022). Additionally, the concept of "circular economy" indicates the activities of replacing, reusing, recycling, and remanufacturing materials during the production/distribution and consumption process (AMIN ET AL., 2024). The objective of this approach is to achieve sustainable development by fostering environmental quality, economic prosperity, and social equity for the benefit of both the current generation and the generations to come (AMIR ET AL., 2024). Circular economic practices (CEP) are responsible for creating value in the manufacturing process by reusing waste materials, re-designing products that have been rejected, continuing to utilize products, and revitalizing natural systems (AMIN ET AL., 2024).

However, AMIN ET AL. (2025) conducted a study based on the concept of a circular economy, where the authors found that the objective of the circular economy is to preserve the circulation of resources within the economy while simultaneously lowering the effect of operations such as extraction, emissions, and disposal of organizational resources. In another similar study, ALLEN ET AL. (2022) indicated that there are three distinct levels at which circular economy systems may be identified: the micro (product), the meso (eco-industrial), and the macro (national or regional) levels. Numerous disciplines of study in the domains of business and management, such as business strategy of developing nations (AHMED ET AL., 2022), sustainability (AKASH ET AL., 2025), supply chain management (ALLEN ET AL., 2022; AFROOZI ET AL., 2025), and eco-innovation (BAG ET AL., 2022), have shown an extensive degree of engagement in the notion of circular economy. In this research, the researcher investigates the circular economy concerning green supply chain management (GSCM) and sustainable performance to contribute to the organizational level. To clarify the distinction between green supply chain management and circular economy, the present study demonstrates the following Table 6, which shows the conceptual, implementation, and functional differences:

Table 6: Differences between GSCM and Circular Economy Activities

Subject	Green Supply Chain Management	Circular Economy Activities
Area of activities	It covers the overall supply chain activities	It is related to manufacturing only
Functions	Functions: 1. Green purchasing 2. Green Procurement 3. Reverse Logistics 4. Green Transportation 5. Green manufacturing	Functions: 1. Reuse 2. Recycling 3. Remanufacturing
Industry where it is using	Using both in manufacturing and service industry	Mostly using in manufacturing industry
Maturity of the concept	It is an old, practice, commonly used, and establishes process	Compare to GSCM it is a very new concept
Implementation level	It is at an implemented level from long time	It is still conception level compared to implementation
Clear concepts	The implementer, manager, decision makers, regulators, and concerned employees are well knowledgeable about this concept	The concept of circular economy still needs to be more clarified by the implementer, manager, decision makers, regulators, and concerned employees
Usage and application rate	Comparably more	Compared to GSCM it is less using and applying

According to SHAH ET AL. (2025), the circular economy is increasingly essential for organizations and governments aiming to save resources and efficiently manage the industry's waste. Developing nations stand to benefit significantly from the adoption of well-crafted policies that include circular economy principles (MONDAL ET AL., 2025). Circular economy provides possibilities to engage with many product categories, such as textiles, ready-made garments, agriculture, plastics, metals, food, and electronic devices (MOUSA ET AL., 2025). Besides, affluent countries often export their obsolete devices and apparel to

developing countries for repurpose and restoration. Consequently, developing nations must establish robust procedures for reusing and restoring imported products. Circular economy strategy may lead to diminished import expenses, less pollution via product recycling, enhanced environmental protection by non-disposal practices, and improved access to inexpensive recycled products for the local population (AMIN ET AL., 2025). However, based on the above contemporary discussion and literature support, the following Table 7 shows the literature matrix on circular economy:

Table 7: Literature Matrix on Circular Economy

SL	Author(s)	Variables	Underlying Theories	Methods Used	Findings
1	CUEVAS-PICHARDO ET AL. (2025)	Circular economy, Industry 4.0, Sustainable performance	Dynamic Capabilities	PLS-SEM	Both circular economy and Industry 4.0 have positive contribution to Sustainable performance
2	SHARMA ET AL. (2025)	Barriers related to Technology, Culture, Environment, Finance, Regulatory, and Supply chain	RBV theory	PLS-SEM	There are culture and technological barriers that exist in the implementation of circular economy, whereas other barriers have not existed.
3	MONDAL ET AL. (2025)	Circular economy, Dynamic Capability, Eco strategy, and Entrepreneurship	RBV theory	PLS-SEM	There are positive relationships found among circular economy, dynamic capability, eco strategy, and entrepreneurship
4	SHAH ET AL. (2025)	Circular economy, Institutional factors, Regulatory focus	Regulatory focus, Institutional-based theory	PLS-SEM	Institutional factors have positive effects on the adoption of circular economy through the mediation of regulatory focus

5	MOUSA ET AL. (2025)	Green Supply Chain Management, Big data analytics, Sustainable performance, and Circular economy	Dynamic Capabilities, RBV theory	PLS-SEM	Green Supply Chain Management, Big data analytics, and Sustainable performance have positive influences on accelerating circular economy performance
6	COTRINA & MARQUINA (2025)	Circular economic strategy, resource maximization, sustainability	RBV, law of ecology theory	SLR, bibliometric analysis	Circular economic strategy enhances resource maximization and organizational sustainability
7	LONG ET AL. (2025)	Circular economy, Digital functions	Stakeholder theory	Critical Literature analysis	Circular economy and digital functions have significant positive relationships
8	AMIN ET AL. (2025)	Circular economy, Knowledge sharing, green HRM, Sustainable performance	Institutional theory	PLS-SEM	Through the mediation of circular economy and knowledge sharing, green HRM has positive effects on Sustainable performance
9	AMIN ET AL. (2024)	Circular economy practices, Sustainable performance	RBV theory	PLS-SEM	Circular economy practices have significant positive influences on sustainable performance of the organizations
10	ISLAM ET AL. (2024)	Sustainable supply chain, Circular economy, Sustainable performance	NRBV theory	PLS-SEM	Sustainable supply chain and circular economy have positive effects on the company's sustainable performance

2.8. Managers' Green Concern

Several research findings show empirical evidence about the substantial influence of a manager's environmental concern on corporate performance (for instance, SONG ET AL., 2021; MO ET AL., 2022; MUNAWAR ET AL., 2022). Due to the apprehension, it mostly pertains to management concerns and decision-making rather than best practices or established corporate policy. In another similar study, RIVA ET AL. (2021) argued that a cognitive framing viewpoint enhances environmental concern to comprehend the managerial decision-making process. The significance of top management in the implementation of green management systems and their impact on firm performance is paramount (MO ET AL., 2022). On the other hand, CAO ET AL. (2022) discovered that management's environmental concern may serve as a catalyst for business success. Their research findings propose that managers who prioritize environmental concerns are likely to allocate more time, attention, and resources to these problems, possibly enhancing the probability of influencing firm performance.

Notwithstanding green concerns of the managers, other similar factors, such as green knowledge, awareness, culture, and adaptive skill, drive managers to participate in pro-ecological behavior and sustainability initiatives (POLAS ET AL., 2023). A multitude of theoretical frameworks have been established by SONG ET AL. (2021) to integrate diverse combinations of ecological knowledge and concern in varied efforts to inform the design of behavioral interventions. The intricate character of pro-ecological concern continues to be a problem in elucidating or forecasting such behavior. Similarly, LIN & ZHAO (2023) offered an overview of the influence of SME managers' ecological values on the firm's ecological sustainability behavior, modulated by the managers' ecological concern. The primary inquiry in that study was how the commitment of SMEs to attain ecological sustainability is influenced by the knowledge and concern of their management.

However, MUNAWAR ET AL. (2022) investigated the correlation between a manager's ecological orientation, including ecological values, beliefs, and norms, and its influence on pro-ecological behavior, with the mediating role of the manager's ecological concern. Conversely, the research of CAO ET AL. (2022) was concentrated on elucidating the fundamental elements that influence ecological sustainability in manufacturing firms, emphasizing ecological orientation and sustainable green practices, while also considering

the moderating impact of managerial ecological concerns. The study assessed a multitude of theoretical frameworks in elucidating the direct correlation between ecological orientation and a firm's sustainable green practices, subsequently recognizing the moderating influence of managerial ecological concern on this relationship.

3. BIBLIOMETRIC LITERATURE REVIEW

3.1. Background and Methodology of Reviewing Bibliometric Literature

This study employs a structured bibliometric methodology to systematically map the scientific landscape at the intersection of Green Supply Chain Management (GSCM), the Circular Economy, and Sustainable Performance. In addition to traditional bibliometric procedures, science mapping techniques were applied to uncover collaboration structures and trace the conceptual evolution of the field.

The bibliographic data was retrieved from the Web of Science (WoS) Core Collection, which is widely recognized for its comprehensive coverage of high-impact journals and stringent indexing standards. The literature search was conducted through WoS's advanced search interface, ensuring the retrieval of peer-reviewed scholarly contributions relevant to the integration of GSCM within broader circular economy and sustainable performance discourses.

To maximize both precision and completeness, a carefully designed search string was applied, using the Topic Search (TS) field tag, which encompasses titles, abstracts, author keywords, and Keywords Plus:

TS = ("green supply chain management" OR "green supply chain") AND ("circular economy")AND ("sustainability" OR "sustainable performance" OR "sustainable organizational performance" OR "sustainable corporate performance" OR "sustainable firm performance").

The query was restricted to publications classified as articles or reviews, while excluding non-scholarly formats such as editorials, notes, and proceedings papers. The temporal window was set from 2004 to 2025, reflecting the period during which the integration of GSCM and circular economy concepts began to gain prominence. This search yielded a curated dataset, which was exported in BibTeX format to ensure compatibility with the R-based analysis environment.

The bibliometric analysis was performed using R-Studio (v.4.3.2) in combination with the Bibliometrix package, an open-source framework for scientometric evaluation. For enhanced

usability and interactive visualization, the analysis was further conducted through Biblioshiny, a web-based application built on Bibliometrix.

Preprocessing protocols were applied to ensure metadata accuracy and analytical reliability. These included the standardization of author names and institutional affiliations, the harmonization of keyword variants (e.g., “green supply chain” vs. “GSCM”), and the exclusion of duplicate or incomplete records. Particularly, the emphasis was placed on the normalization of Author Keywords and Keywords Plus to facilitate accurate co-occurrence analysis and thematic clustering. Records lacking core bibliographic fields (title, abstract, and citation data) were removed from downstream analysis.

The finalized dataset was analyzed across multiple dimensions, including publication trends, citation metrics, and the identification of leading authors, institutions, countries, and journals. Network-based indicators were computed to generate co-authorship structures, country collaboration maps, keyword co-occurrence networks, and thematic maps, thereby offering a comprehensive view of both the intellectual and collaborative architecture of the field. The bibliometric dataset was constructed following a structured search strategy in the Web of Science Core Collection, with clear specifications regarding the query string, inclusion criteria, document types, and temporal scope. The details of the data retrieval, preprocessing, and analytical tools employed are summarized in the following Table 8:

Table 8: Search strategy, dataset parameters, and analytical tools applied in the bibliometric study of GSCM, Circular Economy, and Sustainable Performance

Component	**Specification**
Database	Web of Science (WoS) Core Collection
Search Query	TS = (“green supply chain management” OR “green supply chain”) AND (“circular economy”) AND (“sustainability” OR “sustainable performance” OR “sustainable organizational performance” OR “sustainable corporate performance”)
Document Types Included	Articles, Reviews
Time Span	2004–2025
Export Format	BibTeX
Software/Tools	RStudio (v.4.3.2), Bibliometrix, Biblioshiny
Preprocessing Procedures	Standardization of names/affiliations, keyword harmonization, exclusion of incomplete records
Analytical Dimensions	Publication trends, citation metrics, leading authors/institutions/countries/sources, co-authorship networks, country collaboration, keyword co-occurrence, thematic maps

3.2. Bibliometric Profile of Literature Data

The dataset spans a scholarly timeframe from 2004 to 2025, encompassing a total of 787 documents across 313 distinct sources, including journal articles, books, and conference proceedings. The annual growth rate of 23.42% suggests a rapidly expanding scholarly discourse within the field, indicative of increasing academic and perhaps policy-oriented interest. The average document age of 3.95 years further confirms the dataset's temporal skew toward recent publications, which enhances its relevance for contemporary trend analyses. The bibliometric information of literature data is shown in Figure 2.

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2004:2025
Sources (Journals, Books, etc)	313
Documents	787
Annual Growth Rate %	23.42
Document Average Age	3.95
Average citations per doc	47.58
References	51178
DOCUMENT CONTENTS	
Keywords Plus (ID)	2045
Author's Keywords (DE)	1833
AUTHORS	
Authors	2112
Authors of single-authored docs	54
AUTHORS COLLABORATION	
Single-authored docs	56
Co-Authors per Doc	3.45
International co-authorships %	38.75
DOCUMENT TYPES	
article	642
book chapter	53
conference paper	38
review	54

Figure 2: Bibliometric information of literature data

With an average of 47.58 citations per document, the corpus demonstrates a high level of academic impact, exceeding benchmarks often reported in domain-neutral bibliometric surveys. This elevated citation density may reflect either a concentration of influential review or foundational works, or a tightly knit research community with high intra-field referencing. The corpus collectively cites 51,178 references, reinforcing the analytical potential for citation network analysis and historiographic mapping.

3.3. Temporal Evolution of Scientific Production

The longitudinal distribution of annual scientific output (2004–2025) reveals a pronounced and accelerating trajectory, characterizing the dataset's intellectual maturation over time. The early phase (2004–2010) is typified by negligible activity. Between 2016 and 2023, the field experienced an inflection point, transitioning from incremental growth to exponential proliferation. The steep incline post-2020 may correspond to increased research funding, interdisciplinary convergence, or the catalytic effect of global events (e.g., technological shifts, policy reforms, or crises that necessitated urgent scholarly response). The annual scientific production of the publications is shown in Figure 3 below:

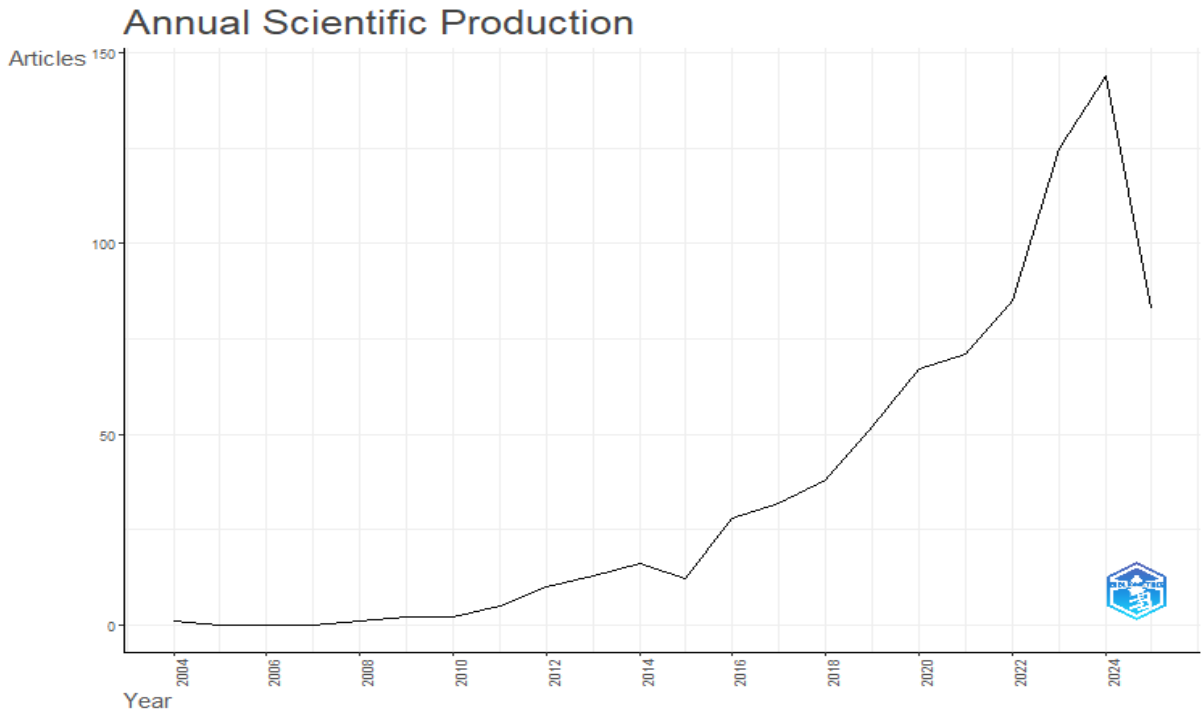

Figure 3: Annual scientific production of the publications

The peak in 2023, surpassing 140 published documents, marks the zenith of scholarly productivity in the dataset. This peak not only underscores the heightened scholarly engagement but also signifies a potential saturation point or thematic convergence. The subsequent decline in 2024–2025, while appearing abrupt, should be cautiously interpreted. It may reflect partial indexing for recent years, the data collection cut-off point, or natural volatility in publication cycles. Hence, final conclusions about a downturn are premature and should be revisited with longitudinal updates.

3.4. Citation Dynamics: Average Citations per Year

The temporal distribution of average citations per year presents a complex yet insightful metric for assessing the longitudinal impact of published documents. Unlike raw productivity measures, citation averages offer a normalized view of influence, revealing patterns of scholarly resonance and potential knowledge diffusion delays. Nevertheless, the average citation per year of the publications has been demonstrated in Figure 4 below:

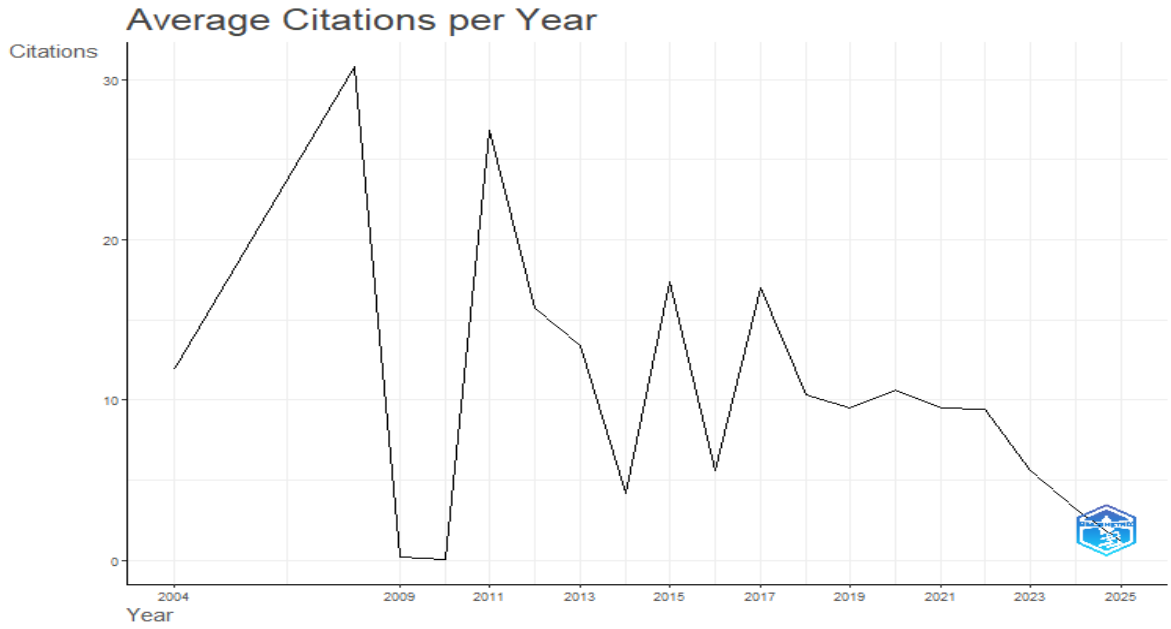

Figure 4: Average citation per year of the publications

The period from 2004 to approximately 2008 shows a steady and notable increase in average citations, culminating in a peak near 2008, where the average exceeded 30 citations per document. From 2018 onwards, the trend exhibits a gradual decline and stabilization, with average citations per document generally falling between 8 and 12: still a respectable range,

but notably lower than the early peak. The sharp downward trajectory post-2022 should be interpreted cautiously. As the most recent publications (2023–2025) are still within their early citation windows, the low averages in this period do not necessarily reflect diminished quality or impact but rather an expected lag in scholarly uptake.

3.5. Geographic, Thematic, and Institutional Linkages in Scientific Output

This Sankey diagram captures the multidimensional structure of global scholarly engagement by mapping the interplay among author countries, dominant thematic keywords, and contributing institutions. Such triadic relationships serve as a proxy for tracing the epistemic geography and thematic orientations of research in the domain—likely centered on *green supply chain management (GSCM)* and related sustainability paradigms. However, the global scholarly engagement of author countries, dominant thematic keywords, and contributing institutions are shown in the following Figure 5:

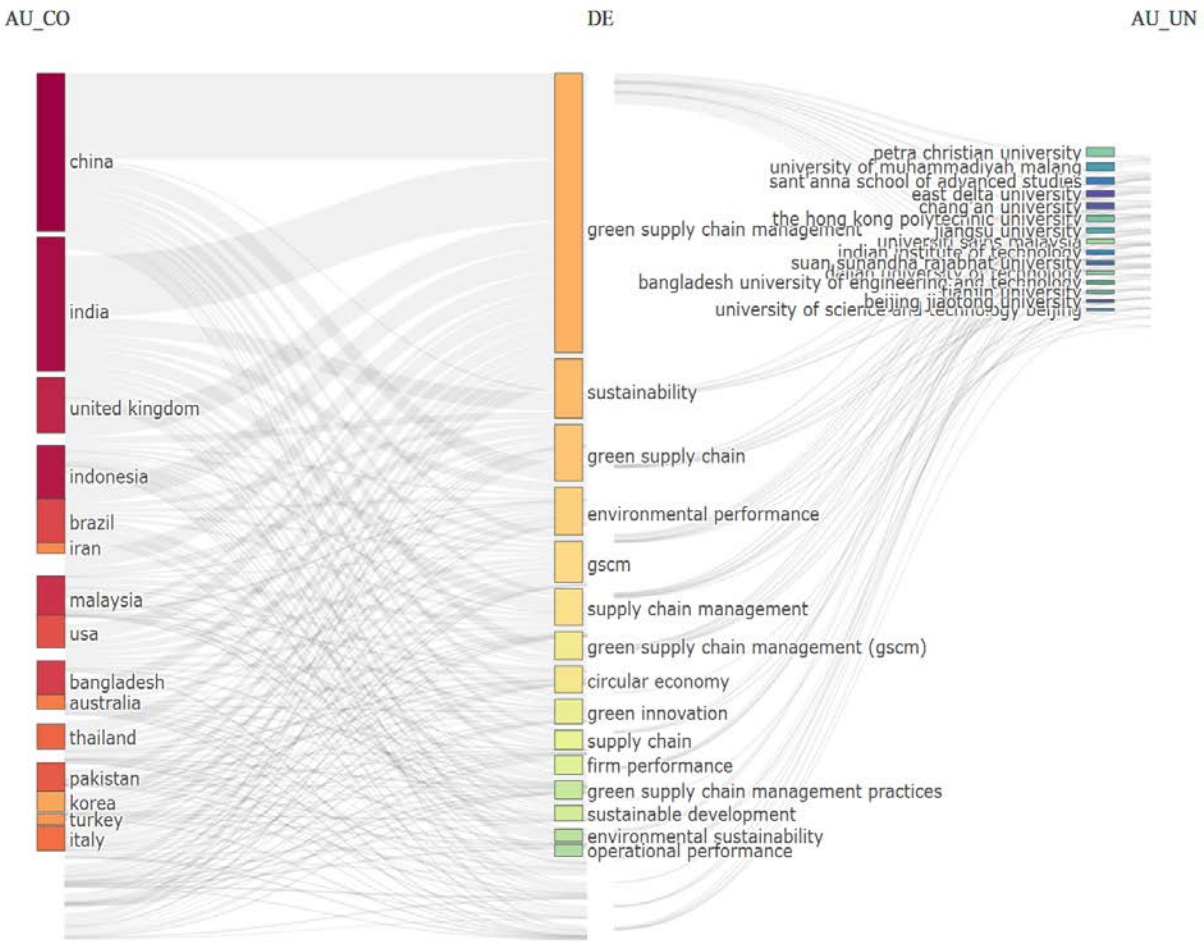

Figure 5: Global scholarly engagement

Geopolitical Distribution of Research Activity

China and India emerge as the leading contributors to the research domain, as indicated by their substantial node sizes on the left of the collaboration map. This pattern corresponds with recent bibliometric evidence demonstrating a surge in sustainability-oriented research investment across Asia—particularly within the domains of environmental regulation, industrial transformation, and circular economy implementation. China exhibits broader thematic linkages, reflecting diversified research across multiple sustainability dimensions, whereas India's output appears more concentrated on green supply chain management (GSCM) and environmental performance. Other notable contributors include the United Kingdom, Indonesia, Brazil, Iran, Malaysia, and the United States. Although their overall publication volume remains moderate, their participation underscores the increasingly interconnected and globally distributed nature of sustainability research. The inclusion of Bangladesh, Pakistan, and Thailand is particularly significant, signalling emerging research engagement from Global South economies that have been historically underrepresented in earlier bibliometric mappings.

Thematic Convergence around Sustainability and GSCM

The thematic analysis reveals a strong convergence around "green supply chain management," "sustainability," and "environmental performance," which occupy central positions due to their high frequency and network connectivity. The concurrent emergence of concepts such as "circular economy," "green innovation" and "firm performance" indicates a progressive integration of ecological and economic perspectives in sustainability scholarship. However, terminological inconsistencies—such as variations between "green supply chain management," "green-supply chain management (GSCM)," and "supply chain management"—suggest ongoing fragmentation in keyword standardization. Such variations can affect retrieval precision and comparability across systematic reviews or meta-analyses. Therefore, the adoption of keyword normalization protocols or controlled vocabularies (e.g., thesaurus-based harmonization) is recommended to enhance analytical accuracy in future bibliometric and scientometric investigations.

Institutional Anchors of Research Production

The institutional affiliations reveal a geographically diverse set of universities. Prominent entities such as Petra Christian University, Beijing Institute of Technology, University of Muhammadiyah Malang, Indian Institute of Technology, Sant'Anna School of Advanced Studies, and Bangladesh University of Engineering and Technology demonstrate a geographically balanced yet thematically focused network. These institutions often serve as hubs for collaborative, policy-relevant, and application-oriented sustainability research.

3.6. Source Impact and Relevance in the Scholarly Ecosystem

The visualized distribution of the most relevant publication sources, based on document frequency, offers a lens into the journals as central dissemination platforms in the field, presumably focused on sustainability, supply chain, and organizational performance.

Core Journals: Productivity and Visibility

The journal *"Sustainability (Switzerland)"* emerges as the most prolific source, contributing 80 documents, far exceeding its nearest peer, *"Journal of Cleaner Production"*, with 57 documents. This aligns with the broader bibliometric trend of *Sustainability* serving as a high-volume, open-access outlet that encourages interdisciplinary contributions, particularly in environmental, economic, and social sustainability. The dominance of these two outlets—jointly accounting for over 17% of total publications suggests a thematic convergence around sustainable development and supply chain innovation. Nonetheless, the most contributing journals by the number of documents represents in Figure 6 below:

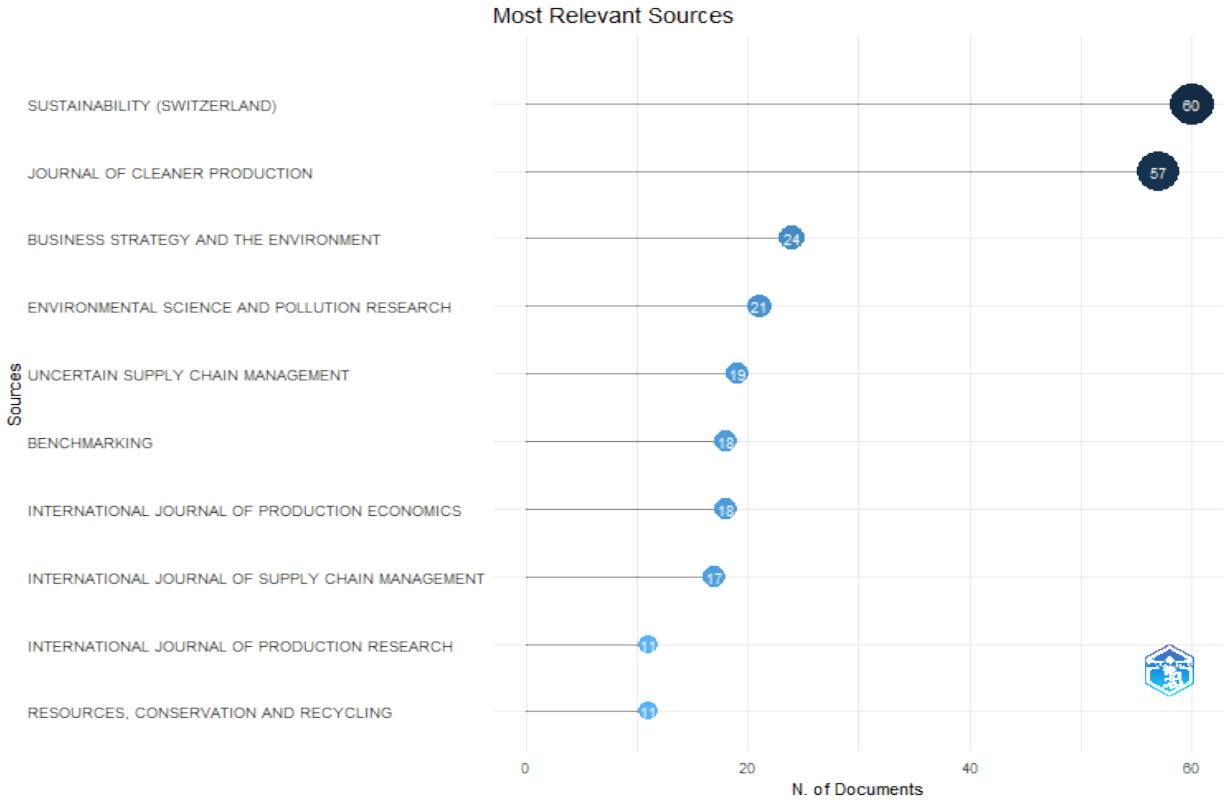

Figure 6: Most contributing journals by the number of documents

Mid-Tier Sources and Domain Specificity

A second tier of journals includes *"Business Strategy and the Environment"* (24 documents), *"Environmental Science and Pollution Research"* (21), and *"Journal of Cleaner Production"* (57), all of which maintain interdisciplinary reach but emphasize environmental systems and managerial applications. These journals play a crucial role in bridging the gap between sustainability theory and operational implementation in industrial contexts. Of particular interest is the presence of niche outlets such as the *"International Journal of Supply Chain Management"*, *"Journal of Food Production Economics"*, and *"Resources, Conservation and Recycling"*. These sources, while publishing fewer documents (11–18 each), often house highly specialized and technically rigorous contributions that support sub-field advancement. The inclusion of *Operations Research* and *Science Engineering* (possibly variants or indexing errors due to label truncation) may indicate the field's computational or modelling orientation, especially in optimization and performance assessment within sustainable supply chains.

3.7. Temporal and Citation-Based Author Productivity

Based on number of articles and total citations per year (TC/year)—facilitates an evaluation of sustained productivity and per-publication scholarly influence. The most scholarly output by the leading authors named Sarkis, Zhu, Khan, Kusi-Sarpong and some others. Notably, SARKIS ET AL., (2011) emerge as early and consistently active contributors to literature review on green supply chain management, initiating their publication record around 2007 and maintaining output over a span exceeding a decade. In another similar study, SARKIS & ZHU (2018) were associated with multiple high-impact publications, as indicated by the relatively large and dark-shaded bubbles. Their sustained presence suggests a central role in shaping the intellectual foundation and evolution of the field, likely contributing to conceptual frameworks and methodological advancements in green supply chain management and sustainability assessment. On the other hand, DEBNATH ET AL. (2023) exhibit a publication trajectory concentrated from 2011 to 2021 includes multiple publications with substantial citation traction in the area of green supply chain management of apparel industry in context of Bangladesh. This signals selective but influential interventions—characteristic of scholars leading specialized subfields or bridging thematic gaps.

Moreover, the literature of KHAN ET AL., (2023A) whose contributions were focused on green supply chain management based on resource-based view theory in context of manufacturing industry. Their entries feature moderate publication frequencies but increasingly visible citation impact. Similarly, the evident literature from KARUPPIAH ET AL., (2023) suggested a rapid rise in scholarly attention. This group represents an emergent cohort likely to shape future discourse, particularly if the observed upward citation trajectories are sustained.

The horizontal lines connecting publication years visually encode authorial continuity, while the bubble size variation underscores differing publication strategies. For instance, SARKIS & ZHU (2018) exhibit a “high-volume, high-impact” strategy, whereas other scholars such as KUSI-SARPONG ET AL., (2023) follow a “low-volume, high-impact” model. These distinctions are relevant when constructing collaboration networks or identifying thought leaders for keynote contributions, editorial roles, or expert reviews.

3.8. Lexical Frequency Analysis: Most Relevant Words

This visualization ranks the top keywords based on frequency of occurrence, offering a concise representation of the field's conceptual core. Bubble size reflects keyword prominence, while the x-axis positions words according to their frequency across documents, thus serving as a proxy for thematic salience. Nevertheless, the most relevant keywords are represented in following Figure 7:

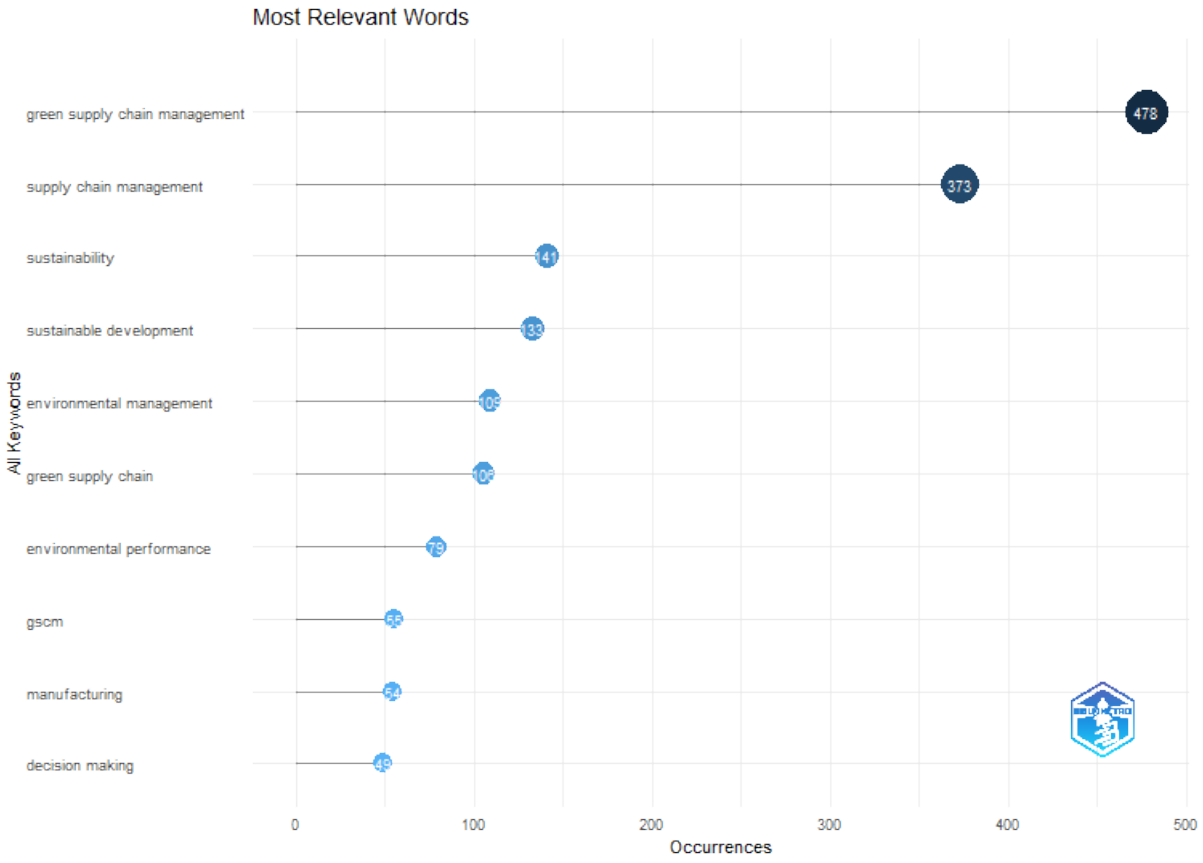

Figure 7: Most relevant keywords

Dominant Conceptual Anchors

At the thematic apex is "green supply chain management", appearing 478 times, followed closely by "supply chain management" (373 occurrences). The overwhelming frequency of these terms confirms the field's sustained focus on environmentally sustainable operations and reinforces the structural centrality of supply chains as the analytical unit. This high frequency also suggests a possible saturation of literature around foundational GSCM

frameworks, inviting a shift toward emerging themes (e.g., digitalization, ESG integration, or regenerative logistics) for future studies seeking novelty and citation potential.

Supporting Thematic Constructs

Words such as “sustainability” (141 occurrences), “sustainable development” (133), and “environmental management” (109) reinforce the ecological imperative underpinning the research domain. Their presence reveals the multi-level articulation of sustainability—from macro-level development agendas to meso- and micro-level managerial practices. Notably, “environmental performance” (79) and “firm performance” (54) suggest a recurrent concern with evaluating the trade-offs and synergies between environmental responsibility and economic viability. This aligns with theoretical tensions between the resource-based view (RBV) and institutional theory, both of which frequently underpin sustainability performance studies.

Methodological Considerations

The results also underscore the value of keyword harmonization, especially between author keywords and Keywords Plus. Discrepancies in term granularity (e.g., “green supply chain” vs. “green supply chain management”) can hinder thematic clustering, necessitating preprocessing strategies such as lemmatization or co-word normalization in advanced bibliometric modelling.

3.9. Visual Lexicometric Analysis: Word Cloud of Author Keywords

The word cloud offers a semi-quantitative, visually intuitive summary of the most recurrent lexical units across the bibliographic corpus, drawing primarily from author-provided keywords. Word prominence (size) is scaled to relative frequency, thereby approximating the semantic density and conceptual priorities of the research field. The following Figure 8 demonstrates the most recurrent author keywords:

Figure 8: Most recurrent author keywords

3.10. Temporal Evolution of Research Themes: Trend Topics Analysis

The trend topics map provides a diachronic view of keyword usage, highlighting both term frequency (via bubble size) and temporal span (horizontal duration) across publication years (2012–2025). This dual-axis representation is instrumental in identifying established, transitional, and emerging themes in the knowledge domain. However, the trend topics analysis is shows in Figure 9 below:

Figure 9: Trend topics analysis

Enduring Core Themes

At the thematic core shows “green supply chain management”, “supply chain management”, and “sustainable development”, all of which exhibit broad temporal ranges (extending nearly a decade) and high term frequencies (300–400 instances). These terms serve as epistemic anchors, reflecting the sustained academic interest and policy relevance of sustainability in supply chain operations. The terms “sustainability”, “environment”, and “green economy” also show long publication spans and sizable term frequencies, positioning them as cross-cutting meta-themes. Their breadth suggests conceptual diffusion into subdomains such as circular logistics, environmental policy, and corporate strategy.

Emergent Priorities and Contemporary Shifts

Post-2020, the vocabulary begins to incorporate future-facing and performance-oriented constructs such as “green development”, “sustainable performance”, and “competitive advantage”. These terms, appearing later in the timeline, signal a growing emphasis on the business case for sustainability, marking a paradigmatic shift from compliance-driven environmentalism toward strategic sustainability. The rising visibility of “manufacturing” and “decision making”—especially with moderate to high frequencies—reflects a methodological turn toward modelling, optimization, and performance evaluation. These are indicative of the field’s operational maturation.

Transitional and Specialized Themes

Terms such as “GSCM”, “green manufacturing”, “environmental management”, and “environmental impact” occupy an intermediate temporal space (2015–2021). While not new, these themes represent second-wave topics, often elaborating earlier construct through empirical generalization, sector-specific case studies, or integrative modelling. Nevertheless, the transitional and specialized themes are shown in following Figure 10:

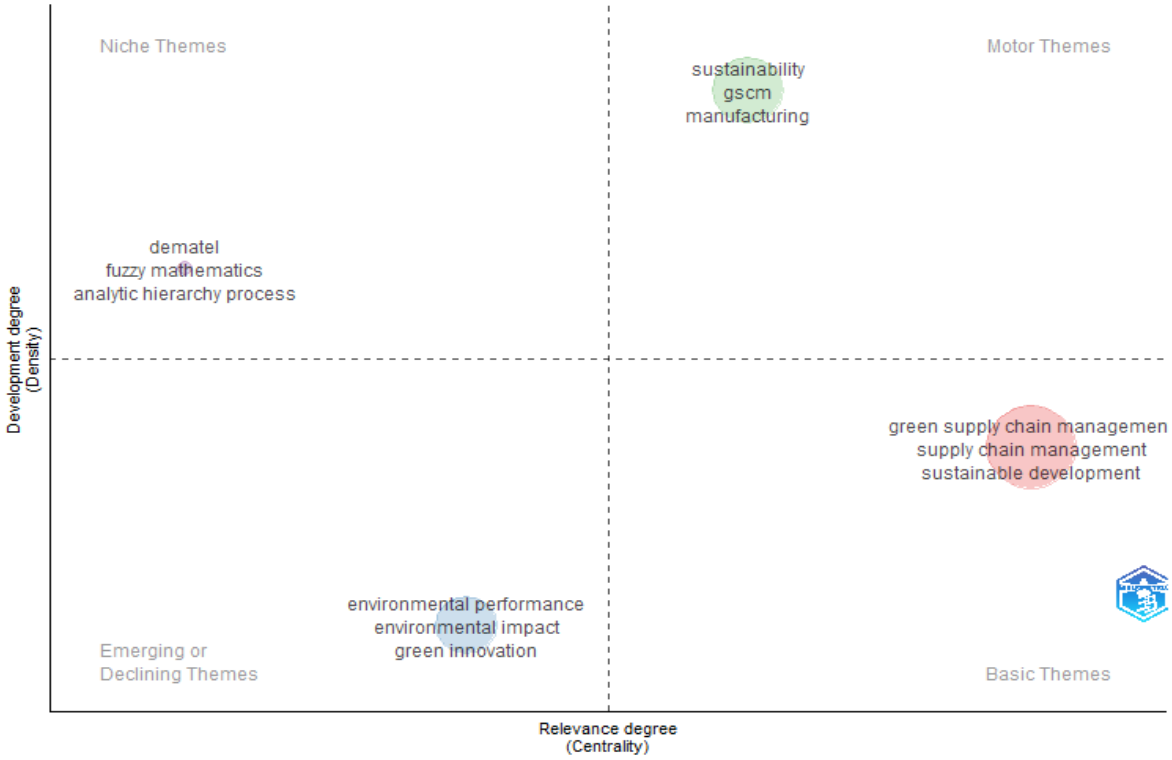

Figure 10: Transitional and specialized themes

3.11. Thematic Structure of the Field: Density–Centrality Mapping

The thematic map delineates the intellectual architecture of the research domain by plotting keyword clusters along two strategic axes—centrality (the degree of thematic relevance or connectivity to other clusters) and density (the degree of internal development and cohesion). The resulting four-quadrant configuration classifies themes as *motor*, *basic*, *niche*, or *emerging/declining*, each reflecting distinct stages of conceptual maturity and influence.

Motor Themes (High Centrality, High Development)

The upper-right quadrant identifies sustainability, green supply chain management (GSCM), and manufacturing as motor themes. These clusters exhibit both conceptual centrality and internal robustness, representing mature and well-integrated research areas that anchor the field's intellectual progression.

- Sustainability and GSCM function as bridging constructs linking subdomains such as environmental economics, logistics, and operations management, thereby facilitating theoretical and methodological cross-fertilization.

- Manufacturing as a motor theme underscores the operational nexus between production systems and sustainable practices, particularly salient in developing economies and industrial transformation studies. Collectively, these themes are strong candidates for longitudinal exploration, empirical modeling, and cross-disciplinary synthesis.

Basic Themes (High Centrality, Low Development)

Positioned in the lower-right quadrant, green supply chain management, supply chain management, and sustainable development occupy pivotal conceptual roles but demonstrate lower thematic density. Their breadth indicates foundational importance yet also conceptual diffuseness, which may obscure domain-specific nuances. Future research should emphasize theoretical refinement and contextual disaggregation—by sector, region, or technological domain—to enhance analytical precision and mitigate redundancy.

Niche Themes (High Development, Low Centrality)

The upper-left quadrant comprises DEMATEL, fuzzy mathematics, and the analytic hierarchy process (AHP)—methodologically advanced yet peripherally positioned clusters. These topics, largely associated with multi-criteria decision-making (MCDM) and systems modeling, exhibit high internal cohesion but limited integration with broader sustainability discourses. Their methodological sophistication warrants strategic linkage with core sustainability constructs to expand their contextual and theoretical relevance.

Emerging or Declining Themes (Low Centrality, Low Development)

Themes located in the lower-left quadrant—environmental performance, environmental impact, and green innovation—represent either nascent or waning research foci.

- As emerging themes, they may denote areas of growing interest yet to achieve structural consolidation.

- As declining themes, they could indicate once-prominent topics now overshadowed by newer constructs such as environmental, social, and governance (ESG) metrics, carbon neutrality, and organizational resilience.

The presence of *green innovation* suggests an evolving intersection between technological modernization and sustainability outcomes that remains theoretically underdeveloped. Conversely, *environmental performance* and *impact* may reflect conceptually saturated areas requiring re-contextualization. Future studies should consider reinvigorating these clusters by integrating them with motor themes—for example, examining *green innovation* through digital manufacturing, Industry 4.0, or stakeholder governance frameworks.

3.12. Co-Occurrence Network of Author Keywords: Mapping the Intellectual Landscape

The keyword co-occurrence analysis reveals the semantic structure of the research domain through the clustering of frequently co-occurring terms. In this network, node size indicates the frequency of a keyword, edge thickness reflects co-occurrence strength, and colors denote modularity-based clusters, representing thematic groupings within the corpus. Figure 11 below demonstrates the co-occurrence network of author keywords:

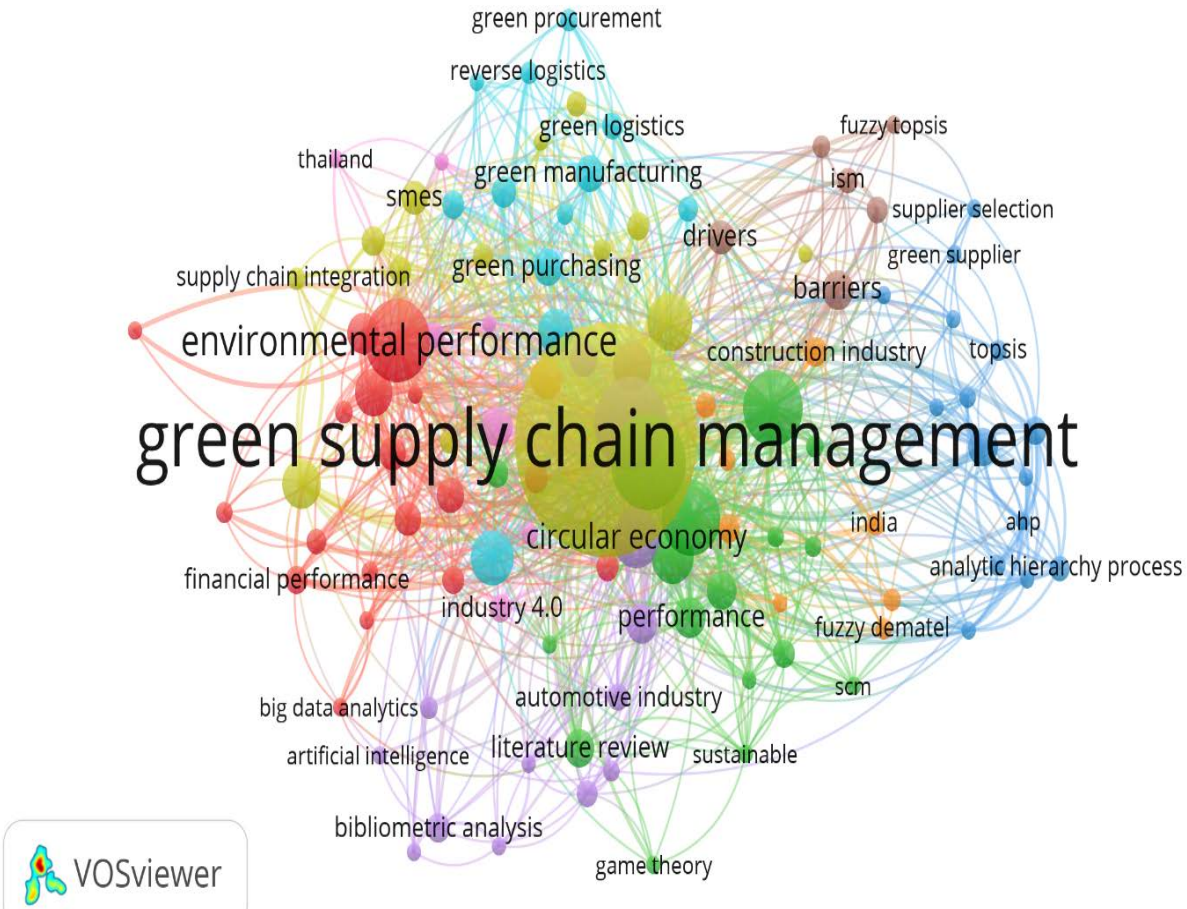

Figure 11: Co-occurrence network of author keywords

Central Nexus: GSCM, Circular Economy, and SOP as the Core Constructs

The largest and most central node is unequivocally “green supply chain management (GSCM)”, underscoring its position as the epistemic nucleus of the field. Closely aligned terms include: “sustainable organizational performance (SOP)”, “circular economy”, “green manufacturing”, “green procurement”, and “reverse logistics”. This centrality reflects a tightly knit intellectual structure focused on the integration of sustainability principles across supply chain functions, from sourcing to disposal. The proximity of “green purchasing,” “green logistics,” and “green supplier” suggests that sustainability is being addressed at both strategic and operational levels.

Clustered Subfields: Thematic Communities of Practice

The network reveals several distinct clusters, each representing thematic subdomains:

- Green Cluster (centered on circular economy, performance, and manufacturing): This group links ecological frameworks (e.g., circular economy) with managerial performance metrics, suggesting a focus on trade-off modelling and value creation in sustainable operations.

- Blue Cluster (analytic methods and decision tools): Includes AHP, TOPSIS, ISM, fuzzy logic, DEMATEL, pointing to the widespread use of multi-criteria decision-making (MCDM) approaches. This cluster emphasizes the quantitative modeling of sustainability challenges, particularly in supplier selection and policy evaluation.

- Red Cluster (strategic and financial themes): Features financial performance, supply chain integration, SMEs, barriers, concerns with organizational adaptation, resource constraints, and competitiveness in sustainable transitions.

- Purple Cluster (emerging digital and methodological innovations): Terms like artificial intelligence, big data analytics, bibliometric analysis, and industry 4.0 are indicative of a technological turn in this field, where digital tools are increasingly being leveraged to optimize green supply chains and generate predictive insights.

- Peripheral clusters (sectoral and contextual keywords): Terms such as construction industry, automotive industry, India, and Thailand denote sector-specific applications

and geographic contexts, signaling the growing global and applied orientation of the field.

3.13. Bibliographic Coupling by Country

This bibliographic coupling map illustrates the networked structure of national research systems within the domain, as defined by co-citation similarity among their bibliographies. In essence, two countries are linked when their respective publications cite overlapping sources, thus indicating thematic alignment and intellectual synergy in research agendas.

The node size reflects the total strength of bibliographic coupling (i.e., cumulative shared references), while link thickness indicates the strength of coupling between country pairs. Colors denote clusters, revealing latent thematic or regional affiliations. Nevertheless, Figure 12 below shows the bibliographic coupling by country:

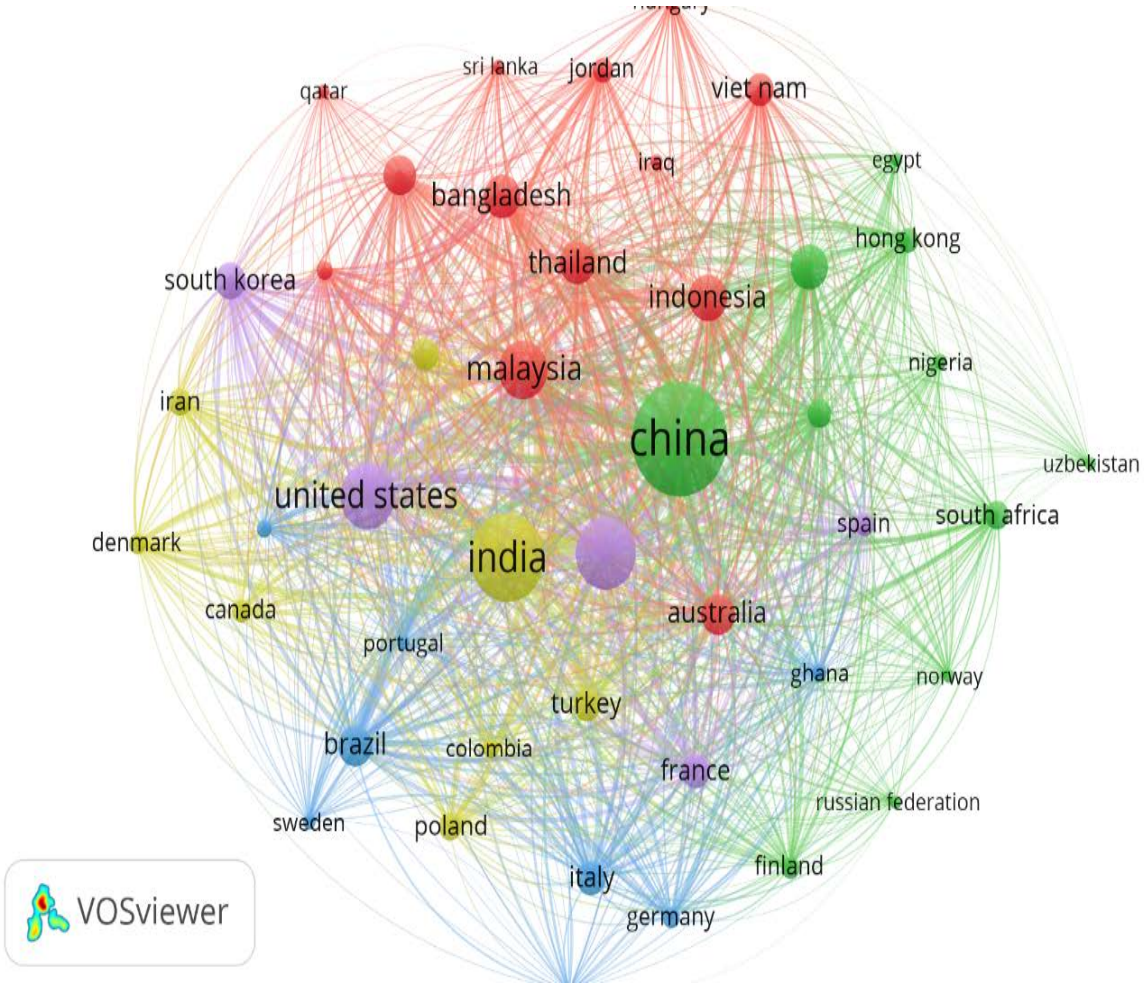

Figure 12: Bibliographic coupling by country

Core Contributors: Dense Intellectual Connectivity

As the core contributors, China, India, and the United States dominate the coupling landscape, represented by the largest nodes and occupying central positions in the network. Their mutual linkages are thick and multilateral, indicating that these nations not only produce the bulk of scholarship but also anchor intellectual convergence around key sustainability and supply chain topics.

- China forms a dense coupling hub with countries like Australia, Malaysia, Vietnam, and Indonesia, likely reflecting strong regional collaboration and shared policy-research orientations (e.g., Belt and Road sustainability concerns, green technology transfer).

- India also exhibits high coupling strength with both developed and emerging economies, bridging Asian, North American, and European knowledge systems.

Regional Clusters and Thematic Affiliations

The color-coded clusters in the bibliometric mapping indicate zones of scholarly alignment rather than geopolitical boundaries. For instance, the green cluster, centered on countries such as China, South Africa, Egypt, and Spain, highlights a convergence of research agendas that emphasize sustainable development and environmental governance. The blue cluster, composed of Italy, Brazil, Germany, Sweden, and Poland, suggests a European Latin-American axis focused primarily on industrial ecology, the circular economy, and systems modelling. Meanwhile, the red cluster, which includes Bangladesh, Vietnam, Thailand, and Jordan, points to an emerging group of Global South nations that are increasingly contributing to and citing similar bodies of literature, particularly in the areas of sustainable manufacturing and policy adaptation.

4. HYPOTHESES DEVELOPMENT

4.1. Green Supply Chain Management and Sustainable Organizational Performance

Scholars in the field of organizational supply chain and sustainable performance (for example, CHEN ET AL., 2023; GUPTA ET AL., 2025; AL AMIN ET AL., 2025; BAGHERPASANDI ET AL., 2025) stated that sustainable performance, including economic, environmental, and social performance, must be considered as significant indicators of sustainable organizational performance. In another similar study, ISLAM ET AL. (2024) and JUNEJO ET AL. (2025) asserted that the manufacturing sectors must incorporate all dimensions of green supply chain management (GSCM) practices to improve sustainable performance. Similarly, ZHOU ET AL. (2023) examined the effects of proactive (reverse logistics) and reactive (threat of legislation and regulation) practices as a component of GSCM to attain the economic, environmental, and intangible performance of SME manufacturing enterprises in Bangladesh. As a collective explanation, these studies exemplify approaches to explore the several relevant aspects of GSCM processes.

However, ALKARAAN ET AL. (2025) asserted that GSCM techniques are the strategic skills that may be used for competitive advantage. Likewise, AHMAD ET AL. (2022) has regarded GSCM techniques as strategic resources or competencies for establishing competitive advantage. On the other hand, ABDALLAH ET AL. (2024) discovered that organizations exhibiting superior GSCM processes improve performance. Similarly, ALLEN ET AL. (2022) discovered that GSCM techniques aid organizations in attaining a competitive edge. Besides, ISLAM ET AL. (2024) used the Resource-Based View (RBV) to examine the relationship between GSCM practices and sustainable company performance. In this regard, LERMAN ET AL. (2022) defined and examined several sets of GSCM methods and many metrics of sustainable corporate performance across various organizational perspectives. Thus, based on the above literature support, it is found that most of the GSCM methods and metrics for sustainable organizational performance are universally applicable across many organizations and sectors.

Nevertheless, HABIB ET AL. (2020) found that GSCM techniques and their different components contribute to sustained organizational performance. Pertinently, LI ET AL. (2024) showed that eco-design, collaboration with consumers, and internal environmental management are favorably correlated with environmental, economic, and social success.

Likewise, GAWUSU ET AL. (2022) discovered that green buying and green manufacturing, in conjunction with other GSCM activities, favorably influence environmental and socio-economic performance. The research by HOSAIN & MUSTAFI (2025) confirmed that GSCM techniques had a beneficial effect on both environmental and economic performance. Thus, numerous studies (for instance, UDDIN, 2021; GAWUSU ET AL., 2022; AHMAD ET AL., 2022; LERMAN ET AL., 2022) have identified that eco-design, green purchasing, green production, customer collaboration, and reverse logistics are positively correlated with the three aspects of sustainable operational performance, namely environmental, social, and economic performance.

Notably, eco-friendly product designs provide several advantages to organizations, including unique manufacturing capabilities, the development of proprietary knowledge, and the acquisition of royalties from green innovations, resulting in a competitive edge (DAHMANI ET AL., 2022). Additionally, eco-friendly product design reduces costs while enhancing value and economic performance, and eco-design methods augment organizational image and reputation (LIU ET AL., 2021), thereby enhancing social performance. Besides, LI & SARKIS, (2022) shown in their empirical analysis of the Chinese car industry that eco-friendly designs mitigate negative environmental consequences and thus improve environmental performance. On the other hand, green buying, or environmentally conscious procurement, entails the integration of environmental considerations in the purchase process (KHAN ET AL., 2023B).

However, green purchasing guarantees that the acquired materials are ecologically sustainable and devoid of hazardous elements (HAZAEA ET AL., 2022). Moreover, green manufacturing improves both economic and ecological outcomes for the companies. Similarly, DAHMANI ET AL. (2022) in their study found that green and lean manufacturing are crucial for waste reduction, minimizing production stages, and raising production efficiency, hence improving economic and environmental performance. In this pertinent, OPOKU ET AL. (2025) contended that green and lean manufacturing enhances organizational image and repute, which ultimately results in social performance. In another similar research conducted by LERMAN ET AL. (2022) discovered that sustainable manufacturing enhances operational efficiency as well as economic and environmental performance.

Prior research (for example, ISLAM ET AL., 2024; RASHID ET AL., 2025a) have shown that all components of GSCM significantly impact overall firm performance. Similarly, GAWUSU ET AL. (2022) discovered that the implementation of proactive (reverse logistics) methods does not have a substantial influence resulting from the performance of GSCM. However, based on the above discussion and literature support, the present study indicates that it is essential to acknowledge a comprehensive range of measuring scales for the proposed model in this study. This research goal arises from the gap in research on incorporating all GSCM practices and sustainability performance within a single study. The activities of GSCM facilitate interaction across different components and play a crucial role in maintaining an organization's sustainability performance. Therefore, this study aims to analyze the relationship between GSCM and sustainable organizational performance thoroughly. The preceding discussions establish the foundation for the subsequent hypothesis:

Hypothesis 1: *Green supply chain management is positively related to sustainable organizational performance.*

4.2. Green Supply Chain Management and Circular Economy

In their study, WANG ET AL. (2025) discussed a comprehensive definition of green supply chain management (GSCM) in theoretical circles. However, clarifying the term GSCM varies across scholars due to their diverse perspectives. In similar research, ALKARAAN ET AL. (2025) proposed a thorough analysis by applying the principles of sustainable development and supply chain management. The authors also included that logistics, information, capital, and knowledge flow will be carefully planned, organized, guided, coordinated, and controlled among the participating entities in their green supply chain system. Similarly, CHEN ET AL. (2023) found that the objective of GSCM is to optimize resource allocation, enhance benefits, and achieve environmental compatibility. Additionally, the concept of GSCM will be appropriately accomplished through activities such as optimizing and improving the speed, certainty, and environmental friendliness of related processes (ISLAM ET AL., 2024). However, GSCM necessitates a complete shift in the mindset of dealing with pollution. It prioritizes the idea of reducing pollution at its source, with prevention being the primary focus and treatment being secondary, which represents that during the product design and purchasing stages, careful consideration must be given to the environmental impact, resulting

in reduced treatment costs for businesses and improved environmental and economic performance (BAG ET AL., 2022).

On the other hand, the term "circular economy" generally refers to the procedures of recycling, reusing, reduction of wastage, and remanufacturing processes of production, circulation, and consumption (CHAITY ET AL., 2025). The circular economy is a form of ecological economy that necessitates human economic activities that adhere to the 3R principle: Reduce, Reuse, and Recycle (AMIN ET AL., 2024). Reduce refers to the act of decreasing the quantity of material during the production and consumption process. Reuse involves prolonging the duration of a product or service. Recycle centers are around the regeneration of renewable resources following their usage. The circular economy replaces the traditional linear economic model of "resource - product - waste" with a feedback circular economy model of "resource - product - waste - renewable resource." This transformation aligns with the principles of sustainable development, allowing for more efficient use of resources and better environmental protection (DAS ET AL., 2025). The aim of the circular economy is to achieve maximum economic and social benefits while minimizing resource consumption and ecological costs (COTRINA ET AL., 2025). The circular economy enhances awareness of resource conservation and environmental protection, hence facilitating the adoption of green supply chain management to some extent (CUEVAS-PICHARDO ET AL., 2025).

There has been a notable emergence of the concept related to green supply chain management with the adaptation of the circular economy framework that businesses are increasingly implementing (DEBNATH ET AL., 2023). The foundations of these frameworks are primarily shaped by influences from the product lifecycle and operational factors (ISLAM ET AL., 2024). In this context, KARMAKER ET AL. (2023) proposed that adopting a comprehensive perspective of the entire product supply chain is a crucial step towards creating greener and more sustainable production systems, particularly regarding the re-use and remanufacturing of materials. The emergence of these systems may facilitate the development of innovative and competitive business models (KHARAT ET AL., 2025). Models like these could draw from the cradle-to-cradle framework, promoting the utilization of raw materials identified as technical and biological nutrients. These materials are designed to have no adverse effects on the environment, contribute positively to ecological systems, and reintegrate into the ecosystem without requiring any processing (LIU ET AL., 2023).

Nonetheless, the ideas surrounding GSCM have evolved concurrently, while there are certain conventional supply chain principles that are somewhat linked to the discussions on the circular economy (ABDALLAH ET AL., 2024). The relationship between GSCM and circular economy has been emphasized in the literature and practice of industrial ecology, highlighting a significant area of interest. Indeed, GSCM, in conjunction with the circular economy, aims to incorporate environmental considerations into organizations by minimizing material flows and mitigating the unintended negative impacts of production and consumption processes (AKASH ET AL., 2025). Moreover, as outlined by AMIR ET AL. (2024), the circular economy advances the boundaries of environmental sustainability by highlighting the concept of reimagining products to foster viable interactions between ecological systems and economic development (AHMED ET AL., 2022). This is accomplished through a fundamental change in the reconfiguration of material flows, emphasizing sustainable economic growth and innovation (HALBUSI ET AL., 2025).

From the perspective of GSCM, the concept of circular economy extends beyond merely minimizing the environment's role as a sink for waste or postponing cradle-to-grave material flows (JU ET AL., 2025). Instead, it focuses on developing systems that facilitate self-sustaining production methods that align with natural processes, where materials are continuously reused. Identifying methods to integrate GSCM strategies with circular economy-related principles become crucial for advancing the limits of environmental sustainability (KARMAKER ET AL., 2023). Besides, the circular economy focuses on the movement of materials within GSCM systems by fostering a transformative change in production philosophy (LONG ET AL., 2025). However, based on the above literature support, the present research proposes the following hypothesis:

Hypothesis 2: *Green supply chain management positively influence Circular Economy.*

4.3. Circular Economy and Sustainable Organizational performance

Over the past few years, there has been a notable growing correlation between organizational performance and environmental measures in the research (MAGDALENA ET AL., 2025). On the other hand, corporations have acknowledged the necessity of achieving a harmonious equilibrium between economic indicators by integrating social and environmental performance measurements (MARTÍNEZ-FALCÓ ET AL., 2024). Organizations are

becoming more cognizant of the numerous advantages that can be obtained by considering various aspects of performance (MEHMOOD ET AL., 2025). Additionally, it is essential to connect the application of the circular economy to achieve sustainable performance to make significant advancements. In this regard, MOUSA ET AL. (2025) proposed that firms are more likely to allocate resources to implement the circular economy while they observe enhancements in domains such as productivity and performance. Similarly, AMIN ET AL. (2024) investigated the correlation between practices of the circular economy and company performance in terms of environmental, financial, and social aspects.

The circular economy aims to minimize resources used across different activities, which may result in lower production costs for businesses, along with improved resource efficiency, economic returns, and environmental sustainability (RASHID ET AL., 2025c). Besides, the concept of a circular economy revolves around the protection of natural resources. Organizations can achieve this by integrating recycling and reusing waste materials throughout the manufacturing process, utilizing sustainable purchasing practices (SHAH ET AL., 2025). The adaptation of circular practices presents a promising strategy for alleviating the adverse effects of manufacturing and globalization on the environment, as indicated by the findings of SHARMA ET AL. (2025). In this regard, SHAHZAD ET AL. (2025) suggested that the adoption of the circular economy positively influences the environmental performance of the companies. Thus, the circular economy also moves towards some social implications beyond the economic and environmental advantages.

In relation to the circular economy, it is found that the most referenced sociological aspects are increase of employment, health and safety, and employee participation (ISLAM, 2025; SANTIAGO ET AL., 2025). The implementation of the circular economy often leads to the creation of job opportunities, which helps to manage the regional disparities in unemployment rates and inconsistencies in occupational demands (OBEIDAT ET AL., 2023). Moreover, the circular economy plays a significant role in societal advancement by adapting mobility and production methods, leading to a reduction in air pollution (KHARAT ET AL., 2025). The implementation of the circular economy can improve the delivery of public health and healthcare services by introducing various strategies that foster cost-effectiveness and efficiency. Thus, the adaptation of principles of circular economy can create a supportive environment and strengthen communities, ultimately resulting in improved welfare and elevated living standards (SANTIAGO ET AL., 2025).

A circular economy-based production system fundamentally ensures the optimal functionality of materials and products. The application of the circular economy significantly improves the efficient use of resources, leading to enhanced operational performance for firms (SHAH ET AL., 2025). The implementation of the circular economy also yields economic advantages for organizations by enabling effective waste management, resource conservation, and efficient financial utilization (SHAHZAD ET AL., 2025). The traditional manufacturing system is the primary cause of environmental degradation (SHARMA ET AL., 2025). Therefore, the implementation of environmentally friendly and sustainable methods through the circular economy has the potential to significantly minimize waste and detrimental emissions significantly, thereby assisting organizations in attaining sustainable performance (SINGH ET AL., 2025). In a similar vein, the circular economy assists organizations in effectively utilizing energy and resources, leading to enhanced overall performance (AFROOZI ET AL., 2025). Thus, existing literature suggests that different practices related to the circular economy, including procurement, design, and recycling, can contribute to the implementation of green sustainable management aimed at achieving sustainable performance (AMIN ET AL., 2025; SANTIAGO ET AL., 2025).

The present study indicates that additional research is required to establish definitive conclusions regarding the relationship between the circular economy and sustainable performance. It is crucial to have a comprehensive understanding of how the activities of the circular economy affect the many aspects of sustainable organizational performance (AMIN ET AL., 2024). According to the resource-based perspective theory, it is possible to believe that by implementing the circular economy, employees can maximize the efficient use of resources by expanding their involvement in the economy, promoting energy conservation, lowering operational expenses, and avoiding environmental harm. Based on the above discussion and prior literature support, the current study puts forth the subsequent hypothesis:

Hypothesis 3: *Circular economy is positively related to sustainable organizational performance.*

4.4. Circular Economy as a Mediator

Several prior studies (for example, LIU ET AL., 2023; KARMAKER ET AL., 2023; CUEVAS-PICHARDO ET AL., 2025) indicate that emerging technologies and Industry 4.0 support manufacturing companies in implementing the structural transformations. The scholars additionally found that these relationships are necessary for attaining business sustainability, facilitated by the mediating influence of the circular economy. Nonetheless, a notable lack of representation exists for innovative technologies like the circular economy within the research domain concerning sustainable company performance (MAGDALENA ET AL., 2025). This gap is even more pronounced in investigations that explore the interplay between Industry 4.0, circular economy (as a mediator), and sustainable performance (SHAHZAD ET AL., 2025). The authors further argued that it is especially possible when the circular economy is a mediating variable linking Industry 4.0 to company performance. Besides, the findings indicate that the circular economy significantly mediates the application of Industry 4.0, enhancing resource use efficiency and the sustainable performance of firms.

In a related study, SHAH ET AL. (2025) discovered that existing literature indicates the capacity to adapt advanced technologies that can enhance sustainability outcomes for companies, especially when the circular economy serves as a mediating variable. In this relevant study, SHAH ET AL. (2025) further illustrated that the adaptability of advanced technologies significantly enhances companies' sustainable performance when the circular economy serves as a mediating factor. In this context, WANG ET AL. (2025) argued that the application of the circular economy alongside advanced technologies holds significant promise for enhancing coordination and improving the sustainable performance of companies. However, the incorporation of advanced technologies alongside circular economy principles holds considerable promise for improving current production systems and paving the way for a more sustainable future for generations to come (CHEN ET AL., 2023).

According to CUEVAS-PICHARDO ET AL. (2025), circular economy practices play a key role in an organization's efforts to attain sustainability in business. The investigation was conducted to emphasize the contributions of the circular economy (as a mediator) to the sustainability of businesses. Taking into consideration the above point, AMIN ET AL. (2025) concluded that the circular economy mediates the connection between green human resource management and sustainable organizational performance. In addition, BAG ET AL. (2022)

have proven the connection between the promotion of innovation and efficient resource usage that the circular economy provides to businesses and the overall sustainability of those businesses.

However, the research of AMIN ET AL. (2025) additionally indicated that green human resource management techniques have the potential to inspire employees to be more environmentally conscious and dedicated by means of the efficient application of circular economy mechanisms. In another similar research, SHAHZAD ET AL. (2025) found that the circular economy process has the potential to influence the relationship between the green supply chain and a firm's sustainability. According to the authors, putting the circular economy into practice within an organization can operate as a gateway for green supply chain management techniques to contribute to the sustainable performance of the company through the mediation of the circular economy. According to the evidence presented in the previous section of the literature review, the current study proposes the following hypothesis:

Hypothesis 4: *Circular economy mediates the relationship between green supply chain management and sustainable organizational performance.*

4.5. Managers' Green Concern as a Moderator

From a managerial standpoint, attention to environmental issues positively influences the implementation of environmental innovation strategies (MO ET AL., 2022). Moreover, the authors emphasized that a manager's ecological concern is crucial in influencing whether a firm will engage in green innovation. They also noted that the level of this concern may moderate the relationship between green innovation and firm performance. Managerial concern plays a crucial role in shaping the effectiveness of an organization's pro-ecological initiatives. In another study, MUNAWAR ET AL. (2022) indicated that when adopting sustainable green practices, such as green supply chain management, it is crucial to consider the knowledge and awareness from management perspectives. As a result, managers should receive a satisfactory level of incentives for their endorsement of the environmentally friendly initiatives.

At the same time, recognizing the necessity to improve a company's public image and the apprehension regarding potential risks to the credibility of the environment drives managers

to implement sustainable green practices (SONG ET AL., 2021). The authors additionally argued that due to these practices and environmental concerns, managers ought to receive incentives from other stakeholders, along with a commitment to environmental reporting. It is essential to highlight that the role of managers should focus on addressing ecological issues in alignment with the expectations of stakeholders, especially those of capital providers (POLAS ET AL., 2023). Moreover, it is essential for managers to be motivated to promote ecological initiatives like carbon reduction and energy conservation, as these efforts can lead to economic advantages for the firm, aligning with the objective of shareholders to enhance their wealth. However, securing ecological protection from parent companies and international buyers is a significant motivation for the environmental protection decisions made by top management (CAO ET AL., 2022).

However, it is important to recognize that managers hold distinct responsibilities in contrast to other shareholders and owners. The individuals responsible for the daily management of the company ensure that it meets the objectives set forth by the owners and shareholders (SONG ET AL., 2021). This demonstrates a connection where the owner acts as the principal, while the manager serves as the representative of all shareholders. As a result, it is essential for the shareholders or owners to determine strategies for navigating rigid communication frameworks. This aims to ensure that managers do not prioritize their own benefits at the cost of the company and protect the environment (RIVA ET AL., 2021). Notably, leaders prioritize business outcomes, especially focusing on enhancing efficiency, minimizing expenses, and preserving the environment. Their role significantly impacts the company's daily operations and corporate strategy, while the owners exert influence over corporate decisions through the managers (LIN ET AL., 2023). Consequently, it is essential for them to possess a deep understanding and genuine concern for environmental issues while also considering the interests of all stakeholders simultaneously.

In their study, CAO ET AL. (2022) revealed that the level of concern for environmental issues among managers influences the connection between shareholder pressures and ecological activities, particularly when shareholders prioritize ecological matters. In a similar vein, MO ET AL. (2022) demonstrated that the green concerns of managers drive organizations to prioritize effective practices, which encompass ecological protection initiatives that not only benefit the company but also enhance its corporate image among stakeholders and society. In another investigation, MUNAWAR ET AL. (2022) proposed that

the green concern of managers (acting as a moderator) has resulted in an emphasis on ecological pressures from shareholders. Conversely, the environmental concerns of managers are seldom addressed, leaving the connection between their ecological awareness and corporate strategies and activities ambiguous (RIVA ET AL., 2021). With the support of previous study discussions and the focus of the present study, which is on green supply chain management and sustainable performance, this research investigates the possible moderating influence of managerial environmental concern in the following subsequent hypothesis:

Hypothesis 5: *Manager's green concern has a moderating effect between the relationship of green supply chain management and sustainable organizational performance.*

4.6. Research Framework with Hypotheses

The objective of this study is to scientifically investigate the effects of green supply chain management on sustainable business performance. The variable that is being influenced in this study is sustainable organizational performance, which encompasses three dimensions: environmental, financial, and social. The independent variable of green supply chain management comprises five components: eco-design, green purchasing, green manufacturing, green distribution and packaging, and internal environment management, all of which are independent or controlled variables. Further, the study aimed to investigate the mediation of circular economy and the moderating influence of managerial green concern on the relationship between green supply chain management and sustainable organizational performance. Based on the objectives of this study, addressing the research questions, and above discussed literature support, following five hypotheses have been developed that are shown in the following framework illustrated in Figure 13:

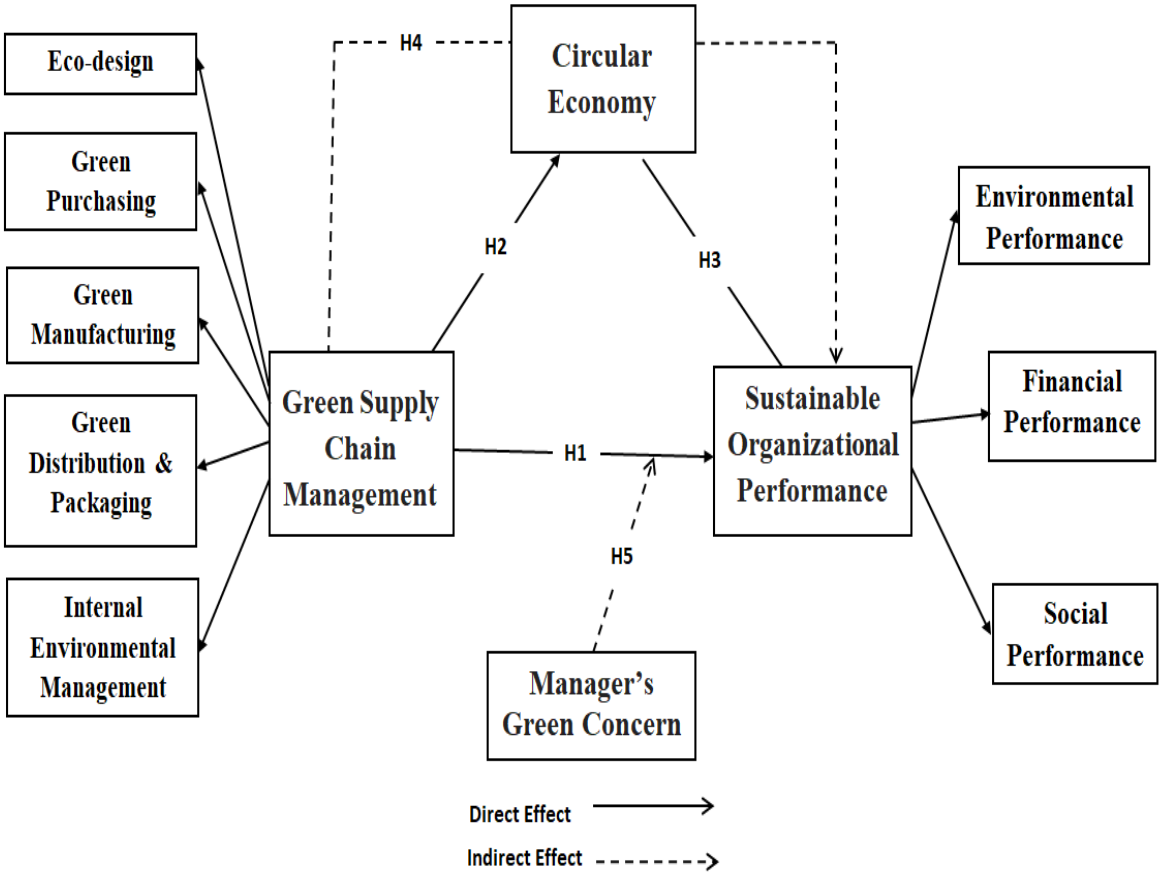

Figure 13: Research Framework and Hypotheses for this Study

5. METHODOLOGY

The methodology chapter of this thesis encompasses research planning, population, unit of analysis, sampling frame, sampling technique, sample size, data collection processes, research questionnaire and scales, and data analysis methods.

5.1. Research Design

Research design represents the structural framework for conducting a research investigation. Additionally, the research design delineates the necessary procedures for advancing the present research. Based on the suggestion of SÜMEN ET AL. (2025), the current study is designed as correlational in nature because the researcher collected data and examined the hypothesized relationships among several variables as outlined in a theoretical model. Besides, the present study is also a cross-sectional investigation in which the researcher collected pertinent data from the participants and drew appropriate conclusions within a certain period. This survey aims to collect responses from employees of ready-made garment organizations regarding their perceptions of the relationship between green supply chain management and sustainable performance at the organizational level. This assessment has been further done, considering the impact of the circular economy as a mediating variable.

The researcher of this study utilizes a standardized survey questionnaire to carry out this empirical study. In this context, SALKIND (2012) recommended that researchers utilize a questionnaire survey to assess the relationships among qualitative constructs, but in a quantitative process. Thus, the questionnaire method can convert the qualitative data into quantitative data so that it can be analyzed and presented in an understandable way to the research beneficiary stakeholders. On the other hand, a thorough examination of the survey results was conducted to collect factual proof for the hypothesized relationships between the discovered elements and constructs. Thus, the details of the research design for the present investigation are addressed and explained in this chapter. Figure 14 represents the present research process in a chart:

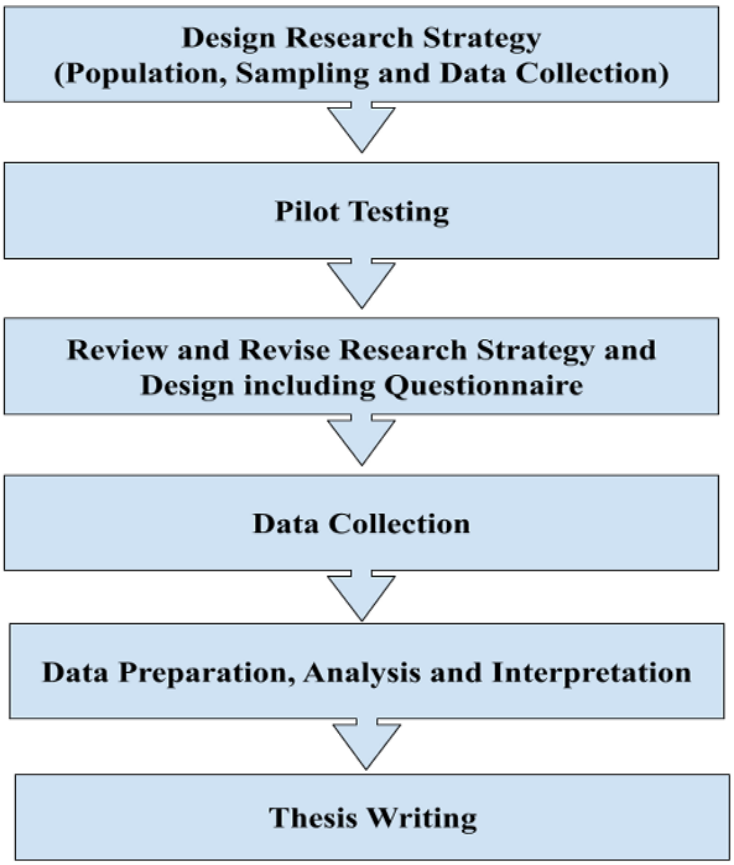

Figure 14: Research Process; Source: Adapted from BLUMBERG ET AL. (2014)

Nature of Research

The present study employs a quantitative approach as it involves collecting data for analysis. Additionally, it explores the potential links or associations among the constructs (variables) established from the research framework. Moreover, this research is a correlational research design in which data were analyzed to provide sufficient empirical evidence for testing the relationship between variables (BLUMBERG ET AL., 2014). In this pertinent, SALKIND (2012) recommended that while assessing the connections among various constructs, such as human behaviors, perspectives, values, ideas, assessment of perceptions, and interpretations in diverse circumstances, the researcher may needs to create survey instruments, namely a research questionnaire, Besides, thorough quantitative approaches was employed to analyze the data and ensure its comprehensibility to the intended audience. Hence, comprehensive research serves as a suitable empirical investigation to examine the authentic correlations among the selected variables.

5.2. Population, Unit of Analysis, and Sample

The current research presents the following descriptions for the target population, unit of analysis, sample, sampling frame, and sampling techniques:

Target Population

The population refers to every component that has the specific information required by the research investigator (MALHOTRA & DASH, 2015). To prevent omissions in sample selection, the researcher followed the recommendations of MALHOTRA & DASH (2015) to determine the target population based on the component, sampling units, extent, and time duration. Additionally, following the suggestion of REDDY & KANNAMANI (2016), the scope of this research included all personnel (including managers at all hierarchical levels) employed in green garment organizations in Bangladesh. The researcher included personnel from all three levels in the organization to ensure accurate generalization of the data since the perception of sustainable organizational performance may differ among employees at various corporate levels. Additionally, the scope of the study includes the whole of Bangladesh, and data collection will be conducted from 1st February 2025 to 31st March 2025, spanning a period of two months.

Unit of Analysis

The present study concentrated on the ready-made garment enterprises that are formally approved and listed by the Bangladesh Garment Manufacturers and Exporters Association (BGMEA, 2025). The unit of analysis for this research is individual managers who work as full-time employees at several hierarchical levels of registered garment enterprises in Bangladesh, including top, mid, and lower levels, as regulated by the garment regulatory body. Additionally, this research focuses on managers who work primarily in green garment organizations that have obtained LEED (Leadership in Energy and Environmental Design) certification across all types of garment organizations (AMIN ET AL., 2024). The individuals employed in the specific clothing organizations identified are the focus of examination in this research. In this regard, SEKARAN & BOUGIE (2016) stated that there are variations in how individual respondents, for example, workers at various levels and positions, have different perceptions. That is why the unit of analysis for the study data was selected to attain the combined perceptions of all levels, departments, corners, and areas of the respondents. Thus, this study aims to assess the perspectives of managers at all levels working individually

in the specified green garment industry in Bangladesh, which is chosen as the 'Unit of Analysis'. Consequently, participants were further selected based on two additional criteria, which are as follows:

1) This refers to those who are employed on a long-term basis in green garment organizations in Bangladesh. It excludes those who work on temporary, contractual, daily basis, probationary, project-based, or temporary job roles, vendors, suppliers, government representatives, international consultants, and external auditors.
2) The selected manager must have at least three years of active work experience in the present company.

Sampling Plan

A sample is a subset of a population that is chosen to reflect the entire population accurately. Relatively, sampling is the method used in selecting a subset, or sample, from a larger group of people, organizations, creatures, items, or units, known as the population of interest. Sampling is the act of determining a representative unit that is meant to represent the essence of the entire population (LANDY ET AL., 2020). Naturally, it is an established reality that accessing every single unit within a population may be very arduous and, in many cases, completely unattainable due to constraints such as time, expense, and other limitations. Under these conditions, researchers must use a sample size that accurately reflects the total population (MARTÍNEZ-MESA ET AL., 2016).

Sample Size

To determine the appropriate sample size, it is essential to compile a comprehensive list of the whole population, i.e., a sampling frame (KREJCIE & MORGAN, 1970). Based on the Bangladesh Bureau of Statistics (2025) survey report, the comprehensive list of all workers in the garment business of Bangladesh is not available. The total number of workers estimated in the Labor Force Survey, Bangladesh (2023-2024) is likewise an approximation. Scholars have discussed different concepts, methodologies, or formulas for calculating the sample size for studies when the population is unidentified or approximate; for example, HAIR ET AL. (2010) suggested that regardless of the magnitude of the population, the sample size should be neither too small nor excessively large to conduct a worthwhile study. The other scientists

have proposed their criteria for determining the ultimate sample size; therefore, Table 9 presents those methods to select the sample size:

Table 9: Criteria of selecting sample size by various scholars

Reference (s)	Recommendations
SEKARAN & BOUGIE (2010)	Based on the concept of multivariate statistics, any researcher or research team can preferably include a sample size ten times greater than the number of variables of concern in their study. Therefore, to meet this criterion, a minimum of 160 respondents (calculated by a total of 10 latent constructs + 6 demographic variables = 16 variables multiplied by 10) is required to be included in this study.
HAIR ET AL. (2010)	While performing research using PLS-SEM analysis, the total number of participants should be at least ten times larger than the number of causal paths directed towards a particular unobserved variable in the structural model. Based on the instructions provided by Hair and his colleagues, the appropriate number of respondents for this study should be 80, which is ten times the largest number of causal paths, which is 8. Therefore, the minimum required sample size for this study should be 80.
HOE (2008)	In general, a sample size of 200 is regarded as a crucial threshold for empirical research.
COCHRAN (1977)	Since there is no available published list of respondents, this research may utilize Cochran's (1977) method to estimate the sample size for an unidentified population. The formula has been applied, and the resulting total sample size is shown below: $n = \frac{z^2(pq)}{e^2}$, $n = \frac{(1.96)^2(0.5\times0.5)}{(0.05)^2}$, $n = \frac{(3.8416)(0.25)}{(0.0025)}$, $n = \frac{(0.9604)}{(0.0025)}$, $n = 384.16$, **That is, n = 384**

	Therefore, based on the formula Cochran (1977) recommended for unlisted populations, a sample size of 384 respondents is considered sufficient for the present study.
KREJCIE & MORGAN (1970)	The current study may also follow the formula table suggested by Krejcie and Morgan (1970) to determine the appropriate sample size for a population provided by Bangladesh Bureau of Statistics (2022-24). The recommendation of Krejcie and Morgan (1970) indicated that the appropriate sample size can be 384.

Based on these scholarly arguments, the sample size for the present study is suggested to be at least 80 or more (HAIR ET AL., 2010), preferably 160 (SEKARAN & BOUGIE, 2010), ideally around 200 but not too large (HOE, 2008). However, the appropriate recommended sample size is 384, according to COCHRAN (1977) and KREJCIE & MORGAN (1970). Hence, according to the above discussion and the supporting literature, the present study was determined to collect data from a sample size of 384 or more.

Sampling Technique

According to the recommendation of RIBE (2011), the present research is determined to utilize the "judgmental purposive sampling (JPS)" approach, which falls within the non-probability sampling type. When a particular list of respondents is unavailable, this strategy is often utilized (SEKARAN & BOUGIE, 2010; HAIR ET AL., 2014). The target demographic for the present research is the managers of green garment companies; no list is available from any group. The Bangladesh Garment Manufacturers and Exporters Association (BGMEA, 2025) also provided a tentative overall workforce count for this category. Likewise, there are a few benefits to the judgmental purposive sampling approach, including its reasonable cost, convenience, and lack of time commitment (MALHOTRA & DAS, 2015). Using this sampling strategy, a researcher may get the information needed from respondents chosen according to criteria that the analyst himself has established (SEKARAN & BOUGIE, 2010). Moreover, this approach has been highly recommended by authors such as RUBEL ET AL. (2021), ISLAM ET AL. (2024), HASSAN ET AL. (2025), UZIR ET AL. (2025), HOSAIN ET AL. (2025), for the unlisted population, particularly in the framework of Asian nations. However, REDDY & KANNAMANI (2016) highlighted the following points in Table 10

that indicate whether to use the judgmental purposive sampling approach over other techniques:

Table 10: Focus points of Judgmental Purposive Sampling Technique

Focus Point	Explanation
Entry restriction	Most organizations have strong restrictions on sharing their organizational information or data with outsiders unless there is a personal connection, trustworthy reference, a trusted relationship, or an exclusive recommendation, which are very challenging to manage.
Non discloser of commitment	Employees of the organizations are obligated to maintain confidentiality about their professional information, opinions, ideas, and thoughts. This confidentiality applies to outsiders of the organization and even in some situations outside of their own department.
Information security	Typically, workers feel insecure while sharing organizational knowledge, personal perspectives, or opinions with others outside the organization. In this situation, the intentionally chosen participants would be the reliable answer according to their perspective.
Employee privacy threat	People often experience a sense of privacy encroachment when they reveal or share their personal, official, or professional information or opinions.
Physical access	Entrance restriction is the primary obstacle researchers often encounter while gathering data from organizations. In this instance, only those individuals who agree to participate would be the final responders.

Hence, considering all the academic arguments, recommendations, and explanations above, the current research intends to use the judgmental purposive sampling approach to select the sample.

5.3. Research Instruments

This segment focuses on explaining the measures used in the study to formulate the questionnaire. The questionnaire for this study has four main parts. The first part of this segment comprises 6 (six) items to collect the relevant demographic information of the respondents, such as Gender, Age, Education, Monthly Income, Total experiences in the Current Organization, and Industry Experience. In the next part, independent variable Green Supply Chain Management consists of 5 (five) dimensions, i.e., Eco-design was measured by 4 (four) items, Green Purchasing was assessed by 4 (four) items, Green Manufacturing by 5 (five) items, Green Distribution & Packaging through 5 (five) items, Internal Environment Management by 4 (four) items. Additionally, the mediating variable, circular economy, contains 5 (five) items, and the moderating variable, Manager's Green Concern, contains 5 (five) items to measure. Moreover, the dependent variable Sustainable Organizational Performance consists of 3 (three) dimensions, i.e., Environmental Performance was measured by 6 (Six) items, Financial Performance was assessed by 5 (five) items, and Social Performance was measured by 6 (Six) items. Table 11 contains the questionnaire instrument summary used in this study, and an attachment of the full questionnaire is given in the appendix section.

Table 11: Summary of the Research Questionnaire Items

Type of Variable	Variables	Constructs	Items	Sources
Independent Variable	Green Supply Chain Management	Eco-design	4	HABIB ET AL. (2020), ABDALLAH & AL-GHWAYEEN (2020)
		Green Purchasing	4	LERMAN ET AL. (2022)
		Green Manufacturing	5	LERMAN ET AL. (2022)
		Green Distribution & Packaging	5	ÇANKAYA & SEZEN (2019), UDDIN (2021)
		Internal Environment Management	4	HABIB ET AL. (2020)
Mediating Variable	Circular Economy		5	KRISTOFFERSEN ET AL. (2021), AMIN ET AL. (2024)
Moderating Variable	Manager's Green Concern		5	YACOB & SOON (2017), SONG ET AL. (2021)
Dependent Variable	Sustainable Organizational Performance	Environmental Performance	6	ÇANKAYA & SEZEN, (2019), AMIN ET AL. (2024)
		Financial Performance	5	ÇANKAYA & SEZEN (2019), AMIN ET AL. (2024)
		Social Performance	6	ÇANKAYA & SEZEN (2019), AMIN ET AL. (2024)
Demographic Variables			06	Gender,

		Age, Education, Monthly Income, Total experiences in the Current Organization, Industry Experience
Total	55	

The questionnaire items in this study were derived from prior research, with minor adjustments made to the original questionnaire to adjust the present context and enhance its clarity. As an example, the wording of 'your organization' was rewritten into 'my organization', and the term ‘business' was transformed into 'organization'. The present independent, mediating, moderating, and dependent variables are designed to be assessed using a Seven-point Likert scale, where response categories range from '1' (strongly disagree) to '7' (strongly agree). This section describes all the variables, their corresponding assessment items, and the sources of the items of this study.

Supply chain management integrates environmental factors into the management of supply chain activities. The main objective of green supply chain management is to reduce or eliminate inefficiencies in resource utilization, including the use of hazardous chemicals, emissions, energy, and solid waste, across the entire supply chain. In addition, this process encompasses various aspects, including product design, sourcing, and selecting raw materials, manufacturing processes, product delivery, and end-of-life product management (LERMAN ET AL., 2022). To measure with the actual clarification of the concept of green supply chain management, the current research adapted 5 (five) dimensions, i.e., Eco-design, Green Purchasing, Green Manufacturing, Green Distribution & Packaging, Internal Environment Management; and the items of these components were adapted from ÇANKAYA & SEZEN (2019), HABIB ET AL. (2020), ABDALLAH & AL-GHWAYEEN (2020), UDDIN (2021), and LERMAN ET AL. (2022).

According to the basic concept of sustainable performance initiated by ELKINGTON (1994), any organization is a function of its triple bottom line perspective, that is, its performance as

measured by its impact on the economy, society, and environment. This viewpoint defines environmental performance as protecting against resource depletion and minimizing environmental damage, whereas economic performance is limited to financial success. Finally, ÇANKAYA & SEZEN (2019) indicated that social performance is concerned with the well-being of all parties involved, including employees and customers. However, for measuring the construct sustainable organizational performance, this study adapted 6 (six) items to measure Environmental Performance, 5 (five) items to assess Environmental Performance, and 6 (six) items to measure Social Performance, where all those items were adapted from AMIN ET AL. (2024) and ÇANKAYA & SEZEN, (2019).

However, the concept of a circular economy involves an economic model that prioritizes the careful management of resources, manufacturing processes, and the life cycle of products. This approach considers the well-being of humans and the environment (AMIN ET AL., 2025). To measure the circular economy, this research adapted 05 (five) items from AMIN ET AL. (2024) and KRISTOFFERSEN ET AL. (2021). Additionally, managers' green concern was measured by 05 (five) items derived from SONG ET AL. (2021) and YACOB & SOON (2017). The following Table 12 shows the scales for constructing all the present variables and their sources:

Table 12 Questionnaire Items and Sources

Variables	Code	Items	Literature source(s)
Eco-design	ED1	Our company emphasizes the design of products for reduced consumption of materials and energy.	HABIB ET AL. (2020), ABDALLAH & AL-GHWAYEEN (2020)
	ED2	Our company emphasizes the design of products for reuse, recycling, and recovery of materials and resources.	
	ED3	Our firm emphasizes the design of products to avoid or reduce the usage of hazardous products in their manufacturing process.	
	ED4	Our firm emphasizes optimization of design processes to reduce air emission and noise	
Green Purchasing	GP1	Our company emphasizes purchasing eco-friendly materials	LERMAN ET AL. (2022)
	GP2	Our company purchases based on environmental specifications established by product design	
	GP3	Our purchasing process is carried out with ISO 14001 certified partners	
	GP4	Our purchasing process follows procedures that minimize environmental impact	
Green Manufacturing	GM1	Our company assesses the environmental impact on developing and manufacturing its products.	LERMAN ET AL. (2022)
	GM2	Our company manufactures its products with recyclable raw material.	
	GM3	Our company manufactures its products with lowest consumption of resources	
	GM4	Our company manufactures its products with the lowest impact on the environment.	
	GM5	Our company manufactures its products with a high life span	
Green Distribution	GDP1	Our company maximizes the reduction of packaging materials	UDDIN (2021),

& Packaging	GDP2	Our company uses ecological materials for primary packaging	ÇANKAYA & SEZEN (2019)
	GDP3	Our company uses recyclable or reusable packaging/containers in our logistics system	
	GDP4	Our company ensures effective shipment consolidation and full vehicle loading	
	GDP5	Our company always emphasizes to selects and using cleaner transportation system	
Internal Environment Management	IEM1	Our company ensures commitment of green supply chain management from senior managers	HABIB ET AL. (2020)
	IEM2	Our company has all supports for green supply chain management from the mid-level managers	
	IEM3	We practice cross-functional cooperation for environmental improvements	
	IEM4	We implement our environmental compliance and auditing programs	
Circular Economy	CE1	Our company re-uses the wastages of the products for another production	AMIN ET AL. (2024), KRISTOFFERSEN ET AL. (2021)
	CE2	We recycle the raw materials of the products to reuse	
	CE3	Our company remanufacture the raw materials of the products	
	CE4	Our company remanufacture the used products to produce a new product	
	CE5	We reduced energy, cost, and raw material use than the previous time	
Manager's Green Concern	MGC1	We ensured the improvement of the financial performance of our company	SONG ET AL. (2021), YACOB & SOON (2017)
	MGC2	We ensured the benefits from government green concern incentives	
	MGC3	We have gained the market opportunities for our company green initiatives	
	MGC4	We adhere to our national government green	

		technology policies	
	MGC5	We increased our employee motivation regarding environmental concerns	
Environmental Performance	EP1	Our company reduced carbon emission	AMIN ET AL. (2024), ÇANKAYA & SEZEN (2019)
	EP2	The waste generation of our company is reduced	
	EP3	Our company reduced the consumption of energy	
	EP4	We reduced the atmospheric pollution of our company	
	EP5	Our company reduced the consumption of hazardous/harmful/toxic materials	
	EP6	We reduced the frequency for environmental accidents	
Financial Performance	FP1	We decreased manufacturing/operational costs of our company	AMIN ET AL. (2024), ÇANKAYA & SEZEN (2019)
	FP2	We increased the annual turnover of our company	
	FP3	Our company market share price is increasing	
	FP4	We increased our profit than the last years	
	FP5	Our company increased the return on investment	
Social Performance	SP1	Our company ensured the improvement of customer satisfaction	AMIN ET AL. (2024), ÇANKAYA & SEZEN (2019)
	SP2	Our company improved its corporate image in the perception of our customers	
	SP3	We improved investments in various social projects such as education, culture, and sports	
	SP4	We optimized the level of awareness and secured the demands and rights of individuals within the community being serviced.	
	SP5	Our company ensures workers' safety and health in the workplace	
	SP6	Our company has improved the general well-being or enhancement of its stakeholders.	

Source: Literature review

5.4. Ethical Clearance

In this research, ethical standards were maintained following Helsinki declarations. As the local institution (Bangladesh Army University of Science and Technology, Saidpur) does not have a formal IRB or ethics committee, the researcher of this study applied for ethical approval to the Head of Department, Department of Business Administration. After assessing all ethical concerns and guidelines, the Head of Department, Department of Business Administration, Bangladesh Army University of Science and Technology approved and provided the ethical clearance certificate (Ref no: BAUST/DBA-03/Part-02/2020/612, issued on 16th January, 2025) for further survey process. Moreover, the researcher of this study informed and collected both oral and written "consent letter" from each of the study respondents. Thus, all the participants were provided written informed consent.

5.5. Demographic Details of the Respondents

In terms of the demographic presentation of the research's respondents, YIING & AHMAD (2009) suggested that the personal traits of the respondents influence the latent variables associated with organizational outcomes. With that statement into consideration, the present research survey revealed several inquiries pertaining to the personal details of the participants. This study utilized a total of 06 demographic items, including Gender, Age, Education, Monthly Income, Total experiences in the Current Organization, and Industry Experience.

As the present research is based in Bangladesh, and although the native language of the participants is Bangla/Bengali, the researcher of this study observed that the individual participants from garment organizations in Bangladesh who are managers, officers, and executives, maximum percentage of their academic qualification was at least graduate and above. The demographic information of this study also supports this information such as 42 percent of managers have bachelor's degree, 46 percent have master's degree and above. So, in total 88% respondents are qualified enough to respond in English. Additionally, the researcher has been informed the reason for the garment managers in Bangladesh are highly qualified, experienced, and capable of communicating in English because they are constantly dealing with various foreign clients from the USA, Canada, Australia, England, and European countries. Moreover, through the pre-test, the researcher cleared all doubts and ensured that all participants could fully understand the survey questions (Appendix 1) in English. At the

next stage, the draft of the survey questionnaire will be sent to several professionals to confirm that the scales or items used in the survey questionnaire are appropriate. Hence, the study can move forward to the next step, which is pre-testing.

5.6. Pre-Test

The purpose of conducting a pre-test is to identify any problems or mistakes in developing survey items, including their arrangement and wording (COOPER & SCHINDLER, 2011). In this regard, ZIKMUND (2003) suggested conducting a pre-test before any survey to reduce the complexities arising from unclear phrasing or biases. Additionally, pre-testing is crucial in the development of survey questionnaires (FAUX, 2010; BRACE, 2018). It involves using a smaller number of participants to ensure that the statements made in the survey are clear and understood by the respondents. This approach reduces problems such as ambiguous language biases and inconsistencies in the research framework (WILLIS, 2016; WOLF ET AL., 2016).

According to PERNEGER ET AL. (2015), selecting the samples for pre-testing is an important endeavor. For this study, a total of four HR officers from garment organizations, two specialists from the Bangladesh Garment Manufacturers and Exporters Association (the regulatory/administrative body of garment organizations in Bangladesh), and two academicians from the University of Dhaka (the top-ranked university in the category of Business and Economics in Bangladesh) were selected using a purposive sampling technique. They were selected to assess the suitability, clarity, and duration of the time required to complete the survey. While conducting the pre-test, initially, the participants will be instructed to assess:

1) The clarity of the questionnaire items,
2) The arrangement and sequence of the items in the survey, and
3) Their assessment of the questionnaire items' effectiveness in capturing the desired information accurately.

In addition, the researcher will observe the duration of time it took for the respondents to answer the questions. The participants may take an average of 25 to 30 minutes to complete the survey. Afterwards, the researcher will request the participants to share their suggestions regarding essential enhancements to the quality and standard of the questionnaire items. The

participants will be commented that they perceived the survey items as clear, logical, and easy to understand.

5.7. Pilot Study

The purpose of conducting a pilot test survey is to determine the accuracy and reliability of the survey questions. In this pertinent, HERTZOG (2008) suggested performing a pilot test at the beginning of an investigation to prevent errors in large-scale research. The primary reason for doing a pilot study is to gain advanced guidance on potential failures of the research endeavor in terms of methodology, tactics, time limits, protocols, data collection instruments, data analysis, and presentation of empirical findings (TEIJLINGEN & HUNDLEY, 2002). Moreover, the knowledge gained from preliminary survey offers guidance for conducting an extensive research activity (ZIKMUND ET AL., 2003).

Four garment organizations will be chosen purposively to perform the pilot survey for this current investigation. The criterion for selecting these companies is to achieve LEED certification and have been operating for more than ten years. Additionally, they should have a workforce of at least 200 employees. Besides, these selected garment companies should be prominent participants in the RMG sector of Bangladesh, and they willingly agreed to participate in the present research survey.

The selected four businesses are *Envoy Textiles, Pioneer Denim Ltd, AR Jeans Ltd,* and *Mithela Textile*. The researcher distributed 100 questionnaires to the respondents and returned 52 questionnaires, of which 40 were found usable and valid. Previous studies have indicated that a sample size ranging from 10 to 40 can be considered adequate for a pilot survey (HERTZOG, 2008). In addition, JULIOUS (2005) recommended using a minimum of 12 samples for conducting a pilot survey. The researcher of this study aimed to perform a reliability assessment using Cronbach's alpha score. Generally, a Cronbach's alpha value of more than 0.70 is deemed sufficient to validate the internal consistency of the scale items (GLIEM & GLIEM, 2003; TABER, 2018). In this study, the researcher assessed the internal consistency of all components using SPSS (version 26). Relatively, the researcher anticipates that the internal consistency of all the underlying components should be higher than the acceptable threshold of 0.60 recommended by NUNALLY (1978). Nevertheless, the participants who were not part of the initial pilot survey were also not considered in the final

data analysis. After the completion of the pilot test, it was found that the internal consistency of each measure was acceptable based on the threshold of 0.60.

5.8. Data Collection Procedures

A formal letter requesting authorization to collect data for this study will be dispatched to the relevant expert personnel of the selected garment organizations in Bangladesh through their human resources (HR) departments. The letter will include a brief description of the research, instructions for distributing questionnaires, an approximate timeframe, and the collection of the complete questionnaires. Each company's HR representative assigned a single employee to aid the surveyor in disseminating and collecting the responses. In these circumstances, a requisite number of questionnaires will be provided to the selected employees for their participation. The HR experts from the chosen garment organizations will be contacted to distribute and collect survey results, following the specific criteria set by the analyst for the present study. The drop-off-pick-up (DOPU) technique was used to distribute and collect the surveys at this point (STEELE ET AL., 2001). In previous studies, BROWN (1978) and IBEH ET AL. (2004) employed a similar DOPU method, referred to as the "drop and collect survey," in their investigations.

Nevertheless, previous research has uncovered compelling explanations in favor of utilizing the DOPU approach, which significantly motivates the present investigation to use this method.

First, the application of DOPU can reduce biases that are commonly associated with interviews, as indicated by MACLENNAN ET AL. (2011).

Second, scholars such as ALLRED & ROSS-DAVIS (2011) and JACKSON-SMITH ET AL. (2016) additionally supported the idea of reducing the bias attribute of the DOPU method presented by MACLENNAN ET AL. (2011). The scholars also noted that this strategy allows respondents to complete the survey within a specific timeframe.

Third, TRENTELMAN ET AL. (2016) observed that this approach is especially suitable for gathering information or data directly from the respondent, which complies with the circumstances of the current study.

Fourth, a notable advantage of DOPU is its emphasis on the convenience and comfort of the responders.

Finally, previous studies have shown that this strategy is generally suitable for participants from developing nations (PHUN & YAI, 2015) and less developed countries (KAYNAK ET AL., 2000). In addition, prior researchers such as STEDMAN ET AL. (2019), BARCOMB (2019), and AYDOĞDU ET AL. (2020) successfully employed this method to gather data in their studies.

5.9. Preparation of Data

Data Error

The present survey data was assessed prior to data analysis with the objective of reducing omissions. The researcher employed SPSS software, version 25, during the data cleaning step. The current study examined the frequency distribution of all the variables. Any variable with values beyond the defined ranges is being adjusted. Moreover, by using similar statistical software, the researcher additionally investigated the missing values.

Missing Value Calculation

The present researcher examined the quantity of missing values and made appropriate adjustments. Missing values arise when respondents of any questionnaire fail to answer any of the questions contained in the survey. In this pertinent, COHEN (2013) and COHEN ET AL. (2013) indicated that a maximum of 10% missing values is not expected to have a significant impact on the clarity of the results. In the case of a dataset with a small number of missing scores, any statistical method can be employed to address the missing scores (KEMP, 2003; HAIR ET AL., 2010). According to the suggestion of HAIR ET AL. (2010), the mean replacement technique was employed in this study to replace missing values with the mean value of the variable. Thus, based on the recommendation of FARHANGFAR ET AL. (2008) and ACUNA & RODRIGUEZ (2004), mean replacement is the predominant method scholars employ to address the issue of missing scores. After including the missing values, this study investigated through statistical tests whether there is any evidence of common method bias.

Common Method Variance (CMV)

According to PODSAKOFF ET AL. (2003), common method variance (CMV) refers to any bias that can be attributed to the measurement method. Common method variance can arise from various factors, such as the context of a common indicator, a common rater, a context of common measurement, or inherent characteristics of the indicators themselves (PODSAKOFF ET AL., 2003). In this regard, CARLSON & HERDMAN (2012) advocated that the existence of CMV can potentially lead to an expansion of the correlations between variables and convergent validity. Subsequently, PODSAKOFF ET AL. (2003) identified CMV as a significant factor that can contribute to measurement inaccuracy, error, or problem. However, CMV-related issues can be addressed by either a procedural remedy or any statistical approach. Some procedural remedies are well recognized in the field, encompass employing distinct scale anchors for multiple dimensions, implementing proximal, methodological, or psychological separation, gathering data on the dependent and independent variables at various time points, counterbalancing the survey items, and other similar approaches. Although there are several statistical methods for testing CMB, the most well-known common methods are Harman's single-factor test, the partial correlation process, the control of measured latent factors, the control of unmeasured latent factors, and the use of multiple method factors.

To address the challenges associated with CMV, the present study has included several procedural remedy tactics, including the utilization of proximal and methodological separation techniques as recommended by PODSAKOFF ET AL. (2003). The survey presented several variables, each accompanied by distinct sets of guidelines to measure, so that the perception of one variable would not be affected or biased by the other ones. Various scale types or anchors were employed to measure the predictor and criterion variables. For example, the endogenous variable, sustainable performance will be assessed using a seven-point Likert scale with response categories ranging from '1' (strongly disagree) to '7' (strongly agree). Similarly, the exogenous variable, i.e., green supply chain management, and the mediating variable of circular economy, will be measured using a five-dimensional Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). In a previous study, RAMAYAH ET AL. (2014) employed two distinct scale formats to assess their independent and dependent variables and reduces common method biases.

The researcher of this study will utilize Harman's single-factor test, a generally used statistical remedy, to detect common method bias. Based on this methodology, PODSAKOFF ET AL. (2003) recommended that a researcher incorporate all the items under investigation to conduct an un-rotated exploratory factor analysis while maintaining a fixed factor count of one. If the variance explained by a single factor is less than 50 percent, it can be concluded that the presence of common method bias is not evident in the measuring method or dataset.

5.10. Data Analysis Techniques

In this research, a multitude of statistical methodologies and software tools were employed for data analysis. The hypotheses proposed in this study were tested using Smart-PLS fourth generation (Version 4) software through the application of structural equation modeling analysis. Pertinently, MALHOTRA & DAS (2015) indicated that structural equation modeling forecasts a series of interconnected relationships among multiple underlying ideas that are assessed by various items and included in a unified analytical model. The utilization of structural equation modeling is justified due to its sophisticated statistical methodology, which enables the simultaneous examination of several complicated connections among various multidimensional variables (HAIR ET AL., 2010). Additionally, it is rational to employ structural equation modeling, i.e., PLS 4 is a fourth-generation method for analyzing multivariate data. It can independently overcome the intricacies inherent in first-generation statistical techniques, such as ANOVA, multiple regressions, and logistic regression (HAIR ET AL., 2013; CHIN, 2010). While using first-generation statistical processes, it is necessary to consider variables that can only be directly assessed without any errors during data analysis. In social science and management studies, researchers might encounter a requirement to address latent characteristics that are not readily evident or free from mistakes, such as motivation, job satisfaction, service quality, employee perception, and innovation. As a result, researchers utilize structural equation modeling due to its ability to facilitate the utilization of latent constructs that are assessed through various indicators. Additionally, it can assess the systematic and random measurement error associated with the observed indicators (BAGOZZI ET AL., 1991). That is why SEM has been acknowledged as a commonly employed method for assessing theory-supported intricate analytical models (REISINGER & MAVONDO, 2007).

Structural equation modeling primarily comprises confirmatory factor analysis and regression analysis, as opposed to exploratory methods. The SEM technique primarily emphasizes two sequences:

1. Validity test for the accuracy of the measurement model,
2. Assessing the reliability of the structural model.

Validation of the measurement model can be accomplished by utilizing confirmatory factor analysis. In this regard, MALHOTRA & DAS (2017) proposed that conducting confirmatory factor analysis (CFA) is necessary to examine the alignment between latent constructs and the item loadings associated with those constructs, as well as the existing theoretical framework. Moreover, CFA enables researchers to determine the goodness-of-fit indices and reliability of the framework or research model, including the validity of each latent component. Once the measurement model demonstrates satisfactory model fits, reliability, and validation, it becomes crucial to proceed with the structural aspect of the model. The structural model employs path analysis to assess the hypothesized underlying connections. The consideration of the sequence of latent variables and their interrelationships is based on antecedent theory, rationality, or the arbitrary judgment of researchers.

5.11. Approaches of Structural Equation Model (SEM)

Generally, various methodologies can be employed to estimate statistics related to structural equation modelling (SEM). The following are the approaches:

1. The covariance-based structural equation modelling (CB-SEM) methodology
2. Partial least square (PLS)-based structural equation modelling methodology

Notably, researchers apply the maximum likelihood estimation (MLE) method in the context of CB-SEM to mitigate the disparities that may arise between the observed sample covariance matrix and the estimated covariance matrix (MALHOTRA & DAS, 2017). It evaluates the degree to which a suggested theoretical model accurately reflects the actual conditions of the examined context. In this regard, HAIR ET AL. (2017) stated that CB-SEM is preferred when the researcher aims to investigate and confirm existing theories or assess alternative models. The SEM technique presupposes that the dataset follows a normal distribution. Moreover, the sample size for multiple research frameworks is recommended to

be sufficiently big, often ten (10) times the number of indicators (CHIN & NEWSTED, 1999).

PLS-SEM is an alternate approach for conducting Structural Equation Modelling analysis. The SEM approach is commonly preferred when the underlying theory is not firmly established, and the researchers aim to estimate and elucidate the outcome constructions using predictor constructs (HAIR ET AL., 2013). PLS-SEM focuses more on optimizing the variance of the dependent variable by the independent variable instead of concentrating on covariance (HAENLEIN & KAPLAN, 2004). Table 13 presents an overview of the characteristics or aspects of the PLS-SEM approach in contrast to CB-SEM:

Table 13: Comparative summarization of PLS-SEM with CB-SEM

Criteria	PLS-SEM	CB-SEM (AMOS)
Purpose	The primary objective of PLS-SEM is to predict the core constructs (variables) to attain the research objectives.	The primary objective of CB-SEM is to evaluate any theory, validate a theory, or comparative study on different theories.
Approach	This technique uses variance-based structural equation modelling.	This technique utilizes covariance-based structural equation modelling.
Assumption	It is a nonparametric form of predictor.	It is a parametric predictor that utilizes techniques such as multivariate analysis, normal distribution, and controlled observation.
Estimation of parameter	It is consistent while the indicators have enormous or larger-sized samples.	It is consistent within a particular or limited sample size.
Latent variable scores	clearly computed	Un-determined
Epistemic relationship between LV and its measures	It is capable of functioning with both formative and reflective models.	It mainly operates based on reflective scales. Nevertheless, formative scales are hardly used in CB-SEM.
Implications	It is appropriate for accuracy in predictions.	It is appropriate for accuracy in parameters.
Model complexity	It can analyze highly complex models.	It has the capability of managing fundamental to moderate complex models.

Sample size Requirement	Large sized sample is not required.	Large sized samples are a must.
Test of Significant	It is applicable in the context of simulations (i.e., restricted validity).	In this method, tests of significance are available for all contexts.
Global goodness of fit availability	The evaluation of goodness of fit indices in PLS-SEM is in progress.	CB-SEM has resilient goodness of fit indices.

Source: CHIN & NEWSTED (1999)

Moreover, several scholars, including URBACH & AHLEMAN (2010), HAIR ET AL. (2013), and HAIR ET AL. (2017), presented several justifications for selecting partial least squares structural equation modelling. According to the scholars, PLS-SEM possesses the following distinct traits and advantages in comparison to classic covariance-based SEM:

I. PLS-SEM entails a smaller sample size for the purpose of research analysis.

II. PLS-SEM provides dependable outcomes even when the data indicates substantial non-normality.

III. PLS-SEM is a resilience method for addressing missing values.

IV. PLS-SEM has the capability to analyze metric measurements, including interval and ratio measurements, as well as ordinal and binary coded variables.

V. The PLS-SEM possesses the ability to effectively deal with both 'reflective' and 'formative' constructs (variables).

VI. It is capable of operating on a solitary statement factor.

VII. PLS is highly advantageous for making predictions.

VIII. It is applicable to recursive models exclusively, without the inclusion of feedback loops. For instance, it can be applied to models such as leadership, motivation, perceived performance, and employee perception.

Based on the favorable and supportive attributes mentioned above, this study intends to employ PLS-SEM to assess the indicated analytical framework. The present study will utilize

PLS-SEM to anticipate the relationship between green supply chain management and sustainable performance, including the multidimensional concept of the variables. Moreover, the circular economy will be examined as a mediator in this relationship. This study will employ PLS-SEM to examine all the direct and indirect relationships among green supply chain management, circular economy, and sustainable performance. However, PLS-SEM is chosen due to its previous success in assessing more significant effects, such as mediation or intervention, within similar kinds of prior models (HAIR ET AL., 2013; URBACH & AHLEMAN, 2010). Hence, considering the above points, rationales, and justifications, the current study employed advanced statistical software called Smart-PLS (version 4).

5.12. 'Reflective' and 'Formative' Measurement Models

In the case of SEM, the measurement model, also known as the outer model, typically has multiple unobserved structures, each captured by several number of items. There are two categories of unobserved or latent constructs.

- Reflective construct
- Formative construct

The concept of reflective construct operates on a unidimensional basis, meaning that all indicators represent the same conception. As a result, all indicators are nearly identical, so they are interconnected. To assess the reliability of the latent constructs (variables), it is necessary to ask the same question again (HENSELER ET AL., 2009). According to HAIR ET AL. (2013), removing one or two indicators does not lead to significant differences in the outcomes when a reflective construct (variable) is considered. HAIR ET AL. (2010) stated that a reflective construct (variables) occurs when the indications representing the construct (variable) of interest occur simultaneously. Reflective constructs in Structural Equation Modelling (SEM) are represented by extending the arrows from the constructs towards the indicators, as illustrated in Figure 15:

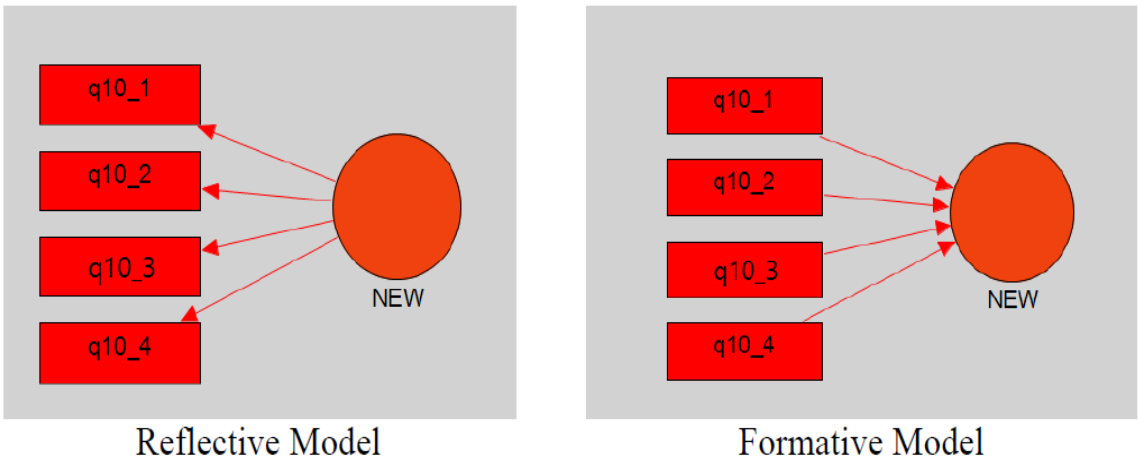

Figure: 15: The visual comparison between reflective and formative model

In contrast, the formative concept examines multiple dimensions, representing no inter-correlation among the items (CHIN, 2010; GEFEN ET AL., 2000). According to JARVIS ET AL. (2003), while using a formative scale, it is anticipated that all indicators will impact the outcomes of a singular latent concept, in contrast to a reflective scale. Eliminating one of the scales or items may impact the content's validity. Compared with reflective constructs, every alteration in one item of the formative scale does not necessarily result in simultaneous increases or decreases in other indicators. In this regard, MALHOTRA & DAS (2017) indicated that the scales in a formative construct represent a whole when all of them are added together.

In the context of empirical research utilizing Structural Equation Modelling (SEM), it is imperative for researchers to differentiate between two distinct categories of constructs (variables). This differentiation is crucial as it renders the examination of hypothesized path relationships, and the hypothesis test will only be useful if the constructs (variables) of the measurement model are accurately defined and evaluated (ANDERSON & GERBING, 1988). The present study will examine the exogenous variable (green supply chain management), mediator (circular economy), and endogenous variable (sustainable company performance) as reflective constructs. Therefore, the scales of these constructs (variables) were derived from previous research that emphasized a rigorous technique for constructing the items for the questionnaire. In this regard, prior scholars such as DIAMANTOPOULOS & SIGUAW (2006) have given significant importance to ensuring the reliability and validity of the reflective constructs.

5.13. Results from the Evaluation of PLS-Path Model

PLS-SEM consists of two stages: first, the measurement model, and second, the structural model (HAIR ET AL., 2013). The following section examines the intricate details of both categories of models.

Measurement Model

The measurement model uses confirmatory factor analysis (CFA) to assess the item loadings, reliability, and validity of the presented theoretical model. In PLS-SEM, the evaluation of the measurement model is based on the following statistical parameters:

- Reliability (Composite Reliability)
- Convergent validity (Average Variance Extracted)
- Discriminant validity (Fornell-Larcker Criterion and HTMT)

The following Table 14 provides a detailed discussion of the statistical criteria related to the PLS-SEM measurement model.

Table 14: Detail criteria of the measurement model in PLS-SEM

Criteria	Explanation
Composite reliability (CR)	The reliability of reflective constructs (variables) in the measurement model is determined by examining composite reliability values. Composite reliability (CR) scores are obtained: the squared sum of the individual item loadings divided by the squared sum of the loadings and the sum of the error variances for the measures. According to HENSELER ET AL. (2009), the function of CR is comparable to Cronbach's alpha in terms of evaluating reliability, except that Cronbach's alpha assumes that each item of a latent concept has an equal impact on the construct. However, HAIR ET AL. (2013) recommend that researchers consider composite reliability instead of Cronbach's alpha when assessing the reliability of measurements. CR values above 0.70 are typically accepted as satisfactory for substantial empirical studies (NUNNALLY, 1994).
Convergent validity (For testifying Indicator Loading)	MALHOTRA & DAS (2017) indicated that convergent validity refers to the degree to which a scale demonstrates a positive correlation with other measures of the same construct. When determining convergent validity, it is important to examine the standardized indicator loadings. Typically, indicator loadings that exceed 0.70 are deemed adequate according to defined standards. In this regard, several researchers (for instance, IGBARIA ET AL., 1995; CHIN ET AL., 1997; HAIR ET AL., 2010,) contend that factor loadings of 0.50 or 0.60 for a small number of items may be considered acceptable if the overall average variance extracted (AVE) score exceeds 0.5.
Convergent validity (Average Variance Extracted; in short, AVE)	To determine convergent validity, it is necessary to calculate the values of Average Variance Extracted (AVE). Specifically, AVE evaluates the extent to which the latent constructs explain the variance value of the items. The AVE is calculated as the total of the squared standardized loadings divided by the sum of the squared standardized loadings plus the

	sum of the indicator measurement error, based on the specifications provided by MALHOTRA & DAS (2017). In this regard, HAIR ET AL. (2013) recommended that all latent constructs should have AVE values of 0.50 or above to achieve the convergent validity requirement.
Discriminant validity (Fornell-Larcker criterion, HTMT, and cross loadings)	Discriminant validity refers to the capability to differentiate between various constructs (HENSELER ET AL., 2015). The discriminant validity might be evaluated using many criteria, including the Fornell-Larcker criterion, HTMT, and cross-loadings. Based on the Fornell-Larcker criteria, discriminant validity is achieved when the square root of the average variance extracted (AVE) for each construct (shown by the bolded diagonal values) is greater than the correlation coefficients between or among all constructs (represented by the off-diagonal values). This criterion has been proposed by CHIN (2010) and FORNELL & LARCKER (1981). Another discriminant validity test proposed by HENSELER ET AL. (2015) is also well-recognized. HENSELER ET AL. (2015) stated that when assessing discriminant validity, it is necessary for all HTMT values of the constructs to be less than 0.85. Conversely, the cross-loading criteria used to evaluate discriminant validity states that each indicator should have a strong correlation with just one underlying construct while having no correlation with the other constructs. Hence, if all the cross-loadings are equal to zero, there is conclusive evidence that represents discriminant validity (GÖTZ ET AL., 2010).

In the case of formative scales, academics must assess the significance of the constructs' weight rather than the indicators' loading score. In this regard, HAIR ET AL. (2013) recommended examining the identification of multi-co-linearity concerns by assessing the variance inflation factor (i.e., VIF) values. It is imperative to be aware that the formative scale comprises items that are not associated with each other. Thus, assessing the reliability

of the formative construct is not essential. Nevertheless, the researcher must evaluate the content validity by addressing previous theories, expert suggestions, and pilot studies.

Assessment of Structural Model

While the measurement model requirements are fulfilled, it is important to assess the structural model based on several criteria to establish the proposed links between the underlying constructs shown in the analytical model (DUARTE & RAPOSO, 2010).

Researchers need to consider the following criteria while examining a structural model:

- Coefficient of determination (R^2)
- Beta Coefficients
- Significance level

R^2 indicates the extent of variance in the dependent or endogenous construct that is explained by the independent, exogenous, or explanatory construct (HAIR ET AL., 2013). In general, researchers prefer higher R^2 ratings when considering the significance. In this regard, COHEN (1988) describes R^2 values ranging from 0.02 to 0.12 as "weak," scores from 0.13 to 0.25 as "moderate," and scores over 0.26 as "substantial."

Additionally, beta coefficients indicate the suggested causal relationship between the latent constructs (variables), according to the indication of HAIR ET AL. (2013). If the researchers find that causal paths are either small or contrary to what was predicted in the analytical model, they should reject the assumptions. According to the recommendation of HAIR ET AL. (2013), standardized beta coefficients have a range of (-)1 to (+)1.

The bootstrapping procedure was used to establish the statistical significance of the beta coefficients. Bootstrapping, as described by HAIR ET AL. (2017), allows researchers to produce subsamples by randomly selecting cases from the original dataset with the replacement. The authors suggested using bootstrapping with large subsamples (such as 5000) to obtain consistent results (HAIR ET AL., 2017).

Predictive Relevance (Q^2)

The primary objective of evaluating structural models is determining the cross-validated predictive relevance of the model (DUARTE & RAPOSO, 2010). In this regard, researchers must calculate the Q^2 value of Stone-Geisser using the blindfolding technique, as STONE (1974) and GEISSER (1975) suggested. Pertinently, HAIR ET AL. (2017) indicated that blindfolding is a method that selectively removes data points and predicts their original values.

Conversely, Q^2 measures the degree to which the model and its parameter estimations accurately reproduce the observed scores (CHIN, 2010). In general, for a specific outcome latent construct to indicate the prediction accuracy of the path model, Q^2 scores should be greater than zero, as stated by FORNELL AND CHA (1994). According to the recommendation of HAIR ET AL. (2017), the Q^2 scores should be evaluated.

Testing the Indirect Effect (Mediation or Moderation) in Smart-PLS

- A mediator is a factor or variable through which the predictor or independent latent constructs exhibit impacts on the outcome or dependent latent constructs (IACOBUCCI ET AL., 2007). In this regard, BARON & KENNY (1986) proposed a popular method for assessing the mediating effects. The scholars suggested that the establishment of mediation must fulfill the following criteria:
- The independent variable, also known as the exogenous construct (variable), should have a clear and statistically significant connection with the dependent variable or endogenous construct (variable), where a mediator is absent.
- The independent variable or exogenous construct should have a direct and statistically significant correlation with the mediator.
- The mediator should exhibit a direct and statistically significant correlation with the dependent variable or endogenous construct - The independent or exogenous construct should demonstrate a statistically insignificant correlation with the dependent or endogenous construct when a mediator is present, indicating complete mediation. In the case of partial mediation, the impact of the independent variable on the dependent variable, including the mediator, should be both statistically significant and a lower level of mediation.

On the other hand, PREACHER & HAYES (2008) suggested a different conception of mediating effect than the concepts of BARON & KENNY (1986). Indicating some drawbacks of BARON & KENNY'S (1986) method, PREACHER & HAYES (2008) recommended a two-step method to evaluate the intervening influence of a variable or construct in the path model. In this regard, ZHAO ET AL. (2010) advocated for the implementation of the two-step technique of mediation, asserting that this approach allows for the comprehensive evaluation of all factors simultaneously. In addition, EBERL (2009) argued that it is necessary to assess both the direct and indirect impacts of the constructs (variables) to determine the mediating function of the constructs (variables). Moreover, PREACHER & HAYES (2008) stated that if there is a statistically significant indirect influence from an exogenous construct to an endogenous construct (variable) with the intervention of a mediator, researchers may infer the presence of mediation. In addition, PREACHER & HAYES (2008) also proposed examining mediation output to illustrate the indirect impact. To analyze the outcome of mediation, it is necessary for any research to determine the 't' statistics using the following formula:

$$t = \frac{\text{indirect effect}}{\text{standard deviation}}$$

Nevertheless, the BARON & KENNY (1986) technique for assessing mediation is considered outdated and is no longer considered appropriate. Therefore, this research intends to employ the product of the coefficient technique proposed by PREACHER & HAYES (2008) to examine mediation. According to these authors, to establish mediation, the confidence interval for the specified indirect effects should not include zero, both in the lower and upper bounds.

6. ANALYSIS AND FINDINGS

6.1. Introduction

The findings of this study and the outcomes of hypothesis testing have been discussed in this chapter. The researcher of this study conducted several descriptive statistics, such as frequency distribution (FD) to describe the demographic and psychographic profile of the respondents; mean (Central Tendency) and standard deviation (SD) to obtain an overall summary of the latent constructs. The research used Harman's single factor test (HSFT) or 'single factor measurement method' and Variance Inflation Factor (VIF) values to evaluate the common method bias (CMB). Subsequently, the analytical model developed for this study was empirically assessed by utilizing PLS-SEM software (version 4.0.9.6). Firstly, to evaluate the goodness of fit of each latent variable used in this model, the researcher examined the measurement model. Afterward, an attempt was made to assess the structural model by testing the relationships predicted by the hypotheses. The degree and strength of the relationship between the identified constructs were predicted by computing R^2 as well as path analysis. Eventually, the results of the hypothesis testing were summarized in a separate table in the final section.

6.2. Rates of the Responses

This research attains a response from the target respondents. Table 15 demonstrates the rate of response of this research. In the beginning, 1000 questionnaires were administered or distributed to the respondents, out of which 609 questionnaires were returned. Among the 609 returned questionnaires, 49 included erroneous and incomplete answers and thus were considered unusable for this study. Ultimately, 560 questionnaires were deemed usable for data analysis. Hence, the finally usable response rate for the research is 56.0%. Even though there has been no universally accepted threshold level for response rates, FOWLER (2002) recommended that any response rate compared to total distribution would be between 20 and 30 percent (%) for a typical survey questionnaire, which may be considered reasonable and satisfactory. In addition, another scholar, NUNNALLY (1994) and HAYES (2009) supported the statement about the validation of the response rate in their research. In this regard, from the perspective of Bangladesh, MAHMUD ET AL (2023) achieved 47.2%, RAHMAN ET AL. (2024) managed 41.5%, KARIM ET AL. (2023) attained a 35.7% response rate for calculating the analysis of their study and reached the desired result. Therefore, the response

rate of 56.00% and the sample size of 560 for this current research can be deemed acceptable. However, Table 15 showed the rate of responses:

Table: 15 Rates of the Responses

Questionnaires	Total Number	Total Percentage
Questionnaires totally distributed to the respondents	1000	100%
Returned or finally received questionnaires	609	60.9%
Questionnaires that are usable for the research	560	56.0%
Not usable questionnaires	49	4.9%

6.3. Respondent's Profile

Table 16 sums up the characteristics of the respondents, including their demography. According to statistics gathered from the Bangladesh Bureau of Statistics (2025), the workforce of the ready-made garment (RMG) sector includes 41% males and 59% females. In contrast, the most common age group for garment sector workers is between 18 and 45. In this regard, SAIF & ISLAM (2025) delineated that the RMG business in Bangladesh is dominated by female employees (60%); perhaps, the notable point included by the scholars is that day by day, the percentage of female workers in this sector is increasing. On the other hand, the present research, based on its total sample size, found that the largest number of respondents (54.29%) fell under the age group of 36-45, as they are in executive and managerial positions. Moreover, most of the respondents chosen for this study were found to be female (55.95%), which is almost similar to the data of the Bangladesh Bureau of Statistics (2025). As a result, it appears that the demographic profile of the respondents chosen for this research may very well represent the personnel who work in the RMG sector of Bangladesh.

Additionally, the current research found that 45.71% of the respondents completed their master's or equivalent degree, and 42.14% completed their bachelor's or equivalent degree. This outcome has been supported by AMIN ET AL. (2024), who reported that most of the workers in the RMG sector have an educational qualification of at least a graduation.

Sequentially, the monthly income range of most of the respondents (41.25%) was more than 300,000 taka ($250).

However, the maximum numbers of respondents (43.21%) have been working in their present organizations for ten to fifteen years. These findings are supported by ISLAM ET AL. (2024), who suggested that the minimum tenure of service by a manager in the RMG sector is ten years. The current research also found that nearly half of the employees (45.36%) possessed industry experience of between ten and fifteen years. Notably, the researcher of this study found that the employees in the RMG sector of Bangladesh are highly qualified, expert, and experienced. The reason is that this sector dominates the global RMG sector and has been facing challenges in upholding its position worldwide over the last two decades. Hence, the overall demographic profile and the descriptive statistics of the sample respondents are given in the following Table 16:

Table 16: Demography of the respondents

Demographic Variables	**Frequency (N= 560)**	**Percentage (%)**
Gender		
Male	246	43.93
Female	308	55.00
Others	6	1.07
Total	560	100
Age		
18 - 25 years	43	7.68
26 - 35 years	176	31.43
36 - 45 years	304	54.29
46 - 55 years	31	5.53
56 years and above	6	1.07
Total	560	100
Education		
Below Secondary School	9	1.61
Secondary School	16	2.86

Higher Secondary/College Diploma	31	5.54
Bachelor’s degree	236	42.14
Master’s Degree	256	45.71
Higher Degree	4	0.71
Others/Professional Degree/Special Degree	8	1.43
Total	560	100
Monthly Income/Salary (in BDT)		
Below 30,000 BDT	79	14.11
30,000 - 40,000 BDT	231	41.25
40,000 - 50,000 BDT	187	33.39
50,000 and above	63	11.25
Total	560	100
Experience in Current Organization		
01 - 05 years	97	17.32
05 - 10 years	113	20.18
10 - 15 years	242	43.21
15 years and above	108	19.29
Total	560	100
Industry Experience		
01 - 05 years	58	10.36
05 - 10 years	129	23.03
10 - 15 years	254	45.36
15 years and above	119	21.25
Total	560	100

6.4. Common Method Biasness (Variance)

In a cross-sectional survey method where information is obtained from the samples only once, common method variance can be a setback (PODSAKOFF ET AL., 2003). In this sense, PODSAKOFF ET AL. (2024) suggested that the common method bias occurs due to two major reasons:

a) When factor analysis results in the extraction of only one single factor from multiple individual indicator variables, and

b) When the first one factor accounts for majority of the common variance prevailing in the dataset.

This research followed the recommendations of PODSAKOFF ET AL. (2003) to reduce the impact of common method biases (CMB) by decreasing the scale and rearranging the survey items in a different sequence. It had also been assured that the replies of the participants would remain anonymous.

Additionally, to statistically identify CMB, the present research used "Harman's single factor test" (HARMAN, 1976) to sort out this issue. Suppose one component does not account for most (50 percent or more) of the covariance among the variables and factors that were made sure by PODSAKOFF ET AL. (2003) study, then CMB will not be a big problem in the measuring process, according to this approach. The first factor contributed to only **32.39** percent of the total variance (see Appendix B, Table 30); therefore, the common method was not considered to be a continual problem in this study. As factor analysis did not yield only one single factor, and the first factor did not contribute to a majority of the variance, it can be said that this research does not involve the problems associated with common method bias.

Besides, as stated by KOCK (2015), the Variance Inflation Factor (VIF) values that are created based on a complete collinearity evaluation may be suggestive for testing the collinearity. However, there is a possibility that a model may have been impacted by common method bias. Therefore, it is important to take these values into consideration. The fact that this is the case demonstrates that the model does not include any common method bias (KOCK, 2015). On the other hand, if all the VIF values that are produced from the SEM analysis in the inner model are less than or equal to 3.3, then this indicates that the model does not include any common method bias. Utilizing the VIF values that are shown in

Appendix B, Table 31, it is easy to arrive at the conclusion that this study is not influenced by the typical common method biasness. This conclusion can be reached without any difficulty.

6.5. Descriptive analysis of the Latent Constructs

The average (mean) and standard deviation of the items used in this study are illustrated in Table 17. All indicators of the exogenous and endogenous variables were measured on a 7-point Likert scale. As shown in Table 17, the mean scores of all the indicator variables were higher than 3.0. Among the independent or exogenous variables, which were measured on a 7-point scale, the top rating score of 'mean' is green purchasing (4.826), and the lowest is green manufacturing (3.809). On the other hand, the highest rating of standard deviation is manager's green concern (0.797), and the lowest is circular economy (0.683). Among the three endogenous or dependent variables of the current research, which were all measured on the 7-point scale, the top rating score 'mean' is social performance (4.718), and the lowest is financial performance (4.395). Besides, the highest rating of standard deviation is social performance (0.686), and the lowest is environmental performance (0.661). In explaining that, green purchasing had the highest score of mean (4.826) and manager's green concern had standard deviation (0.797) amongst all independent, dependent, mediating, and moderating variables. However, to represent all the above explanations, Table 17 is presented below:

Table 17: Descriptive statistics of the Latent Constructs

Constructs	Mean	Standard Deviation
Eco-design	4.476	0.706
Green Purchasing	4.826	0.733
Green Manufacturing	3.809	0.702
Green Distribution & Packaging	4.171	0.719
Internal Environment Management	4.762	0.759
Circular Economy	4.049	0.683
Manager's Green Concern	3.838	0.797
Environmental Performance	4.697	0.661
Financial Performance	4.395	0.674
Social Performance	4.718	0.686

6.6. Goodness of Measurement Model

First, it was necessary to substantiate the measurement model to confirm if indicator variables load on the number of factors as predicted by the theory. In this sense, according to CHIN (2010), the reliability and validity of the observed (indicator) variables that characterize latent variables were examined to evaluate the excellence of the measurement model. This study contains all the reflective scales as predicted by theory and as obtained from statistical analysis. Moreover, HAIR ET AL. (2011) suggested that the reflective measurement model must be examined to assess and deduce its reliability and validity.

Hence, after taking into consideration all these concerns, the researcher analyzed the measurement model based on an evaluation of the composite reliability (CR), factor loadings, and average variance extracted (AVE), and discriminant validity. The evaluation of these statistics associated with the assessment of the measurement model has also been recommended by HAIR ET AL. (2011).

Content Validity

In this study, the researcher examined whether the items of the scales adequately covered the concept of interest. To fulfill this purpose, the questionnaire was initially administered to five academicians, five industry experts, and ten respondents from the target population. After discussion and consultation with these three categories of experts and respondents in the study, the researcher eliminated irrelevant, illogical, complicated items, and items that attack the personal sensitivity of the respondents.

Convergent Validity

Convergent validity is one kind of construct validity that estimates the extent to which a scale positively correlates with other measures of a similar concept (MALHOTRA & DAS, 2015; CHEAH ET AL., 2018). In this sense, HAIR ET AL. (2010) suggested that a researcher may compute factor loadings, average variance extracted (AVE), and composite reliability to obtain evidence regarding the convergent validity of the latent constructs.

Firstly, the factor loadings were computed, and a cutoff point of 0.6 for factor loadings was suggested by CHIN (2010), and 0.7 was suggested by HAIR ET AL. (2010). During the evaluation of the main loading, from a total of 49 items (Eco-design 4, Green Purchasing 4, Green Manufacturing 5, Green Distribution & Packaging 5, Internal Environment

Management 4, Circular Economy 5, Manager's Green Concern 5, Environmental Performance 6, Financial Performance 5, and Social Performance 6 items), among them no item was deleted, as their loading score was more than 0.6. Thus, the minimum required score of item loading was 0.6, which was recommended by CHIN (2010). However, each indicator used to assess the latent constructs (variables) in the research was adequately represented by the items.

Moreover, composite reliability (CR) scores for each construct were also used in this research (Table 18), where all the scores were above 0.7, which indicated acceptable reliability according to NUNNALLY (1978) and HAIR ET AL. (2011). The value of composite reliability (CR) fell in the range between the minimum score of 0.881 and the highest of 0.938. The CR was used to assess the reliability and internal consistency of the study. Subsequently, the average variance extracted (AVE) of the constructs (variables) was investigated. AVE is the variance in the individual items that are accounted for by the latent constructs (variables) indicated by MALHOTRA & DAS (2015). The results indicate a minimum Cronbach's alpha score of 0.833 and the highest of 0.921, demonstrating satisfactory internal consistency among the items within each construct, hence confirming its reliability. The inquiry successfully met the convergent validity criteria, achieving a minimum score of AVE of 0.598 and a maximum of 0.759, whereas the threshold value of 0.500 for AVE according to HAIR ET AL. (2011). Table 18 represents the comprehensive results of the measurement model for the reliability and validity assessment:

Table 18: Measurement Model

Constructs	Item Code	Loading Score	AVE	CR	Cronbach's alpha
Eco-design	ED1	0.797	0.725	0.913	0.873
	ED2	0.850			
	ED3	0.882			
	ED4	0.873			
Green Purchasing	GP1	0.870	0.759	0.926	0.894
	GP2	0.856			
	GP3	0.882			
	GP4	0.875			
Green Manufacturing	GM1	0.870	0.744	0.935	0.914
	GM2	0.835			
	GM3	0.853			
	GM4	0.875			
	GM5	0.879			
Green Distribution & Packaging	GDP1	0.864	0.707	0.923	0.896
	GDP2	0.843			
	GDP3	0.830			
	GDP4	0.830			
	GDP5	0.837			
Internal Environment Management	IEM1	0.731	0.678	0.893	0.840
	IEM2	0.863			
	IEM3	0.828			
	IEM4	0.864			
Circular Economy	CE1	0.871	0.702	0.922	0.894
	CE2	0.887			
	CE3	0.811			

	CE4	0.855			
	CE5	0.760			
Manager's Green Concern	MGC1	0.763	0.598	0.881	0.833
	MGC2	0.741			
	MGC3	0.771			
	MGC4	0.733			
	MGC5	0.853			
Environmental Performance	EP1	0.847	0.718	0.938	0.921
	EP2	0.83			
	EP3	0.848			
	EP4	0.864			
	EP5	0.859			
	EP6	0.834			
Financial Performance	FP1	0.857	0.746	0.936	0.915
	FP2	0.875			
	FP3	0.857			
	FP4	0.875			
	FP5	0.853			
Social Performance	SP1	0.789	0.662	0.921	0.897
	SP2	0.836			
	SP3	0.848			
	SP4	0.745			
	SP5	0.798			
	SP6	0.860			

Note: *"Composite reliability (CR) = (square root of the summation of the factor loadings)/ {(square of the summation of the factor loadings) + (square of the summation of the error variances)}"; "Average variance extracted (AVE) = (summation of the square of the factor loadings)/ {(summation of the square of the factor loadings) + (summation of the error variances)}".*

Additionally, the Variance Inflation Factor (VIF) was computed to ascertain the presence of any multicollinearity concerns within the research. Based on the reference threshold of less than 3 established by many scholars, all items exhibited an optimal VIF score (please see Appendix 3), affirming the validity and reliability of the research (HAIR ET AL., 2010). Therefore, this study obtains sufficient support from empirical evidence necessary to confirm the convergent validity of scales.

Discriminant Validity

Discriminant validity refers to the degree to which an unobserved variable is less correlated with other unobserved variables (HAIR ET AL., 2010). In this regard, RAMAYAH ET AL. (2010) and RAMAYAH ET AL. (2011) put forward two methods for assessing the discriminant validity of the latent constructs, such as the cross-loading and Fornell-Larcker method.

Firstly, the researcher conducted a PLS algorithm analysis to identify the cross-loading. Generally, suppose the same individual variable loading scored highly (factor loading of greater than 0.1) on more than one factor. In that case, there will be noteworthy cross-loading, which may result in a lack of discriminant validity. As evident from Appendix B, Table 32 and 33, the cross-loading table indicates that the items belong to the relevant latent variable, having a score of more than 0.1 for all items under the constructs (ZENG ET AL., 2024). After the evaluation of cross-loading, other parameters are necessary to satisfy the discriminant validity were examined (please see Appendix B, Table 32, 33).

In the subsequent stage of this research, the Fornell-Larcker principle was used to evaluate the measurement model's discriminant validity. According to this principle, the square root of average variance extracted had to be judged against the correlation coefficients of the several other unobserved variables used in this study (FORNELL & LARCKER, 1981). As evident from Table 19, the scores of average variances extracted (AVE) surpassed the inter-connections of the diagonal unobserved variables against the other non-diagonal unobserved variables, which are indicative of satisfactory discriminant validity.

Table 19: Discriminant Validity of the Constructs (Fornell-Larcker Criterion Check)

	CE	ED	EP	FP	GDP	GM	GP	IEM	MGC	SP
CE	**0.838**									
ED	0.185	**0.851**								
EP	0.376	0.488	**0.847**							
FP	0.309	0.455	0.472	**0.864**						
GDP	0.127	0.303	0.422	0.445	**0.841**					
GM	0.167	0.312	0.448	0.469	0.401	**0.862**				
GP	0.212	0.528	0.401	0.393	0.422	0.422	**0.871**			
IEM	0.308	0.397	0.646	0.637	0.524	0.404	0.314	**0.823**		
MGC	0.205	0.232	0.545	0.33	0.151	0.226	0.179	0.342	**0.774**	
SP	0.361	0.493	0.503	0.494	0.441	0.482	0.448	0.582	0.154	**0.814**

Note: *Scores in bold demonstrate the squared root of AVE (average variance extracted) while the other scores demonstrate the co-relationship amongst constructs. The elaborations are ED = Eco-design, GP = Green production, GM = Green manufacturing, GDP = Green Distribution & Packaging, IEM = Internal Environment Management, CE = Circular Economy, MGC = Manager's Green Concern, EP = Environmental Performance, FP = Financial Performance, SP = Social Performance*

Additionally, the following Table 20 represents the values from Heterotrait-Monotrait Ratio (HTMT) ratio:

Table 20: HTMT values

	CE	ED	EP	FP	GDP	GM	GP	IEM	MGC	SP
CE										
ED	0.212									
EP	0.409	0.543								
FP	0.335	0.508	0.509							
GDP	0.138	0.338	0.461	0.489						
GM	0.183	0.345	0.485	0.511	0.441					
GP	0.234	0.596	0.44	0.433	0.471	0.466				
IEM	0.352	0.46	0.729	0.724	0.594	0.455	0.363			
MGC	0.23	0.268	0.608	0.374	0.166	0.25	0.204	0.397		
SP	0.401	0.556	0.549	0.543	0.488	0.53	0.501	0.666	0.167	

Higher-order Construct model

In this study, based on the proposed framework and the prior studies, Green Supply Chain Management (GSCM) is composed of five components, including Eco-design (ED), Green production (GP), Green manufacturing (GM), Green Distribution & Packaging (GDP), and Internal Environment Management (IEM). GSCM is formed as a second-order reflective formative construct using the latent variable scores of the first-order constructs ED, GP, GM, GDP, and IEM. Similarly, Sustainable Organizational Performance (SOP) is composed of three dimensions, including Environmental Performance (EP), Financial Performance (FP), and Social Performance (SP). SOP is also formed as a second-order reflective formative construct using the latent variable scores of the first-order constructs EP, FP, and SP. This study carefully examined the outer weights and outer loadings of each exogenous latent variable along with the VIFs to investigate the degree of relationship of the lower-order variables with higher-order variables and multicollinearity (HENSELER ET AL., 2015; ROSE ET AL., 2023). The five factors having the ‘p’ value less than 0.05 represent a significant influence on GSCM (Table 21). The VIF of each factor is less than 3.50, which is the threshold representing no multicollinearity issues (USAKLI & RASOOLIMANESH,

2023). The following Table 21 describes the validation of the second-order construct of GSCM:

Table 21: Validation of second order construct of GSCM

	Outer loading	**Outer weight**	**T statistics**	**P values**	**VIF**
ED → GSCM	0.667	0.253	15.09	0	1.513
GDP → GSCM	0.59	0.018	11.896	0	1.57
GM → GSCM	0.641	0.23	14.893	0	1.384
GP → GSCM	0.591	0.149	14.122	0	1.647
IEM → GSCM	0.9	0.65	53.374	0	1.577

Similarly, the three factors having the 'p' value less than 0.05 representing significant influence on SOP (Table 22) and their VIF values are less than 3.50 as the threshold representing no multicollinearity issues based on the recommendation of USAKLI & RASOOLIMANESH (2023). Thus, the following Table 22 represents the validation of second order construct of SOP:

Table 22: Validation of second order construct of SOP

	Outer loading	Outer weight	T statistics	P values	VIF
SP → SOP	0.759	0.295	26.856	0	1.509
EP → SOP	0.864	0.525	48.702	0	1.469
FP → SOP	0.798	0.404	37.625	0	1.452

6.7. Assessment of Structural Model

Direct Effect

The structural model signifies how several latent variables specified by theory or hypothesis are related to each other (DUARTE & RAPOSO, 2010). Because the primary goal of PLS is an estimation (HAIR ET AL. 2011), the robustness of the conceptual model may be identified by the percentage of variance in the endogenous (dependent) latent variables that can be explained by the exogenous (independent) constructs (R^2) and by the significance of all the regression coefficients or path coefficients (CHIN, 2010).

In this research, the multi-dimensional dependent (endogenous) variable named sustainable organizational performance has three dimensions: environmental, financial, and social performance, which scored R^2 of 0.642, 0.515, and 0.525, respectively. On the other hand, the mediating and dependent variable, as well as the circular economy, scored R^2 of 0.117. However, it is noted that the coefficient of multiple determination (R^2) scores of environmental, financial and social performance were deemed to be 'substantial', and circular economy deemed 'poor' based on the recommendation provided by COHEN (1988), in which the scholar suggested that R^2 of 0.02 - 0.12 is poor or 'weak,' 0.13 - 0.25 is 'moderate,' and 0.26 and above is 'substantial' model. The following Table 23 demonstrates the R^2 values of the dependent variables:

Table 23: R^2 values

Dependent Variables	R-square	R-square adjusted
Circular Economy	0.117	0.109
Environmental Performance	0.642	0.637
Financial Performance	0.515	0.507
Social Performance	0.525	0.517

As shown in the above Table 23, the R^2 for the endogenous latent variable (environmental, financial and social performance) turned out to be 0.642, 0.515, 0.525 consecutively, which indicated that the antecedents such as all the dimensions of green supply chain management and circular economy explained 64.2% variance of environmental performance, 51.5%

variance of financial performance, and 52.5% variance regarding social performance. In addition, R^2 for the mediating (endogenous) latent variable (circular economy) turned out to be 0.117, which indicates all the dimensions of green supply chain management explained 11.7% variance of circular economy. Thus, the R^2 values obtained in the present study may be deemed satisfactory in accordance with the suggestion of COHEN (1988).

After the computation of the path coefficients in the structural model, the researcher performed a bootstrap analysis to examine whether the path coefficients are statistically significant. Based on the suggestions put forward by CHIN (2010) and HAYES (2009), a bootstrapping analysis was performed in this study based on 5000 re-samplings to evaluate the statistical significance of the path coefficients.

The outcomes of the data analysis, the Hypothesis 1, shows that all the five exogenous (independent) constructs (ED, GP, GM, GDP, IEM) through the higher order construct GSCM ($\beta = 0.725$; $p < 0.05$) significantly contribute to sustainable form performance, the endogenous (dependent) higher order constructs of EP, FP, and SP. Similarly, the result of Hypothesis 2 represents that all five exogenous (independent) constructs (ED, GP, GM, GDP, IEM) through the higher order construct GSCM ($\beta = 0.288$; $p < 0.05$) significantly contribute to the circular economy. On the other hand, the result of Hypothesis 3 demonstrates that the circular economy ($\beta = 0.181$; $p < 0.05$) significantly contributes to sustainable form performance, the endogenous (dependent) higher-order constructs of EP, FP, and SP. Figure 16 highlights the outcomes of the direct pathways from exogenous constructs to the endogenous constructs as predicted by the hypotheses of this study. Therefore, the present research can accept hypotheses H1, H2, and H3. The structural model with the investigation of direct relationships among exogenous (independent), mediating, moderating, and endogenous (dependent) constructs is shown in the following Figure 16. Consequently, the summary of direct path coefficients, p-values, and the result of hypothesis testing for the present research are shown in Table 24:

Table 24: Hypotheses Testing (Direct Effects)

Hypotheses	Paths	Std. Beta	Std. Error	T Statistics	P Values	5.0% LLCI	95.0% ULCI	Decisions
H1	GSCM → SOP	0.725	0.725	41.122	0.000	0.695	0.753	Significant
H2	GSCM → CE	0.288	0.293	6.387	0.000	0.221	0.370	Significant
H3	CE → SOP	0.181	0.18	9.149	0.000	0.147	0.213	Significant

Note: *GSCM = Green Supply Chain Management, CE = Circular Economy, SOP = Sustainable Organizational Performance, VIF= Variance Inflation Factor; LLCI = Lower Limit Confidence Interval; ULCI = Upper Limit Confidence Interval; S = Supported*

However, the following Figure 16 represents the Path coefficient and P-values of the present model generated from the PLS software:

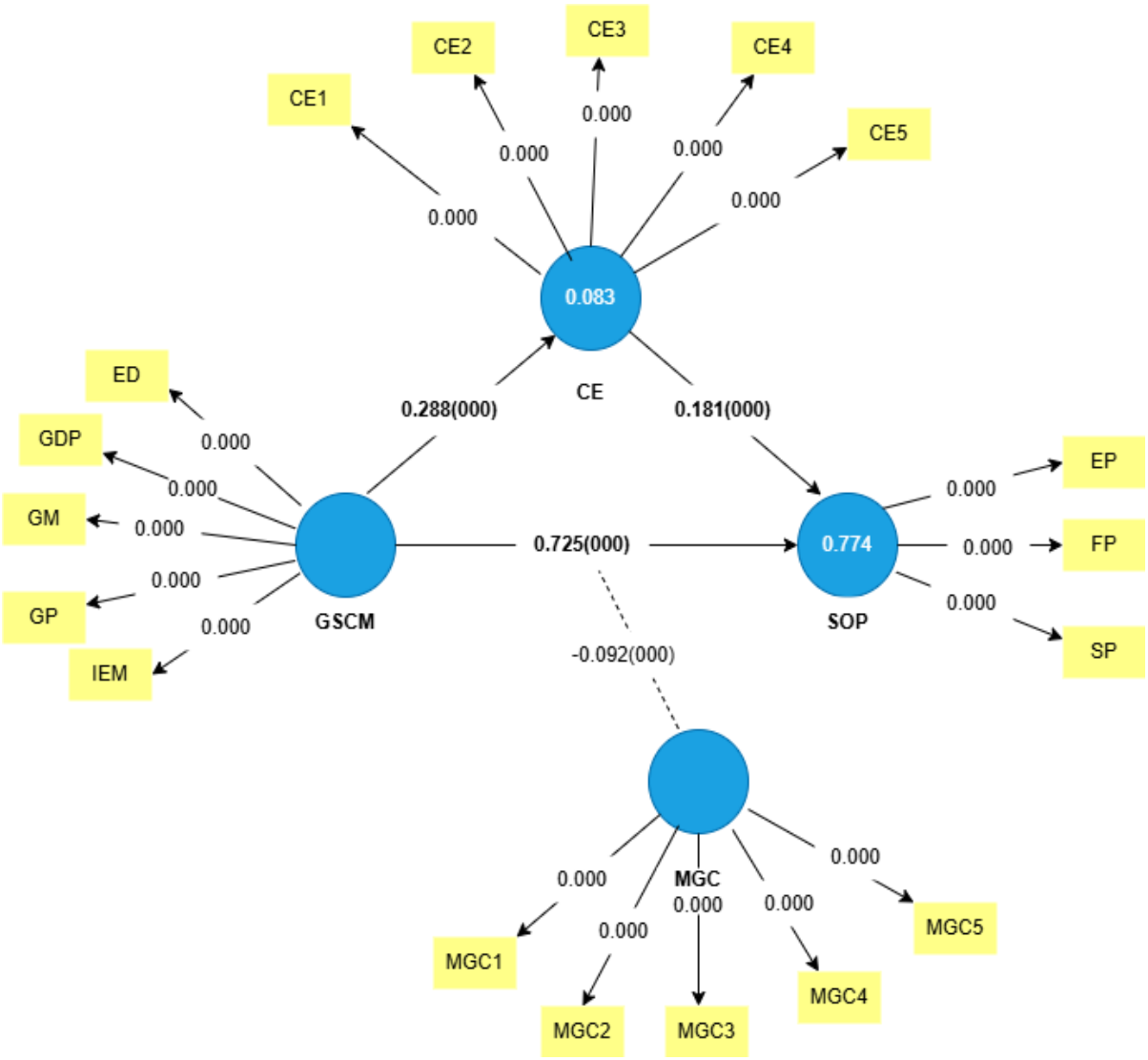

Figure 16: Path coefficient and P-values

Additionally, the following Figure 17 represents the path coefficient histogram between GSCM and SOP:

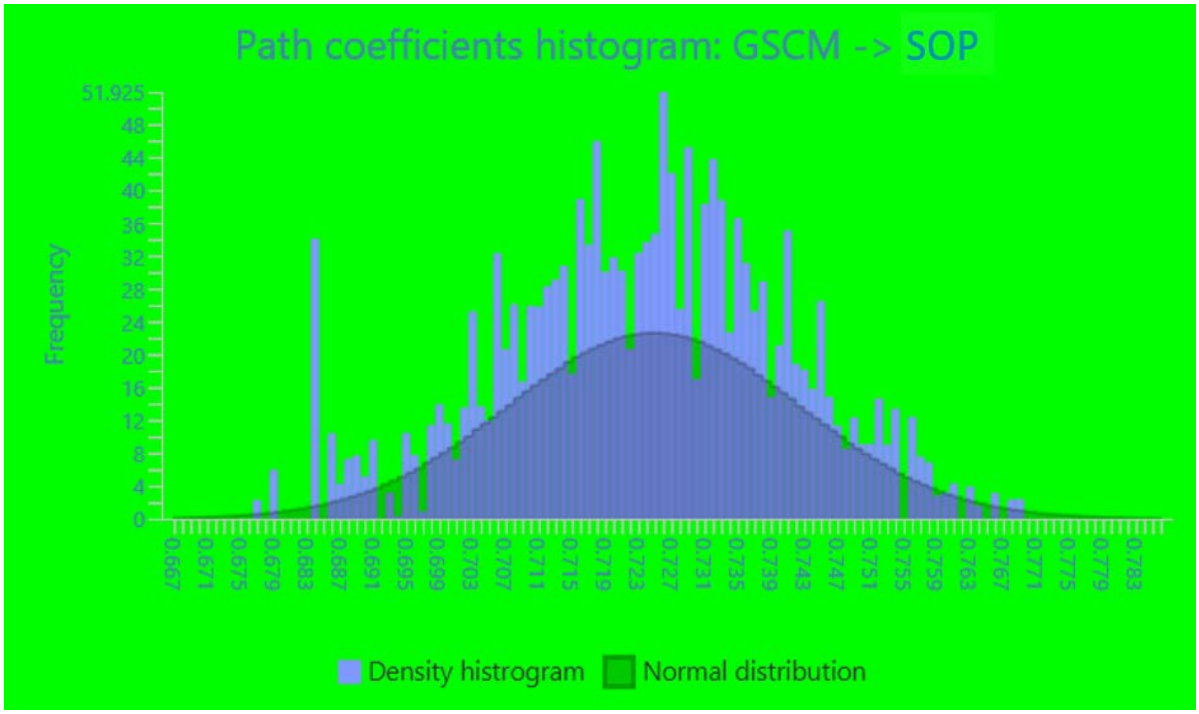

Figure 17: Path coefficient histogram between GSCM and SOP

Moreover, Figure 18 below shows the path coefficient histogram between GSCM and CE:

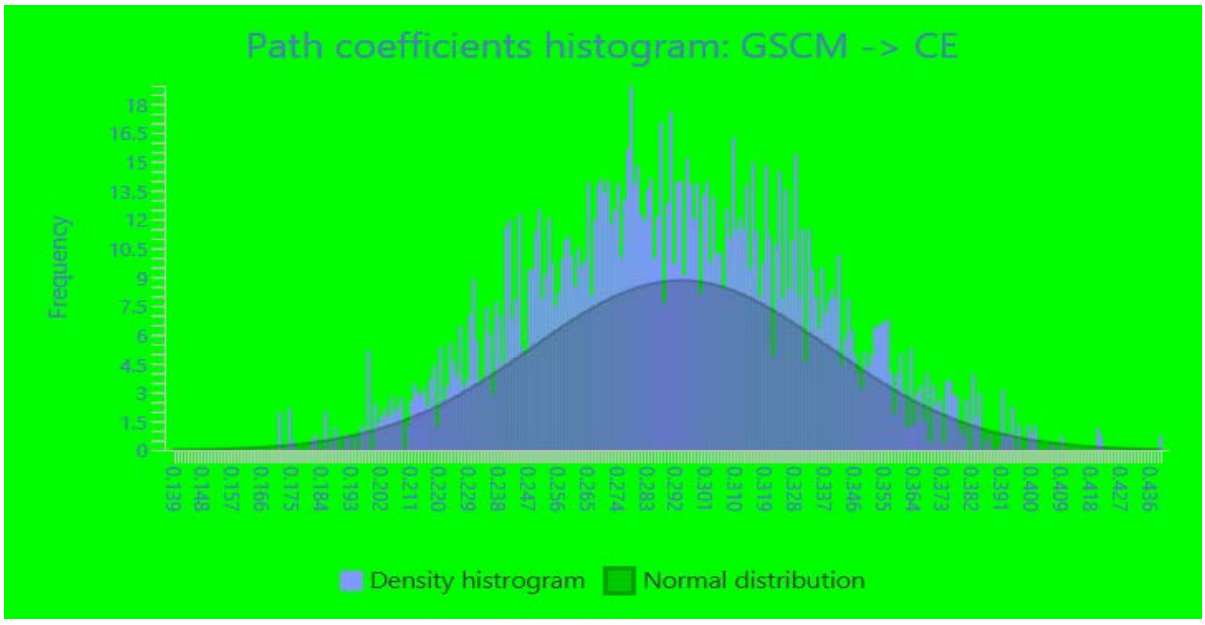

Figure 18: Path coefficient histogram between GSCM and CE

Nevertheless, the following Figure 19 represents the path coefficient histogram between CE and SOP:

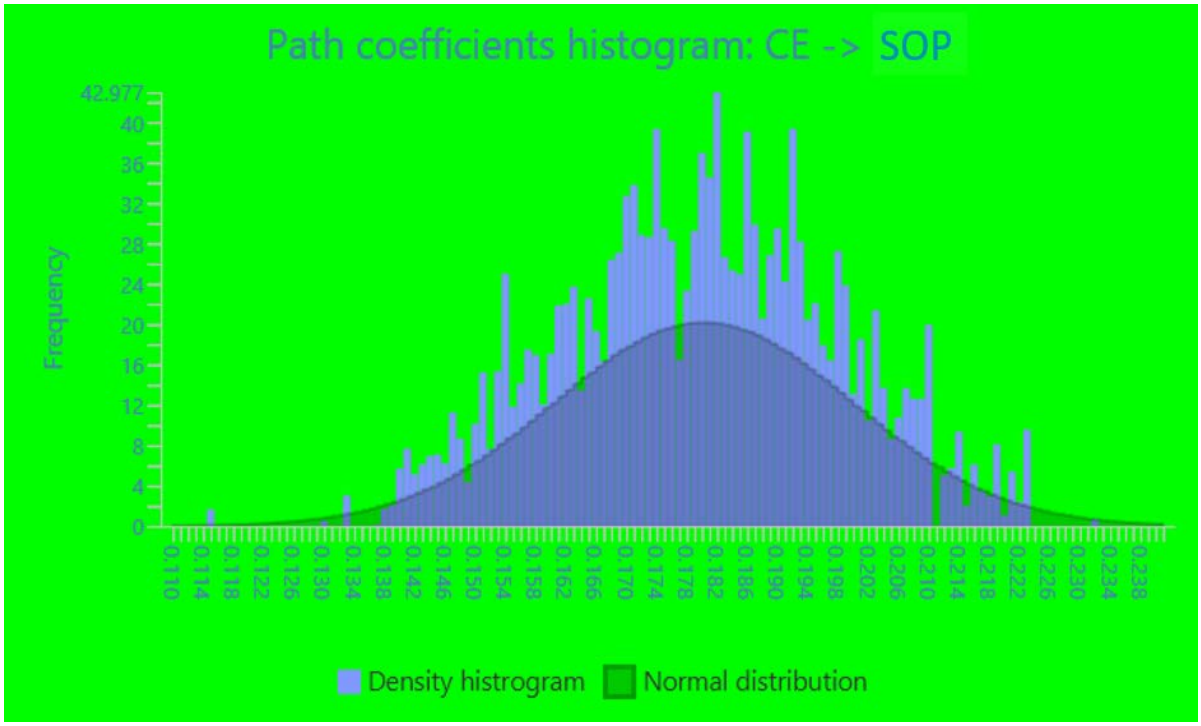

Figure 19: Path coefficient histogram between CE and SOP

Furthermore, the following Figure 20 represents the path coefficient and T-values of the present model generated from the PLS software:

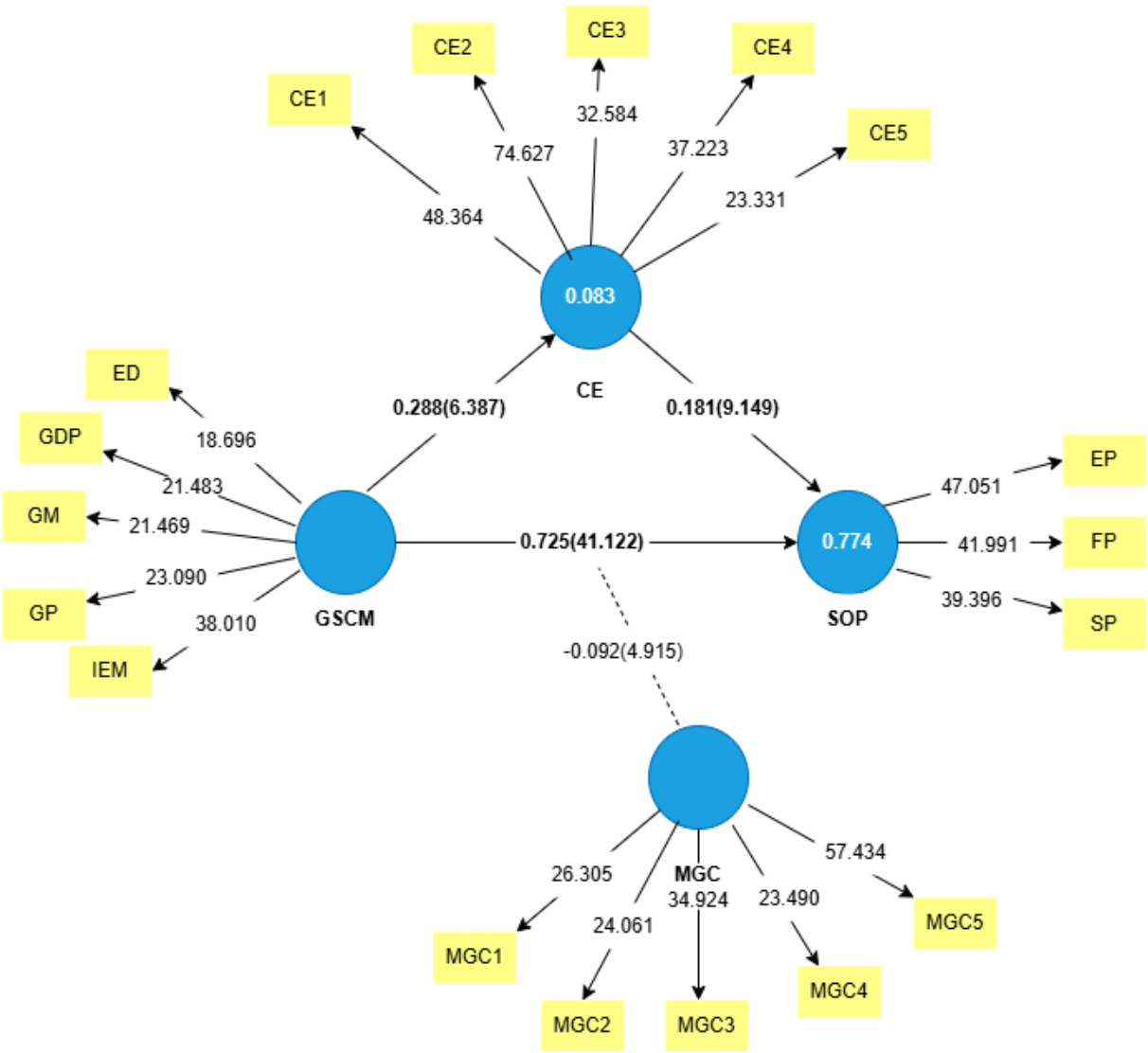

Figure 20: Path coefficient and T-values

Testing the Mediating Effect

This section analyzes the mediating influence of 'circular economy' in the relationship between GSCM and sustainable form performance. To test this mediating influence for structural equation modeling, the researcher followed the methods suggested by MACKINNON ET AL. (2004), IACOBUCCI ET AL. (2007), and HAYES (2009), where they recommended the use of bootstrap analysis since this method has been proven to be a better technique than the technique suggested by BARON & KENNY (1986). In this sense, HAIR ET AL. (2013) recommended a non-parametric bootstrapping process to find out the significance of the mediating outcome.

If the indirect effect (mediator) of the predictor variable on the outcome variable turns out to be significant, it may be inferred that there is a full or partial mediating effect of the mediating variable (PREACHER & HAYES, 2008; HAYES, 2009). According to Table 25, the result from the Hypothesis 4 shows that circular economy has an indirect effect (mediating) among the relationships of all the five exogenous (independent) constructs (ED, GP, GM, GDP, IEM) through the higher order construct GSCM through the mediation of circular economy ($\beta = 0.052$; $p < 0.05$) and sustainable form performance, the endogenous (dependent) higher order constructs of EP, FP, and SP. Therefore, the study can accept hypothesis H4. Additionally, as the direct relationship is also shown to be positively significant in the result of Hypothesis 1, this mediating effect of circular economy between GSCM and SOP is 'partial'. The summary of the results of the hypotheses testing with indirect effect is shown in Table 25:

Table 25: Hypotheses Testing (Indirect Effects)

Hypo-theses	Paths	Std. Beta	Std. Error	T Statistics	P Values	5.0% LLCI	95.0% ULCI	Decisions
H4	GSCM → CE → SOP	0.052	0.053	5.299	0.000	0.038	0.070	Significant
H5	MGC x GSCM → SOP	-0.092	-0.092	4.915	0.000	-0.123	-0.062	Significant

Note: *GSCM = Green Supply Chain Management, CE = Circular Economy, SOP = Sustainable Organizational Performance, MGC = Manager's Green Concern, VIF= Variance Inflation Factor; LLCI = Lower Limit Confidence Interval; ULCI = Upper Limit Confidence Interval; S = Supported*

Testing the Moderating Effect

This study is intended to explore the moderating role of Manager's Green Concern (MGC) as a moderator between GSCM and sustainable form performance, proposing Hypothesis 5. To evaluate the moderating effect through structural equation modeling, the researcher of this study adhered to the methodology proposed by MACKINNON ET AL. (2004), IACOBUCCI ET AL. (2007), and HAYES (2009). The scholars recommended bootstrap analysis, as it has been demonstrated to be superior to the approach suggested by BARON & KENNY (1986).

The result from Hypothesis 5 shows that MGC moderates (β = - 0.092; $p < 0.05$) the relationships of all five exogenous (independent) constructs (ED, GP, GM, GDP, IEM) through the higher order construct GSCM and sustainable form performance, the endogenous (dependent) higher order construct of EP, FP, and SP as the Beta value of this relationship shows a negative value while MGC moderates, the result suggests that MGC weakens this relationship. This present result suggests that when managers already practice a green supply chain system, their greater concern for the environment may negatively impact the approaches of the managers, leading to weaker organizational performance.

6.8. Analysis of Predictive Relevance (Q^2)

To assess the strength of the R2 scores as a decisive factor for identifying predictive accuracy, Stone-Geisser's Q2 value (STONE, 1974; GEISSER, 1975) has been investigated. In evaluating the predictive relevance, blindfolding methods were conducted with the use of omission distance G = 5 as suggested by CHIN (1998), who recommends that omission distance scores between 5 and 10 are satisfactory. This study found an omission distance G = 7. In addition, the Q2 score, which is greater than zero (0), implies that the latent. The multi-latent equivalent of independent variables has predictive relevance for the latent, multi-item equivalent of the dependent variable (HAIR ET AL. 2013). Based on the outputs demonstrated in the following Table 26, the model is deemed to possess satisfactory predictive relevance:

Table 26: Predictive Relevance of Exogenous Constructs

Constructs	Construct Cross-validated Redundancy	Construct Cross-validated Communality
Circular Economy	0.076	0.510
Environmental Performance	0.286	0.563
Financial Performance	0.122	0.566
Social Performance	0.096	0.499

6.9 Summery of the Results

The summary of all hypotheses results with direct and indirect relationships are shown in the following Table 27:

Table 27: Summary of Hypotheses Results

Hypothesis	**Path**	**Decision**
H1	Green Supply Chain Management → Sustainable Organizational Performance	Significant
H2	Green Supply Chain Management → Circular Economy	Significant
H3	Circular Economy → Sustainable Organizational Performance	Significant
H4	Green Supply Chain Management → Circular Economy → Sustainable Organizational Performance	Significant
H5	Manager's Green Concern x Green Supply Chain Management → Sustainable Organizational Performance	Significant

6.10. Chapter Summary

The quantitative section of the present analysis represented the demographic data of the employees working at various levels in ready-made garment organizations of Bangladesh. It has been examined and justified that the current study will not be threatened by the common method biasness or variance. Consequently, the measurement model was evaluated and showed that the convergent and discriminant validity and composite reliability of this research met the standard. Finally, the hypothesis test of the current study was conducted through the assessment of the measurement and structural models. The result showed that there are significant direct relationships between all components of GSCM and all dimensions of sustainable organizational performance. Additionally, the circular economy as a mediator accelerates all the activities of GSCM to achieve sustainable organizational performance. However, the present result shows that the moderating effect of the manager's green concern weakens the relationship between GSCM and sustainable organizational performance.

7. DISCUSSION

RQ-1: Does green supply chain management positively influence sustainable organizational performance?

To address the first research question, this research tested hypothesis *H1* where the study found that environmentally responsible supply chain management, i.e., green supply chain management, significantly enhances the sustainable performance of the enterprises. This result was obtained based on the Beta value, a standardized regression coefficient, which is 0.725, indicating a substantial positive linear relationship between green supply chain management and sustainable organizational performance. The assumed relationship between the variables represents in the hypothesis *H1* found significant. Additionally, the P value of 0.000 and T value of 41.122 in this instance demonstrate the statistical significance of the association between the two indicated variables. Therefore, it is proven that there is no significant multicollinearity issue among the variables classified as independent. This result is also supported by the VIF score of 1.209. Consequently, the hypothesis *H1* is supported, indicating its significance. Thus, it is plausible to conclude that the implementation of environmentally responsible supply chain management will enhance the overall sustainability of the organization's performance.

The first result of this study is similar to the previous findings of AHMAD ET AL. (2022), BAG ET AL. (2022), CHEN ET AL. (2023), and ISLAM ET AL. (2024). In the domain of green supply chain management (GSCM), HABIB ET AL. (2020) identified a positive correlation between green purchasing, green manufacturing, reverse logistics, and internal green management as components of GSCM practices and corporate performance. In another similar study conducted by BASHAR ET AL. (2023), it was found that GSCM, along with environmental cooperation from suppliers and customers' concerns for the environment, reduces the unsustainable behaviors of both customers and suppliers. These relationships, in turn, positively influence the sustainable performance of manufacturing companies. Following the implementation of educational and monitoring initiatives, LI & SARKIS (2022) discovered that GSCM can aid manufacturing entities in generating materials for the final product that are associated with minimal environmental pollution, thus enhancing the sustainable performance of these organizations.

In alignment with the current findings, the empirical investigation conducted by MUSTAFI ET AL. (2025) revealed a positive correlation between GSCM practices and the sustainable performance of companies, achieved through the attainment of competitive advantage. Nonetheless, according to their findings, this was especially applicable for producers in emerging economies. MUSTAFI ET AL. (2024) indicated that GSCM has gained significant importance, prompting manufacturers to implement proactive strategies, such as transitioning to cleaner production and green management, alongside GSCM, to enhance their overall company performance. The authors further proposed that companies could attain enhanced efficiency and reduced resource consumption, leading to overall cost savings, by focusing on internal green supply chain management that embraces environmentally friendly manufacturing practices.

However, LIU ET AL. (2021) discovered that eco-design, an element of GSCM, indicates that minimizing waste and utilizing materials efficiently can result in cost savings, thereby enhancing the overall performance of the firm. In a similar vein, DAHMANI ET AL. (2022) observed a favorable connection between GSCM practices and cost reduction, attributed to the increased likelihood of product sales in international markets, along with additional advantages that surpass the costs associated with implementing these practices. Conversely, FENG ET AL. (2022) opposed the current findings by asserting that there is no confirmation that GSCM can effectively decrease expenses and conserve company resources. In this context, NTETA & MUSHONGA (2021) highlighted that GSCM can lead to enhanced production and reduced operational costs through waste minimization in manufacturing processes, only if employees are sufficiently skilled to manage this eco-management system effectively. Similarly, YASSIN ET AL. (2022) observed that GSCMS may not always lead to an increase in annual net income and can result in a decrease in the cost of goods sold.

Although there are some negative correlations, most of the previous results found a positive relationship between GSCM and sustainable performance. For example, AL AMIN ET AL. (2025) discovered that by reducing the use of toxic materials, eliminating or properly disposing of random product components, and lessening the environmental impact of products, GSCM has a positive effect on company annual sales and revenue. In a similar vein, HAVERILA ET AL. (2025) noted that GSCM results in cost savings along with enhancements in profits, sales, and increased market share. Besides, embracing environmentally friendly practices is thought to enhance the working conditions for

employees and benefit the local community, allowing individuals to lead healthier lives (HABIB ET AL., 2020). The execution of manufacturing processes that prioritize environmental considerations and reduce pollution has a positive impact on the social aspects of both employees and the broader community (CHEN ET AL., 2023).

RQ-2: Does green supply chain management positively influence circular economy?

This study investigates the second research question performing the hypothesis test *H2* where the research revealed that green supply chain management has a significantly positive impact on the circular economy. This result is proven by the beta value, a normalized regression coefficient of 0.288, which indicates a substantial positive linear relationship between green supply chain management and the circular economy. Besides, the statistical significance of the association between green supply chain management and circular economy is shown by a P value of 0.000 and a T value of 6.387. Additionally, a VIF score of 1.000 indicates the absence of significant multicollinearity issues among the related variables. Consequently, the hypothesis *H2* is substantiated, indicating its significance. The acceptance of hypothesis *H2* represents that the implementation of environmentally responsible supply chain management, i.e., green supply chain management, has a positive effect on the circular economy.

Similarly, in the present result from Hypothesis *H2*, there are some prior studies that support the idea that green supply chain management (GSCM) has a positive contribution to the circular economy. For example, ABDALLAH ET AL. (2024) identified eco-industrial parks as a potential application of GSCM, wherein the enterprises within the industrial park endeavor to integrate circular economy principles into their GSCM systems. Additionally, AROONSRIMORAKOT & LAIPHRAKPAM (2024) investigated a similar relationship with the present study, between five aspects of GSCM practices and four tiers of circular economic practices that require further investigation to explore. In a similar vein, the interrelationships between GSCM and the circular economy led to enhanced organizational performance due to their simultaneous implementation (AHMAD ET AL., 2022). The research undertaken by AMIN ET AL. (2025) substantiated the connections between GSCM and the circular economy, which supported the present result. They discerned several connections between GSCM and CE practices, particularly within the textile industry.

However, KARMAKER ET AL. (2023) pointed out a significant query regarding whether similar or contrasting theoretical perspectives should be employed to comprehend GSCM and

the domain of the circular economy. Similarly, ALLEN ET AL. (2022) identified a conceptual boundary that will be beneficial for the practical and theoretical development of the connection between GSCM and the circular economy. The scholars also identified a research gap in which a systematic literature review and evaluation could yield significant insights to address these questions. Besides, MOUSA ET AL. (2025) highlighted the distinctions in core objectives between the two concepts, namely GSCM and circular economy. They explained that GSCM focuses on the environmental performance of the organization, whereas the circular economy places a stronger emphasis on both environmental and economic performance.

Several studies (for example, BAG ET AL., 2022, KHARAT ET AL, 2025) have explored notable theoretical and practical connections between GSCM and the circular economy, similar to the present investigation; nonetheless, ambiguity persists regarding the relationship and interconnections between these two ideas. Moreover, other scholars (for instance, SHAHZAD ET AL, 2025; SINGH ET AL, 2025) identified parallels between GSCM and the circular economy, asserting that these two activities have been regarded as interrelated at certain levels in specific contexts. In this regard, AFROOZI ET AL. (2025) contended in their study that the alignment between GSCM and the circular economy is progressively intensifying. The characteristics of GSCM are interconnected with the circular economy at multiple levels: firm, industrial zone, region, nation, and worldwide. In support of the present finding, AMIR ET AL. (2024) advocated that GSCM is a crucial component in advancing the circular economy. At the corporate level, the combination of GSCM and circular economy altogether enhances the design of reverse supply chains, facilitating the reproduction of end-of-life products (ISLAM ET AL., 2024).

From the perspective of marketing management, YASSIN ET AL. (2022) argued that the integration of GSCM and the circular economy can fulfil several social objectives, including consumer protection, market transparency, and environmental conservation. However, if organizations integrate GSCM and the circular economy into their operations, they may significantly enhance sustainable performance (JU ET AL., 2025). Although empirical studies on the relationship between GSCM and the circular economy are scarce, existing evidence indicates that sustainable practices can be achieved through the integration of GSCM and the circular economy, which serve significant social functions, including fostering customer loyalty, improving corporate reputation, creating advanced business

opportunities, ensuring product safety, promoting environmentally friendly working conditions, and upholding legal and ethical standards (LU ET AL., 2024).

RQ-3: Does circular economy have a positive effect on sustainable organizational performance?

To examine the third research question, this study's third hypothesis *H3* has been tested and found that the circular economy positively and significantly affects the sustainable organizational performance. The third hypothesis result indicates that circular economy and sustainable organizational performance are positively correlated, as shown by the beta value of 0.181, a normalized regression coefficient. The correlation between circular economy and sustainable organizational performance is also statistically significant, as evidenced by the P value = 0.000 and T value = 9.149. Moreover, there are no major multicollinearity difficulties among the associated variables, as shown by a VIF score of 1.111. As a result, the relevance of the hypothesis *H3* is demonstrated by its significance. As a result, this research accepts hypothesis *H3*, which represents that the circular economy is accountable for the environment, has a favorable impact on sustainable organizational performance.

Although the United Nations has shed some light on the need to look beyond financial objectives to account for the impact of human activities, the idea of sustainability was initially encapsulated by Elkington, using the concept of the triple bottom line, which is underpinned by three pillars: environmental, economic, and social (AKASH ET AL., 2025). The present result proved the concept of Elkington through its result, which shows that the circular economy has a positive impact on the three dimensions of sustainability. Along with the traditional focus on financial success, sustainability involves looking at the perspective of society and the impact of human activities on the environment (AHMED ET AL., 2022). In support of the present finding, RASHID ET AL. (2025c) indicates that the movement towards sustainability represents significant challenges for businesses. Thus, it requires placing less attention on financial results and considering the social and environmental impacts, which can be daunting for risk-averse companies operating with constrained resources.

However, there are some prior findings that show dissimilarity and create an argument with the present hypothesis *H3*. For example, the research of JUNEJO ET AL. (2025) was based on the SME sector that is struggling to introduce sustainability practices, which leads to a

delay in the development of their organizations. Additionally, SMEs have a key role in the implementation of the circular economy because of their combined contribution to the economy of different countries. In this pertinent, ZHOU ET AL. (2023) argued that more research is needed to understand the aspects impacting the implementation of sustainable practices and find out which aspects need to be enhanced to facilitate their transition to the circular economy. Their study was based on sustainability and particularly the impact of circular economic practices on enhancing sustainability performance.

The present result has been further supported by the prior study of AMIN ET AL. (2024), CHAITY ET AL. (2025), and CUEVAS-PICHARDO ET AL. (2025). In their research, they found that the circular economy reduces waste and increases energy and resource efficiency. This can help to achieve sustainable corporate performance through biosphere or materials that can circulate their economic activities, along with the reduction of overall resource consumption in their existing production processes. Similarly, NWAOGU AL EL. (2025) explained the 3Rs (reduce, reuse, and recycle) of the circular economy process, which can attain sustainable performance of the company. They additionally explained that 'reduce' involves finding opportunities to modify raw materials, improving production and consumption processes, and modifying process design. Reuse comprises practices through the reintroduction of end-of-cycle products to reduce the use of raw materials along with other resources involved in the design, manufacture, and use of products or components.

Nevertheless, the result of SHAHZAD AL EL. (2025) supported the findings of the present study, highlighting that the circular economy, with its dimensions, i.e., reused or reduced, recycling, is a useful alternative to achieve sustainability for company success. The author further indicated it as the most widespread strategy because it allows reduced exploitation of limited resources through the transformation of end-of-life items into useful materials. The combination of the 3Rs, including other approaches such as eco-innovation, enables the efficient use of resources, leading to sustainable economic, environmental, and social benefits for the corporations (OBEIDAT ET AL., 2023; SANTIAGO ET AL., 2025; SHAH ET AL., 2025). Prior scholars also found literature to support the present finding that the circular economy has valuable contributions to sustainable performance. For instance, COTRINA ET AL. (2025) undertook an in-depth analysis of the drivers, barriers, and practices related to circular economy adoption in the mining sector. The content analysis of prior publications included in their systematic literature review found drivers associated with the internal and

external environment of the circular economy. These drivers can ensure environmental protection for the company, society, and economic gain.

On the other hand, RASHID ET AL. (2025c) highlighted the challenges related to the implementation of the circular economy and its adverse effect on sustainability, and found dissimilar results compared to the present study. They found that because of some adverse factors, it is difficult to ensure profitability, cost reduction, and environmental appreciation through the implementation of the circular economy by companies. In another similar study by SHARMA ET AL. (2025) also found comprehensive barriers that affect the implementation of the circular economy, where they revealed unsupported results with the current research. They stated that some barrier drivers are context-specific, and specifically, information technology plays a negative role in the introduction of circular economy practices. From the perspective of emerging economies, LONG ET AL. (2025) collected the perception of the consumers as the samples for representing the need for extending the lifetime of products using the 3Rs, the use of big data to improve information flows, and government policy as significant factors for the adoption of the circular economy in developing countries. However, they also found that attaining sustainability in the performance of the organization is sometimes difficult because of the circular economy.

RQ-4: Does circular economy have a mediating effect between green supply chain management practices and sustainable organizational performance?

Based on the fourth research question, this study tested the mediation analysis to evaluate the mediating effect and significance level using T values and variations in the confidence interval. The results from Hypothesis *H4* demonstrate that the circular economy partially mediated all five components of GSCM and three dimensions of SOP. Hypothesis *H4* was found statistically significant ($\beta = 0.052$; $p < 0.05$), as the result of a P value = 0.000 and a T value = 5.299. The findings demonstrated that the circular economy has mediation among the relationships of all five independent constructs (ED, GP, GM, GDP, IEM) through the higher order construct GSCM and sustainable organizational performance, the endogenous higher order construct of EP, FP, and SP. Besides, in the result of Hypothesis *H1*, the direct relationship between GSCM and SOP is also shown to be positively significant, which is why this mediating effect of circular economy is 'partial mediation'. The findings indicate that

when GSCM achieves sustainable performance by the company, in this achievement, the circular economy partially has an intervening contribution.

The prior results from sustainability-focused studies (for example, ISLAM ET AL., 2024; DAS ET AL., 2025; HOSSAIN ET AL., 2025) highlighted organizations' growing interest in developing sustainable economic activities. Notably, the previous research findings revealed that companies are seeking to increase their rational exploitation of resources and have a stronger interest in environmental protection, which has led managers to rethink their linear business models. Consequently, scholars have found that the circular economy has arisen in response to a new paradigm that has redefined traditional key economic activities such as production, distribution, and consumption, which develop in a linear, unidirectional manner. Circular economy promotes resource regeneration, the conscious design of materials, and their return to specific cycles for reuse, while maintaining the maximum value of products until the end of their life cycle and optimizing their economic usefulness (AHMED ET AL., 2022; ABDALLAH ET AL., 2024; AKASH ET AL., 2025).

The research of ALLEN ET AL. (2022) found results similar to the present finding, where they explored the circular economy as a dynamic approach that involves transformations of value chain processes, including industrial redesign, modified business strategies, and information systems. In another study, AMIN ET AL. (2025) assessed the sustainable performance of the companies and confirmed that the circular economy has an intervening role between green management and sustainability. Regarding the majority (more than 71%) of respondents, managers supported the positive role of the circular economy; however, the cited authors observed that 29% of managers reported negative outcomes of the circular economy because of the challenging nature of the production process. This finding of that study further suggested that firms' inclusion of the circular economy within their production system is sometimes superficial and inconsistent, thereby indicating that this topic needs to be studied more extensively.

The research findings of AMIR ET AL. (2024) also supported the present result by constructing a circular economy in a comprehensive model that encompasses all organizational activities and integrates the economic, social, and environmental outcomes affected by the circular economy approach. Similarly, AROONSRIMORAKOT & LAIPHRAKPAM (2024) found evidence of the full mediation of the circular economy

between green business activities and sustainable performance. The authors reported a deeper comprehension of business landscapes and circular economic activities, thereby paving the way for enhanced opportunities and the development of additional strategies. Regarding environmental issues, CUEVAS-PICHARDO ET AL. (2025) supported the present finding, representing the assessments of the mediating role of circular economy between environmental management, quantification of social and economic benefits, and environmental gains. On the other hand, new technological challenges highlight a potential barrier to implementing the circular economy that could hinder investment accessibility and make recycled products less available (LIU ET AL., 2023).

However, the research finding of RASHID ET AL. (2025c) shows results that are dissimilar to the present finding, where they developed a model for measuring companies' circular economic practices based on an environmental accounting approach. The cited researchers found that the adoption of the circular economy is very challenging; it can typically be implemented gradually, without ensuring standardized patterns in terms of which principles and activities are adopted. In addition, the adoption of the circular economy depends heavily on companies' definition and assessment of their environmental capabilities and competencies. This result was supported by LONG ET AL. (2025) found that the circular economy may not always correlate positively with environmental practices, levels of responsibility, accountability, and the circular scope of operations because of some environmental challenges. Thus, a circular economy model can be effective only when it has some social impacts to the same degree as economic and environmental ones and shapes decision-making at a micro level (RAHMAN ET AL., 2025).

According to SHARMA ET AL. (2025), there are some organizations that have clearly failed to apply the circular economy because of several growing integrated challenges in terms of obtaining circular economy-related information and incorporating it into their existing business practices. On the other hand, SINGH ET AL. (2025) underscores the need for a broader dissemination of information related to the circular economy. Nevertheless, MOUSA ET AL. (2025) confirmed that the circular economy has a full mediating role in the disclosure of circular economy-related information, social networks, and sustainable performance of IT firms. In this regard, this process requires a widespread awareness of the circular economy, and companies must develop well-defined strategies to integrate these principles into their management practices (NWAOGU ET AL., 2025) to ensure sustainable development. The

authors additionally suggested promoting forward-thinking initiatives, including renewable energy, resource maximization, reducing wastage, and climate change mitigation.

RQ-5: Does managers' green concern have a moderating effect between green supply chain management and sustainable organizational performance?

This study also addresses its fifth research question; that is why it tests the moderating effect of managers' green concern and its significance level using T values and variations in the confidence interval. The results from hypothesis *H5* demonstrate that managers' green concern (MGC) has a moderating influence on the relationship between all five components of GSCM and three dimensions of sustainable organizational performance. According to the P value of 0.000 and the T value of 4.915, the result shows that Hypothesis *H5* is statistically significant. The results indicated that the MGC has a moderating role ($\beta = -0.092$; $p < 0.05$) between GSCM and sustainable organizational performance. The negative Beta value in this relationship indicates that MGC acts as a moderator; however, it diminishes the strength of this relationship. The result shows that when managers are already implementing a green supply chain system, their heightened concern for the environment may adversely affect their approaches, resulting in an adverse effect on organizational performance.

Previously, MUNAWAR ET AL. (2022) explored the moderating effects of managers' ecological concern, where they found that it moderated the relationship between ecological orientation, i.e., ecological values and ecological beliefs, and the firm's sustainable green practices. The results provide significant support for the present result of H5. Similarly, POLAS ET AL. (2023) investigated a framework with the moderation of managers' green concern and found similar results to the present study. Their study revealed that ecological values and ecological beliefs are the main basis for managers' general predispositions to pro-ecological action. Nevertheless, these results illustrate how individual behaviors are strongly influenced by corporate values (RIVA ET AL., 2021). Moreover, the study of SONG ET AL. (2021 found that each organization has different factors that drive them to adopt different pro-ecological behaviors, which are in line with the current research result. However, it is apparent from the results that there is an indirect link between ecological norms and a firm's sustainable green practices, with the moderation of managers' ecological concern.

On the other hand, the research result of CAO ET AL. (2022) shows dissimilarities with the current finding, where they explored that the moderating effect for ecological concern shows

insignificance between green practices and sustainable performance. Another similar scholar, MO ET AL. (2022) claimed that while managers' ecological concern was important, managers' norms and engagement with environmental issues need a fit between personal and professional values. This is essential in underpinning a manager's ecological engagement with sustainable green practices and encouraging a sense of personal responsibility of self-transcendence/openness to change. The authors suggested that additional studies are needed to explore further the construction of cultural value scores that can be moderated by managers' ecological concern. Future studies that derive data from different samples, along with the measurement of a wider array of ecological manifestations, may provide an outlook on the relationship between ecological norms and sustainable green practices of a firm based on the manager's ecological concern.

The research of MUNAWAR ET AL. (2022) investigated the level of implementation of circular economy practices and highlighted the most relevant drivers for implementing this in the manufacturing industry, where they found a significant moderating effect of managers' green concern between circular economy practices and sustainable environmental performance. Similarly, POLAS ET AL. (2023) found a significant relationship among the economic factors affecting the adoption of the circular economy, the triple bottom line measurement of sustainability, and managers' green concern. They identify economic efficiency as the most influential factor, commonly trying to find circular economic practices that address environmental concerns and, at the same time, provide financial and social benefits. Besides, they conclude that those organizations' managers are more concerned about ecological issues and are prone to adopt circular economic practices.

Despite the potential of circular economic practices and green management to support the SDGs (LIN ET AL., 2023), it is found that organizations face several potential challenges concerning managers' green concerns. In fact, POLAS ET AL. (2023) indicated that several companies are concerned about the need for managers to address environmental issues. The present result from H5 shows a significant moderating effect of the manager's green concern between GSCM and sustainable performance; however, the beta value shows a negative value, which indicates a negative impact. This result demonstrates that as the company is already practicing GSCM and circular economy, managers' green concern was built into this production system. In this regard, managers' green concern may be overpressure for the ecosystem, which shows a negative impact on the existing ecosystem. Moreover, the present

result represents the perception of the managers of the green garment organizations of Bangladesh, which may be different than other industry or country contexts.

8. IMPLICATIONS, LIMITATIONS, AND CONCLUSION

8.1. Theoretical Implications

Theoretically, this research anticipates providing insights into sustainable practices in the ready-made garment (RMG) sector, with a focus on developing nations like Bangladesh. Using the Resource-Based View, Natural Resource-Based View, and Dynamic Capabilities theories as the foundation, this study seeks to reveal several significant theoretical implications. It contributes to existing practical understanding of how the RMG sector, which stands in for the world's developing countries, has successfully integrated GSCM, circular economy, and sustainable performance. To fill the present knowledge gap regarding the actual implementation of GSCM and techniques that are appropriate for emerging nations like Bangladesh, the current literature often emphasizes a hybrid approach that combines GSCM with the support of the circular economy model. This research adds to the growing body of theoretical literature on global sustainability practices by shedding light on the specific difficulties and potential rewards of the RMG industry in Bangladesh. Its findings might be applied similarly to those of other developing countries. Moreover, the study explores GSCM and sustainable performance as a multidimensional higher-order construct.

This study combines the factors (variables) of the present research framework within the distinctive context of the RMG business in Bangladesh. In contrast, other studies often address these factors separately or in different circumstances. Academic research and industrial practices may benefit from the nuanced picture it provides, which enhances theoretical knowledge of the interactions and contributions of various green activities to sustainability and circularity. This research fills a significant gap in the literature by examining how the circular economy mediates the relationship between GSCM and SOP. To better understand how green practices impact the implementation of circular economy concepts, this mediation study provides deeper insights. Theorists will benefit from the results because they will better understand the significance of sustainable practices in the RMG industry and how they might enhance broader environmental, economic, and social outcomes. These contributions are especially significant for formulating comprehensive sustainability models that include several underlying aspects.

However, the present study indicates that it makes a significant addition to the existing body of knowledge by applying the Resource-based View theory, focusing on GSCM, circular

economy, and sustainable organizational performance. The research represents managers' perceptions of a developing country's large-scale, environmentally friendly, ready-made garment manufacturing perspective. Managers in this industry may gain knowledge-centric expertise in this professional domain because of the exploration of this kind of research. This study claims that it is one of the first empirical studies to examine the interrelationships between GSCM and circular and sustainable performance in the context of Bangladesh's green RMG manufacturing industry. Thus, the existing information on the main concepts being studied has been broadened. According to the Resource-Based View, Natural Resource-Based View, and Dynamic Capabilities theories, this study focuses on the fact that the GSCM and circular economy practices of green RMG industry managers are crucial for expanding and integrating sustainable performance in RMG production. The RBV and Dynamic capabilities theories apply to the managers in green RMG manufacturing businesses in Bangladesh since they focus on their knowledge of how connections and interactions among managers and their work team members potentially contribute to organizational success.

Nevertheless, this research differs from the conventional approach of assessing sustainable performance at the organizational level from an extensive perspective to comprehend the importance of sustainability in performance by the managers in the RMG production sector in Bangladesh. In a similar prior study, AMIN ET AL. (2024) developed a conceptualization of sustainable organizational performance from a contemporary standpoint. The authors revealed that there are significant differences between "conventional firm performance" and "sustainable organizational performance." Although there are variations, there are also substantial connections between the three dimensions of sustainable performance alongside various frameworks. According to another research recommendation, NOGUEIRA ET AL. (2025) proposed that using a multiple-dimensional measurement of sustainable performance provides for the generalization of overall performance. The current study departs from prior research in terms of sample selection. This research investigates the perspectives of managers who are presently working in the 26 certified green RMG organizations in the platinum category. Bangladesh, a leading global producer of Ready-Made Garments, is at the forefront of promoting sustainable green manufacturing and industrialization. Nonetheless, Bangladesh has numerous numbers of world-renowned green manufacturing garment factories compared to other countries in the globe.

Notably, the inclusion of the survey sample in this research has broadened the range of samples used to understand the idea of GSCM and the circular economy in numerous circumstances. This research provides theoretical confirmation of definitive evidence of the absence of a significant quantity of investigations on sustainable performance contributed by GSCM and the circular economy. This research focuses on the impact of GSCM and CEP on sustainable production in the context of large-scale ready-made garment manufacturing. Utilizing the Resource-Based View (RBV) framework, this research discovered that GSCM and circular economy have a significant influence on the sustainable performance of the company, where the managers take leadership. Both GSCM and circular economy are increasingly being used to strategically impact specific outcomes, such as influencing the environmentally, economically, and socially sustainable output by organizations.

8.2. Practical implications

This study indicates that the policymakers, corporate governance experts, and managers in Bangladesh may all benefit from understanding the implications of the present study's results. Based on these research findings, GSCM must adopt circular economic tactics if it wants to achieve long-term success. This revolutionary method is required to maintain sustainable garment business practices in the RMG sector. By integrating GSCM with the circular economy, companies may gain a competitive edge while reducing the challenges of resource shortages. Moreover, GSCM is critical to the long-term viability of businesses, particularly in the ecologically delicate region of South Asia, where stakeholders are pressuring traditional companies to embrace sustainability and circularity by becoming green. According to the current research results, as Bangladesh is a developing economy in South Asia, its RMG industry requires the GSCM and circular economy, which is crucial to its future economic growth plans. This research proposes a framework for the transformation of the RMG industry that necessitates the implementation of GSCM throughout the distribution process. Additionally, government and financial institutions should provide enhanced environmental protection initiatives and tax incentives as rewards.

However, the expected result from this study highlights the importance of promoting the adoption of GSCM and the application of the circular economy among top executives in the large-scale manufacturing industry to enhance the overall corporate sustainable performance. In particular, the garment organization’s executive management will be responsible for

raising awareness and implementing GSCM and circular economy programs. They understand the need to emphasize greening and circular systems, particularly initiatives that focus on green-based production, purchasing, internal environment management, green logistics, reducing wastage, repairing and reusing resources, recovering and recycling, and remanufacturing mechanisms.

The combination of GSCM and circular economy strategies should prioritize imparting knowledge to workers about the importance of the best corporate sustainable performance and developing them with the required skills to adopt these practices effectively. This research suggests that GSCM and the circular economy can further set an organization's standards for managing environmentally conscious employees and recommendations for promoting sustainable performance at the organizational level. Implementing policies focusing on green-based production and purchasing, internal environment management, green logistics, minimizing wastage, repair and reuse, recovering and recycling, and reproducing may effectively showcase the environmental commitment of green textiles. Thus, the present study indicates that the abovementioned process can attract policymakers, managers, regulators, investors, and all other stakeholders who prioritize ecological values and have a strong interest in sustainable garments.

In addition, it is crucial to implement activities focused on enhancing understanding of ecological concerns and promoting awareness of energy preservation and efficient resource use. The abovementioned concerns with experience in issues related to the environment are more inclined to implement the GSCM and circular economy system. In this pertinent, AMIN ET AL. (2025) recommended that acknowledging personnel for exhibiting positive practices regarding the environment and addressing sustainability obligations will enhance employee excitement, resulting in increased dedication to environmental measures for the sustainable performance of garment enterprises. The present study highlights the impact of GSCM and circular economy on the sustainable performance of garment companies and emphasizes the significance of applying these processes for achieving corporate success. In a similar kind of study, RASHID ET AL (2025) found that all aspects of sustainable performance measures have equal significance, and companies should provide equal emphasis to all indicators for measuring sustainable performance, i.e., environmental, economic, and social performance.

Corporate leaders must not only emphasize and implement green policies but also offer additional contributions (CIVERA ET AL. 2025). The dedication and endorsement of organizational leaders play a crucial role in achieving profitable outcomes in the context of sustainability (AKASH ET AL., 2025). Consequently, the sustainability perspectives of business leaders and managers could prove useful as a reliable means of impacting the development of performance concerns inside enterprises in the garment sector (SAIF & ISLAM, 2025). To address industrial difficulties, managers are obliged to serve as shining examples for the stakeholders of their company (CIVERA ET AL. 2025). Additionally, the employees of the organization concerned are more inclined to engage in environmentally friendly activities if they perceive their managers as essential leaders within the company who actively support and encourage green initiatives, while additionally establishing the expectation for others to follow similarly. The significance of proficient management interaction in promoting sustainability or green projects has been emphasized. Managers in the RMG industry with an honest interest in and strong dedication to all dimensions of sustainability are expected to serve as role models for their staff members, investors, business owners, and all other stakeholders.

Managers must achieve sustainable performance for their company since they must fulfil the expectations of investors and other stakeholders. The whole management team may effectively perform at an overall organizational level through their managerial duties and each individual task. The expected results of this present study, which will focus on sustainable corporate performance, are valuable for policymakers when confronted with the sustainable performance issues of industrial organizations, particularly those that are concentrated on the labor-intensive garment sector. Policymakers have an opportunity to establish environmentally friendly standards that encourage organizations to engage in contribution activities, such as resource maximization campaigns and saving natural energy, to enhance the environmental sustainability of their garment firms. As specified in the green standards, the intention to achieve sustainable performance could be seamlessly incorporated into day-to-day activities. Policymakers should prioritize the adoption of eco-friendly measures by enterprises to enhance their environmental impact throughout the implementation of GSCM and circular economy systems.

8.3. Policy Contributions

The Bangladeshi government has established several environmental regulations and plans in response to the growing significance of the ready-made garment (RMG) manufacturing industry to the country's GDP. Nevertheless, there is a lack of connection between these strategies and long-term competitiveness at the organizational level. Because of a lack of proper training, research & development funding, many RMGs are unaware of these rules. Besides, when it comes to transforming into more sustainable practices, they do not have enough support from the government and regulatory organizations. RMGs in developing nations with an emphasis on practical knowledge for environmental concerns have not yet resulted in a coordinated national effort. This makes it hard for RMGs to take advantage of cutting-edge sustainability solutions, business strategies, and market trends. A unified framework to improve RMG owners' and managers' knowledge that is methodical, action-oriented, and successful is also necessary from current training and workshop programs. Authorities (such as government regulatory agencies and industrial associations) should work with stakeholders to launch capacity development initiatives to fill this shortage of knowledge and policy gaps.

According to the current research findings, RMGs can enhance their operational efficiency and their influence on the environment by developing a knowledgeable workforce that is an expert on sustainable practices. This research provides useful information not just for Bangladesh but also for other Southeast Asian nations with comparable histories, socioeconomic frameworks, and, most crucially, knowledge gaps when it comes to sustainable practices, such as India, Pakistan, Afghanistan, Myanmar, Nepal, Bhutan, Maldives, and Sri Lanka. Policymakers in these nations may encourage cooperation among RMG organizations, environmental NGOs, and the government regulators by forming public-private partnerships. These collaborations facilitate the spread of best practices, the exchange of technology and expertise, and collaborative ventures focused on sustainability. Regulatory bodies and ministries need to facilitate the development and certification of eco-friendly goods and services, therefore enabling RMGs to secure a competitive edge in global markets. This is particularly relevant since few manufacturing RMGs have obtained certifications such as ISO 14001, while an increasing number of garment organizations are very close to achieving LEED certification; however, Bangladesh has the highest number of LEED-certified green garment factories in the world.

8.4. Limitations and Future Research Directions

The study provides significant contributions to business and society while also recognizing its limitations and offering suggestions for future research. This study's findings are based on the garment industry, which may not generalize to all manufacturing industry contexts. Additionally, it is focused on Bangladeshi green garments; however, research should also cover other non-green garment organizations in Bangladesh to determine what they consider to be green, as both green and non-green garments contribute to the Bangladesh Government's sustainability objective.

In addition, replication of this study in a cross-cultural context will aid in developing globally applicable measures of green supply chain management (GSCM), circular economy, and sustainable organizational performance (SOP) in labor-intensive manufacturing organizations. Future research should collect data from diverse sectors and regions to inform universal decisions for emerging economies in South Asia. Moreover, the GSCM and circular economy are novel concepts in Bangladesh. Firms are still at a very nascent stage of adopting it. However, the performance of each variable has not yet been measured. To find out how far the GSCM and circular economy have really come, performance matrix analysis should be used in future research. Thus, future research could broaden its scope by conducting multi-group analysis across diverse regions.

Like earlier studies, the present study acknowledges its methodological and theoretical shortcomings, which provide the opportunity for future research. First, this cross-sectional study collects data at a single point. It may take time to assess GSCM and the circular economy to have their most significant impact on performance improvement. Future research may employ a longitudinal research method to examine the changes in organizational performance over time due to GSCM and the circular economy, in order to acquire a deeper understanding. Additionally, future research might also use a mixed-method approach to investigate further the connection between GSCM and sustainable results at organizations, for there needs to be more insight into respondents' opinions when only quantitative data based on closed-ended questions is used.

This study's intended participants were limited to garment managers' perceptions of organizational performance. In addition, this study investigates the influence of five components of GSCM on three dimensions of SOP. As a study population, further studies

should encompass another level of employees. Future research should emphasize organizational policies to minimize adverse environmental behaviors by employees. In addition to organizational performance, prospective studies should explore the development of green behavior by the employees; it may consider both enacted and professed values. In conclusion, despite the limitations described earlier, the research provides some basis for the suggested framework of study and an empirical premise for future comparisons.

8.5. Conclusion

In response to the growing trend of environmental responsibility, green garment organizations have realized that they should support and implement green organizational initiatives that lead to sustainable performance. This study expanded the understanding of GSCM and circular economy in the garment manufacturing industry by concentrating on managers' eco-friendly activities. The garment industry is a significant economic driver for the development of Bangladesh, but it should not be judged just on its contribution to GDP or export revenues; it should also be held to a higher standard if it actively works to improve the environment in which it operates. The research presented here highlights the emerging notion of GSCM and circular economy as a collection of green environments, resource maximization, energy conservation, and recirculation of resources perceived as facilitators in fostering sustainable productivity by the manufacturing organizations. The impact of GSCM and circular economy on SOP suggests that organizations should have a system for recycling resources to develop sustainable business performance conditions. In addition, the managers' perspective on SOP suggested that organizations must recognize the significance of the emergence of a circular system. Organizations could use this knowledge to engage themselves and their members in establishing an environment conducive to promoting GSCM and the circular economy among all employees to attain long-term competitive advantages and enhance company performance. The findings encourage policymakers to evaluate the actions of garment managers regarding the optimization of resources and the conservation of energy, as well as the factors that motivate all levels of employees to attain overall sustainable organizational performance.

9. NOVEL FINDINGS

The first novel finding of this research is that green supply chain management (eco-design, green purchasing, green manufacturing, green distribution and packaging, and internal environment management) positively contributes to sustainable organizational performance, i.e., environmental, financial, and social performance. Understanding how green supply chain management (GSCM) influences sustainable organizational performance is vital for Bangladesh's ready-made garment (RMG) industry's future. Resource-based-view theory emphasizes organizational and industrial adoption of GSCM, and the current study proves it through its empirical findings. The research examines perception-based sustainable organizational performance and evaluates GSCM, whereas prior studies only discussed basic literature. This procedure reveals existing knowledge, discrepancies, and research needs for empirically examining Bangladesh's RMG sector.

The second novel finding of this study reveals that GSCM is significantly connected with the circular economy. Based on the Resource-based View theory, this finding explains that the managers of the RMG sector of Bangladesh perceive that the practices of GSCM positively support the activities of the circular economy. Therefore, GSCM significantly enhances the circular economy of green garments in Bangladesh.

This research indicates that the circular economy significantly and positively influences sustainable organizational performance. The third novel finding of this study is that managers in Bangladesh's RMG industry believe that embracing the circular economy enhances sustainable organizational performance. Consequently, the more they utilize circular economy practices, the more significantly they can achieve sustainable organizational performance in Bangladeshi green garments.

According to the fourth novel finding of this research, the circular economy has a significant and favorable mediating effect between GSCM and sustainable organizational performance. It may be inferred that the managers of the RMG industry in Bangladesh have the opinion that a rise in circular economy to support the activities of GSCM by the employees of the organization has a favorable impact on the organization’s overall performance in terms of environmental, financial, and social. As a result, the green RMG in Bangladesh can accelerate a more circular economy along with GSCM to attain outstanding and sustained organizational performance.

In terms of the environmental, economic, and social aspects, this study investigates whether the integration of GSCM and SOP has a moderating effect of managers' green concern. This study reveals a novel finding that managers' of green concern has a significant negative moderating effect on GSCM and sustainable organizational performance. So, this finding demonstrates that as the company is already practicing GSCM and circular economy, managers' are already working in a green management production system. The managers of green garment factories in Bangladesh are well concerned, knowledgeable, and expert to deal with all environmental issues. Therefore, there is no additional green concern policy or initiatives are required for the professional efficiency development of the managers. Managers are capable, responsible, and concerned enough to attain the SOP on this present ecosystem.

10. SUMMARY

Green supply chain management (GSCM) is an imperative contributory factor for achieving sustainable organizational performance. Research shows that GSCM is essential for organizational environmental protection and sustainably. GSCM addresses supply chain challenges such as hazardous chemical consumption, pollution, energy, and solid waste by covering product design, material selection, manufacturing, distribution, and end-of-life management. Additionally, circular economy is another crucial factor that prioritizes sustainability, energy efficiency, and global competitiveness, increasing firm's extreme productivity. Now-a-days, companies are intensively exploring the practical use of both GSCM and circular economy to benefits the company ecologically, commercially and socially. However, circular economy promotes resource efficiency, energy conservation, and commodity management in the present green supply chains. These specialists emphasize GSCM integration for circular economy transition and organizational sustainability.

This research highlights sustainable organizational performance (SOP) including its environmental, economic, and social dimensions i.e., the triple bottom line indicators. The present study indicates a significant gap in the contributions of GSCM and circular economy to SOP that requires increasing potential research. This study advocates new academic and literature gaps to be fulfilled in the area of GSCM and circular economy in emerging South Asian economies. Notably, global sustainable organizational development is promoting by green industry. As globally the second-largest textile exporter Bangladesh leads sustainable green industrialization with top green industries, the clothing industry must protects its green energy, water, and material usage to manage the scarce of resources. Nevertheless, Bangladesh is a significant ready-made garment producer; hence more scientific studies are needed to assess the GSCM practices, circular economy model, and to address SDG compliances. Thus, this industry contributes to the global green supply chain movement to encourage environmentally responsible business managers and policy makers.

To address the research gap, this research statistically analyzes Bangladesh's ready-made clothing industry, a typical sample of growing South Asian nations. The main objective of this research is to investigate the relationships among green supply chain management, circular economy, sustainable performance, and manager's green concern. This study addresses the research question that how GSCM and circular economy positively affects SOP

of the clothing industry in Bangladesh? The present research model has been developed based on Resource-Based View (RBV), Natural-Resource-Based View, and Dynamic Capabilities theories. This study presents contemporary literature along with comparative contextual discussion, bibliometric analysis, and related literature matrixes. Based on the literature support, the current study selects five components of GSCM: eco-design, green purchasing, green manufacturing, green distribution & packaging, and internal environment management as the independent variables to explore and investigate.

To represent the empirical results, this study conducted a quantitative survey through questionnaire to collect the perception-based data. A total of 560 managers from LEED certified green garment organizations in Bangladesh were selected to participate as the respondents. For data input and analysis, VOS-viewer, R-studio, MS excel, SPSS, and PLS-SEM software were used. Based on Resource-based view concept, this study's first novel finding is that eco-design, green purchasing, green manufacturing, green distribution & packaging, and internal environment management as the dimensions of GSCM improve environmental, financial, and social performance of the company. The second novel result shows that Bangladesh's green textile's circular economy can be benefits from GSCM. Similarly, this study's third novel result is Bangladeshi RMG managers believe that the circular economy boosts organizational sustainable performance. The fourth novel finding is that the circular economy improves the contribution of GSCM to organizational sustainable performance. The fifth findings represents that the managers of Bangladeshi RMG sector are well expert, knowledgeable, and concerned about environmental issues.

This research indicates that the findings may support Bangladeshi policymakers, business governance specialists, and managers. In this present environmentally sensitive South Asia, stakeholders are pressuring conventional enterprises to becoming more green and sustainable. Studies reveal Bangladesh, a fast-growing South Asian economy, needs the GSCM and circular economy to expand its RMG industry's productivity and success. Moreover, environmentally friendly governments may encourage garment producers to maximize resources and save energy to improve sustainability. Additionally, green standards simplify sustainable performance and improve environmental effect; policymakers can encourage eco-friendly business practices during GSCM and circular economy implementation. This research benefits not only Bangladesh, also other South Asian countries such as India, Pakistan, Afghanistan, Myanmar, Nepal, Bhutan, Maldives, and Sri Lanka by sharing

socioeconomic frameworks and fulfills the knowledge gaps of sustainable practices. Governments may encourage environmental NGOs and regulators to develop public-private partnerships, collaborative supports, shared technology, and create more sustainable businesses.

Green garment organizations recognize the rising trend of environmental responsibility and must promote and execute green organizational activities for sustainable performance. The research analyzed managers' eco-friendly attempts to improve garment manufacturing GSCM and circular economy understanding. Though crucial to Bangladesh's economy, the garment sector should be held to higher standards if it actively improves its environment. This research presents GSCM and circular economy as green environments, resource maximization, energy conserving, and resource recirculation as industrial firm productivity enhancers. SOP suggests resource maximization for business performance due to GSCM and circular economy. Managers believe that their organization should value GSCM and circular systems to achieve SOP. This understanding may help companies and their members to promote GSCM and the circular economy to all workers for long-term competitive advantage and organizational success. The results suggest policymakers to explore garment managers' resource optimization and energy-saving techniques to achieve sustainable organizational performance.

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LIST OF ABBREVIATIONS

GSCM	Green Supply Chain Management
CE	Circular Economy
SOP	Sustainable Organizational Performance
SFP	Sustainable Firm Performance
ED	Eco-design
GP	Green Purchasing
GM	Green Manufacturing
GDP	Green Distribution & Packaging
IEM	Internal Environment Management
MGC	Manager's Green Concern
EP	Environmental Performance
FP	Financial Performance
SP	Social Performance
RBV	Resource-based View
NRBV	Natural Resource-based View
TAM	Technology Adaptation Model
KBV	Knowledge-Based View
ANN	Artificial Neural Networks
OLS	Ordinary Least Square
SLR	Systematic Literature Review
VDT	Voluntary Disclosure Theory
MICMAC	Matrice d'Impacts Croisés Multiplication Appliquée à un Classement
PLS	Partial Least Square
PLS-SEM	Partial Least Square: Structural Equation Modelling
MGA	Multi-group Analysis
CV-M	Covariance based method
CMB	Common method biasness
VIF	Variance Inflation Factor
CIF	Confirmatory Factor Analysis
EFA	Explanatory factor analysis
CR	Composite Reliability
CV	Convergent Validity
HTMT	Heterotrait-monotrait Ratio
SMEs	Small and Medium Enterprises
EV	Electric Vehicle
R&D	Research and Development
RMG	Ready made garment
NGO	Non governement organization

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LIST OF PUBLICATIONS

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Registry number: DEENK/49/2026.PL
Subject: PhD Publication List

Candidate: Mohammad Bin Amin
Doctoral School: Doctoral School of Management and Business
MTMT ID: 10085754

List of publications related to the dissertation

Articles, studies (8)

1. **Amin, M. B.**, Rubel, M. R. B., Kee, D. M. H., Rimi, N. N., Oláh, J.: Achieving sustainable excellence: investigating the impact of green HRM, circular economy, and green knowledge sharing on the sustainable performance of Bangladesh's green garment industry.
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Total IF of journals (all publications): 153,6
Total IF of journals (publications related to the dissertation): 32,5

The Candidate's publication data submitted to the Tudóstér have been validated by DEENK on the basis of the Journal Citation Report (Impact Factor) database.

10 February, 2026

DECLARATION

I undersigned (name – **Mohammad Bin Amin**, date of birth – 1981.12.10) declare under penalty of perjury and certify with my signature that the dissertation I submitted in order to obtain doctoral (PhD) degree is entirely my own work.

Furthermore, I declare the following

- I examined the Code of the Doctoral School of Management and Business Administration and I acknowledge the points laid down in the code as mandatory;
- I handled the technical literature sources used in my dissertation fairly and I conformed to the provisions and stipulations related to the dissertation;
- I indicated the original source of other authors' unpublished thoughts and data in the references section in a complete and correct way in consideration of the prevailing copyright protection rules;
- No dissertation which is fully or partly identical to the present dissertation was submitted to any other university or doctoral school for the purpose of obtaining a PhD degree.

Debrecen, 2025 February 23

.....

Mohammad Bin Amin

Signature

ACKNOWLEDGEMENT

I like to convey my profound respect and gratitude to my doctoral supervisor, Professor Dr. Judit Olàh, for her advice, support, and encouragement throughout my PhD journey. Her expertise, kindness, and patience have been extremely valuable, and I am deeply humbled by the opportunity she afforded me to enhance my research knowledge and abilities.

I express thankfulness to the Doctoral School of Management and Business, University of Debrecen, Hungary, for providing me with the academic foundation and intellectual rigorousness necessary to pursue my research interests. Their teaching, suggestions, and critical insights throughout several joint conversations, doctorate school conferences, other informal discussions, and knowledge sharing have significantly improved the quality of my research and thesis. I would like to specifically express my gratitude to Prof. Dr. András Nábrádi (Head of the doctorate school) and Prof. Dr. Fenyves Veronika (Dean, Faculty of Economics and Business) for their enormous support.

I like to express my thanks to my colleagues from the PhD cohort of 2022-2023 session for their teamwork, camaraderie, and friendship. I like to show my gratefulness to Prof. Dr. Mohammad Rabiul Basher Rubel, BRAC Business School, BRAC University, Bangladesh for his valuable guidance, learning, and support. I would like to express my sincere gratitude to Dr. Mohammad Morshadul Hasan, Alumni, Doctoral School of Management and Business, University of Debrecen for his kind support and guideline throughout my PhD journey.

I would like to convey my deep appreciation and devotion to my beloved wife, Hasina Imam, whose support and encouragement greatly helped throughout my PhD journey. Mostly, I want to express my deepest affection for my two daughters, Inaya Amin and Irtiqa Amin, who sacrificed their joy and comfort when they did not fully understand the meaning of sacrifice.

I appreciate everyone's contributions to my PhD journey and for supporting me to be the person and scholar I am today.

APPENDICES

APPENDIX A:

Part-A: Ethical Clearance form Local Institution

বাংলাদেশ আর্মি ইউনিভার্সিটি অব সায়েন্স এন্ড টেকনোলজি (বিএইউএসটি)
BANGLADESH ARMY UNIVERSITY OF SCIENCE AND TECHNOLOGY (BAUST)
web :www.baust.edu.bd e-mail: registrar@baust.edu.bd, info@baust.edu.bd
Saidpur Cantonment, Saidpur.

Ref: BAUST/DBA-03 (part-02)/2020/612 Date: 16th January 2025

To Whom It May Concern

Subject: **Ethical Approval of Research Study**

This is to certify that the research titled:

"Green Supply Chain Management, Circular Economy, and Sustainable Firm Performance"

conducted by Mohammad Bin Amin for his doctoral study under supervision of Prof. Dr. Judit Oláh, has undergone ethical review by the Department of Business Administration, Bangladesh Army University of Science & Technology (BAUST). The Department has reviewed the research design and evaluated the purpose and content of the planned questionnaire survey, and the ethical rules for the survey process.

As the study involves human participants, the review assessed the following:

1. Questionnaire – The questionnaire will be anonymized, no personal or sensitive data will be collected, and responding will be voluntary.
2. Inform Consent – No contact will be made with the respondents without their consent, and they will be informed of the purpose of the survey; the researcher will collect the consent of the participants and ask them to participate anonymously. They are free to decide whether to respond and participate or not.
3. Confidentiality and Data Protection – The participants will be assured that all personal information will be handled securely, anonymized, and used exclusively for academic purposes.
4. Compliance with Ethical Standards – The study adheres to BAUST's research ethics policies for research involving human participants and ethical standards following Helsinki declarations.

Based on this review, the Department certifies that the study meets the required ethical standards and is approved to proceed.

Sincerely,

Dr. Md. Anowar Hossain
Head of the Department
Department of Business Administration
Bangladesh Army University of Science & Technology (BAUST)
Saidpur 5310, Nilphamari, Bangladesh
E-mail: anowar@baust.edu.bd

Dr. Md. Anowar Hossain
Head
Dept. of Business Administration
Bangladesh Army University of
Science and Technology (BAUST)

Part-B: Cover Letter for Survey Questionnaire (Confidential)

Dear Participant,

We want to conduct this research for a doctoral study; therefore, we need your kind participation with some insights for its accomplishment. It will be very helpful for us if you participate in this research study. The research aims to determine the effects of Green Supply Chain Management and Circular Economy on Sustainable Organizational Performance. The enclosed questionnaire has been designed to collect information on Eco-design, Green Purchasing, Green Manufacturing, Green Distribution & Packaging, Internal Environment Management, Circular Economy, Manager's Green Concern, Environmental, Financial, and Social Performance of your organization.

Your participation in this research is completely voluntary. There are no known risks of participation beyond those encountered in everyday life. Your responses will remain confidential and anonymous. Data from this research will be kept secret and reports only as a collective combined total. No one other than us will know your individual answers to this questionnaire.

We thank you sincerely for your valuable time and effort in completing the questionnaire. Your valuable feedback will contribute to the advancement and success of this research. If you are interested in knowing about the research outcome later, please do not hesitate to contact my academic supervisor or me.

Sincerely yours,

Mohammad Bin Amin
Doctoral Candidate,
Doctoral School of Management and Business,
Faculty of Economics and Business,
University of Debrecen, Debrecen, Hungary
E-mail: binaminbd@mailbox.unideb.hu

Professor Dr. Judit Oláh, D.Sc.
Doctoral Research Supervisor
Doctoral School of Management and Business,
Faculty of Economics and Business,
University of Debrecen, Debrecen, Hungary
E-mail: olah.judit@econ.unideb.hu

Part-C: Inclusion Criteria for the Respondents

It is requested to distribute the questionnaire to those employees who fulfilled the following criteria:

1) This refers to those who are employed on a long-term basis in green garment organizations in Bangladesh. It excludes those who work on temporary, contractual, daily basis, probationary, project-based, or temporary job roles, vendors, suppliers, government representatives, international consultants, and external auditors.

2) The selected manager must have at least three years of active work experience in the present company.

Part-D: Research Questionnaire

Table 28: Demographic Information of the participants [Please tick (√) the appropriate box]

1	Gender	1.	Male	2.	Female	3.	Others
2	Age	1.	18-25 years	2.	26-35 years	3.	36-45 years
		4.	46-55 years	5.	56 years and above		
3	Education	1.	Below Secondary School	2.	Secondary School	3.	Higher Secondary/ College Diploma
		4.	Bachelor degree	5.	Master's degree	6.	Higher Degree
		7.	Others/Professional Degree/Special Degree				
4	Monthly Income (in BDT)	1.	Below 30,000	2.	30,000 – 40,000		
		3.	40,000 – 50,000	4.	50,000 and above		
5	Total Experience in Current Organization	1.	01 – 05 Years	2.	05 – 10 years		
		3.	10 – 15 Years	4	More than 15 years		
6	Industry Experience	1.	01 – 05 Years	2.	05 – 10 years		
		3.	10 – 15 Years	4	More than 15 years		

Please read each statement carefully and put (√) mark at the most appropriate option from your concept or opinion as a scale of **1** = **strongly disagree** to **7** = **strongly agree**.

Strongly Disagree (SD)	Disagree (D)	Nearly Disagree (ND)	Neutral (N)	Nearly Agree (NA)	Agree (A)	Strongly Agree (SA)
1	2	3	4	5	6	7

Table 29: Perception of the participants based on variables [Please tick (√) the appropriate box]

Items		**SD**	**D**	**ND**	**N**	**NA**	**A**	**SA**
Eco-design		**1**	**2**	**3**	**4**	**5**	**6**	**7**
ED1	Our company emphasizes the design of products for reduced consumption of materials and energy.							
ED2	Our company emphasizes the design of products for reuse, recycling, and recovery of materials and resources.							
ED3	Our firm emphasizes the design of products to avoid or reduce the usage of hazardous products in their manufacturing process.							
ED4	Our firm emphasizes optimization of design processes to reduce air emission and noise							
Green Purchasing		**1**	**2**	**3**	**4**	**5**	**6**	**7**
GP1	Our company emphasizes purchasing eco-friendly materials							
GP2	Our company purchases based on environmental specifications established by product design							
GP3	Our purchasing process is carried out with ISO 14001 certified partners							
GP4	Our purchasing process follows procedures that minimize environmental impact							
Green Manufacturing		**1**	**2**	**3**	**4**	**5**	**6**	**7**
GM1	Our company assesses the environmental impact on developing and manufacturing its products.							
GM2	Our company manufactures its products with recyclable raw material.							
GM3	Our company manufactures its products with lowest consumption of resources							
GM4	Our company manufactures its products with the lowest impact on the environment.							
GM5	Our company manufactures its products with a high life span							
Green Distribution & Packaging		**1**	**2**	**3**	**4**	**5**	**6**	**7**

GDP1	Our company maximizes the reduction of packaging materials							
GDP2	Our company uses ecological materials for primary packaging							
GDP3	Our company uses recyclable or reusable packaging/containers in our logistics system							
GDP4	Our company ensures effective shipment consolidation and full vehicle loading							
GDP5	Our company always emphasizes to selects and using cleaner transportation system							
Internal Environment Management		**1**	**2**	**3**	**4**	**5**	**6**	**7**
IEM1	Our company ensures commitment of green supply chain management from senior managers							
IEM2	Our company has all supports for green supply chain management from the mid-level managers							
IEM3	We practice cross-functional cooperation for environmental improvements							
IEM4	We implement our environmental compliance and auditing programs							
Circular Economy		**1**	**2**	**3**	**4**	**5**	**6**	**7**
CE1	Our company re-uses the wastages of the products for another production							
CE2	We recycle the raw materials of the products to reuse							
CE3	Our company remanufacture the raw materials of the products							
CE4	Our company remanufacture the used products to produce a new product							
CE5	We reduced energy, cost, and raw material use than the previous time							
Manager's Green Concern		**1**	**2**	**3**	**4**	**5**	**6**	**7**
MGC 1	We ensured the improvement of the financial performance of our company							
MGC 2	We ensured the benefits from government green concern incentives							
MGC 3	We have gained the market opportunities for our company green initiatives							
MGC 4	We adhere to our national government green technology policies							
MGC 5	We increased our employee motivation regarding environmental concerns							
Environmental Performance		**1**	**2**	**3**	**4**	**5**	**6**	**7**
EP1	Our company reduced carbon emission							
EP2	The waste generation of our company is reduced							
EP3	Our company reduced the consumption of energy							
EP4	We reduced the atmospheric pollution of our company							
EP5	Our company reduced the consumption of hazardous/harmful/toxic materials							

EP6	We reduced the frequency for environmental accidents							
Financial Performance		**1**	**2**	**3**	**4**	**5**	**6**	**7**
FP1	We decreased manufacturing/operational costs of our company							
FP2	We increased the annual turnover of our company							
FP3	Our company market share price is increasing							
FP4	We increased our profit than the last years							
FP5	Our company increased the return on investment							
Social Performance		**1**	**2**	**3**	**4**	**5**	**6**	**7**
SP1	Our company ensured the improvement of customer satisfaction							
SP2	Our company improved its corporate image in the perception of our customers							
SP3	We improved investments in various social projects such as education, culture, and sports							
SP4	We optimized the level of awareness and secured the demands and rights of individuals within the community being serviced.							
SP5	Our company ensures workers' safety and health in the workplace							
SP6	Our company has improved the general well-being or enhancement of its stakeholders.							

Thank you for your participation and valuable time

APPENDIX B:

Table 30: Harman's Single Factor Test

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	15.873	32.395	32.395	15.873	32.395	32.395
2	3.741	7.635	40.030			
3	3.088	6.302	46.332			
4	2.588	5.282	51.615			
5	2.319	4.733	56.348			
6	2.119	4.324	60.672			
7	1.976	4.032	64.704			
8	1.340	2.735	67.440			
9	1.152	2.351	69.791			
10	.800	1.632	71.422			
11	.654	1.335	72.757			
12	.650	1.327	74.084			
13	.623	1.271	75.355			
14	.571	1.166	76.522			
15	.548	1.119	77.641			
16	.504	1.028	78.669			
17	.490	.999	79.668			
18	.470	.960	80.628			
19	.459	.936	81.564			
20	.444	.907	82.471			
21	.429	.876	83.347			
22	.419	.854	84.201			
23	.398	.813	85.014			
24	.381	.778	85.792			
25	.375	.765	86.557			
26	.366	.748	87.305			
27	.352	.718	88.023			
28	.347	.708	88.731			
29	.342	.698	89.430			
30	.331	.675	90.105			
31	.321	.654	90.759			
32	.316	.645	91.404			
33	.313	.638	92.042			
34	.309	.631	92.673			
35	.299	.610	93.283			
36	.288	.587	93.870			
37	.280	.571	94.441			
38	.269	.548	94.989			
39	.266	.543	95.532			

40	.260	.531	96.062			
41	.241	.493	96.555			
42	.228	.465	97.020			
43	.223	.455	97.475			
44	.221	.452	97.927			
45	.214	.436	98.363			
46	.209	.427	98.790			
47	.206	.421	99.211			
48	.198	.404	99.615			
49	.189	.385	100.000			
Extraction Method: Principal Component Analysis.						

Table 31: VIF values

	CE	GSCM	MGC	SOP	MGC x GSCM
CE				1.111	
GSCM	1.000			1.209	
MGC				1.166	
SOP					
MGC x GSCM				1.038	

Table 32: Cross Loading of Items

Items	CE	ED	EP	FP	GDP	GM	GP	IEM	MGC	SP
CE1	0.9	0.186	0.335	0.269	0.079	0.122	0.197	0.267	0.158	0.327
CE2	0.9	0.124	0.364	0.316	0.147	0.192	0.23	0.283	0.203	0.35
CE3	0.8	0.144	0.302	0.288	0.146	0.152	0.134	0.289	0.185	0.287
CE4	0.9	0.156	0.303	0.214	0.087	0.082	0.148	0.231	0.172	0.283
CE5	0.8	0.173	0.254	0.184	0.061	0.145	0.171	0.21	0.131	0.252
ED1	0.1	0.797	0.378	0.345	0.175	0.188	0.383	0.307	0.18	0.398
ED2	0.2	0.85	0.422	0.372	0.265	0.247	0.449	0.348	0.244	0.398
ED3	0.2	0.882	0.434	0.44	0.299	0.309	0.471	0.362	0.184	0.445
ED4	0.2	0.873	0.427	0.389	0.282	0.308	0.488	0.334	0.183	0.438
EP1	0.3	0.368	0.847	0.38	0.323	0.347	0.335	0.536	0.446	0.364
EP2	0.3	0.439	0.83	0.462	0.397	0.408	0.368	0.553	0.43	0.483
EP3	0.3	0.397	0.848	0.317	0.297	0.372	0.311	0.489	0.473	0.373
EP4	0.3	0.407	0.864	0.342	0.365	0.332	0.338	0.556	0.45	0.451
EP5	0.3	0.449	0.859	0.525	0.439	0.447	0.384	0.63	0.473	0.491
EP6	0.3	0.416	0.834	0.355	0.309	0.363	0.294	0.508	0.499	0.381
FP1	0.2	0.37	0.402	0.857	0.369	0.387	0.323	0.564	0.369	0.383
FP2	0.3	0.402	0.391	0.875	0.378	0.396	0.352	0.55	0.28	0.443
FP3	0.2	0.379	0.362	0.857	0.372	0.39	0.34	0.526	0.254	0.392
FP4	0.3	0.389	0.436	0.875	0.386	0.434	0.345	0.552	0.279	0.405
FP5	0.3	0.425	0.446	0.853	0.413	0.415	0.338	0.559	0.241	0.507
GDP1	0.1	0.272	0.362	0.417	0.864	0.361	0.381	0.458	0.128	0.43
GDP2	0.1	0.264	0.378	0.379	0.843	0.329	0.352	0.467	0.147	0.369
GDP3	0.1	0.241	0.355	0.336	0.83	0.319	0.345	0.435	0.127	0.359
GDP4	0.1	0.258	0.333	0.372	0.83	0.328	0.369	0.43	0.092	0.367
GDP5	0.1	0.233	0.344	0.359	0.837	0.345	0.323	0.406	0.14	0.32
GM1	0.2	0.285	0.431	0.42	0.381	0.87	0.385	0.391	0.212	0.431
GM2	0.2	0.242	0.343	0.341	0.303	0.835	0.331	0.289	0.112	0.391
GM3	0.1	0.245	0.38	0.402	0.343	0.853	0.36	0.327	0.205	0.408
GM4	0.2	0.286	0.381	0.425	0.352	0.875	0.369	0.358	0.226	0.437
GM5	0.1	0.282	0.393	0.427	0.343	0.879	0.372	0.369	0.208	0.41
GP1	0.2	0.455	0.339	0.343	0.365	0.348	0.87	0.254	0.139	0.381
GP2	0.2	0.458	0.346	0.292	0.394	0.347	0.856	0.264	0.136	0.38
GP3	0.2	0.471	0.356	0.353	0.374	0.378	0.882	0.293	0.157	0.401
GP4	0.2	0.455	0.355	0.376	0.339	0.396	0.875	0.283	0.189	0.4
IEM1	0.2	0.25	0.446	0.441	0.285	0.253	0.233	0.731	0.252	0.392
IEM2	0.2	0.386	0.575	0.56	0.499	0.359	0.292	0.863	0.3	0.501
IEM3	0.3	0.342	0.522	0.522	0.426	0.343	0.304	0.828	0.285	0.494
IEM4	0.3	0.321	0.573	0.565	0.488	0.364	0.208	0.864	0.287	0.519
MGC1	0.2	0.135	0.352	0.306	0.088	0.16	0.108	0.252	0.763	0.079
MGC2	0.1	0.144	0.379	0.2	0.037	0.118	0.129	0.21	0.741	0.051
MGC3	0.2	0.229	0.525	0.246	0.182	0.207	0.169	0.354	0.771	0.223
MGC4	0.1	0.192	0.336	0.209	0.089	0.16	0.133	0.197	0.733	0.099

MGC5	0.2	0.183	0.47	0.302	0.151	0.209	0.145	0.273	0.853	0.108
SP1	0.3	0.36	0.351	0.372	0.311	0.348	0.361	0.426	0.055	0.789
SP2	0.3	0.425	0.461	0.464	0.399	0.469	0.364	0.509	0.146	0.836
SP3	0.3	0.394	0.389	0.385	0.362	0.384	0.327	0.504	0.122	0.848
SP4	0.3	0.407	0.417	0.375	0.335	0.354	0.396	0.416	0.153	0.745
SP5	0.3	0.374	0.405	0.402	0.358	0.386	0.344	0.491	0.135	0.798
SP6	0.3	0.444	0.425	0.407	0.381	0.404	0.398	0.488	0.135	0.86

Table 33: Cross Loading and VIF values of Variables and Items after Second Order

Variables and items after second Order	VIF values
CE1	2.59
CE2	2.736
CE3	2.011
CE4	2.518
CE5	1.798
ED	1.513
EP	1.469
FP	1.452
GDP	1.57
GM	1.384
GP	1.647
IEM	1.577
MGC1	1.723
MGC2	1.631
MGC3	1.518
MGC4	1.607
MGC5	2.207
SP	1.509