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The Moderating effect of Environmental Collaboration on the Green Supply Chain Management Practices and Sustainability Performance in Construction Industry's

* Abdur Rahman, PhD Scholar

** Dr. Syed Mohsin Ali, Assistant Professor

*** Dr. Muhammad Jehangir, Associate Professor

Abstract

As environmental issues become more pressing, people involved in businesses are paying more attention due to increasing competition. A company's success isn't just about profits anymore, but also how well it develops sustainably. This study looks at how "green" supply chain practices can impact the success of the construction industries. We collected data from 347 companies and used software called SPSS and AMOS to analyze it. We found that actions like green manufacturing; green purchasing, Eco-design, and using helped companies perform better sustainably. However, working closely with green information system didn't make much of a difference. Also, the collaboration from larger societal structures didn't significantly change the impact of green purchasing, and green information system on sustainability performance. But, they did have a notable effect when it came to customer green purchasing and eco-design. This study is unique because it looks at four different aspects of green supply chain management and considers the role of environmental collaboration. We also discuss what this means for managers in these companies.

Keywords: Green Supply Chain Management Practices, Sustainability, Environmental Collaboration, Construction Industry

Introduction

As concern for our environment grows, there's an urgent need to explore eco-friendly practices, particularly in emerging economies. When looking at a company's long-term success, it's not just about profits. We also need to consider its values, how it communicates, and its strategies (Schaltegger, 2017). This approach also shows in how businesses handle their responsibility to sustainable. A company's success over time can be measured using three key areas: financial health; social impact; and environmental responsibility (Muhammad et al., 2020). But assessing a company's performance isn't only about looking at its financial status. It's also about how it contributes to sustainable development as a whole. As environmental issues gain more attention, company collaborate are feeling the environmental pressure. Companies are now more aware of how their products impact the environment and they're looking at ways to grow sustainably. Practices such as green supply chain management, especially in the construction sector, are being used to boost a company's long-term value (Ananda et al., 2018, Fien et al, 2023). Given that the industrial and construction sectors are major contributors to CO2 and greenhouse gas emissions, it's vital they focus on environmental management and innovation. Doing so is a key part of their responsibility to collaborate. Plus, numerous studies have shown the clear benefits of green supply chain management for a company's sustainable performance.

In recent years, there's been a surge of interest in green manufacturing among Pakistani construction firms, both in real-world applications and in research. On a day-to-day level, green manufacturing focuses on how workers and machines can be eco-friendlier. At the planning level, it looks at how processes can be controlled to be more sustainable. And at the overall strategy level, it involves coming up with designs that are greener (Govindan et al., 2015). Recent studies show that business partners and consumers are stepping away from construction whose products and services aren't environmentally friendly (Gupta, 2019). This shift towards green manufacturing is becoming

* Institute of Business Studies and Leadership, Abdul Wali Khan University, Mardan, KP, Pakistan
Email: itsabdurrahman@gmail.com
** Institute of Business Studies and Leadership, Abdul Wali Khan University, Mardan, KP, Pakistan
***Institute of Business Studies and Leadership, Abdul Wali Khan University, Mardan, KP, Pakistan

more popular in the construction industry and among customers. Beyond just gaining more market share and consumer interest, green manufacturing is also directly tied to a company's long-term sustainability.

Green purchasing stands as a crucial component of green supply chain management. In the past, purchasing was primarily viewed from a financial perspective. However, recent studies highlight the strong connection between purchasing practices and environmental management. Observations worldwide have confirmed that incorporating eco-friendly criteria in purchasing decisions substantially improves an organization's performance, addressing both economic and environmental aspects (Liobikien˙e et al., 2016). Companies adopt a variety of green purchasing strategies. These strategies vary in their approach and influence the environmental behaviors of suppliers in different ways. The emphasis is on products that are more environmentally friendly in nature. This strategy holds great value in today's market, as consumers are increasingly leaning towards eco-friendly products, resulting in potential benefits for the organization in the form of a larger market share (Fien, 2023).

Within the realm of environmentally-friendly products, the strategy of eco-design has risen to significant prominence in the field of business management in Pakistan. The concept of eco-design was initially brought to the fore by the World Business Council for Sustainable Development, and it has been instrumental in shaping product life cycles from then on (Fernando, 2017). This method oversees the production, packaging, and delivery stages of products, ensuring alignment with eco-design principles. Among its many advantages, the impact of eco-design on an organization's sustainable performance is particularly noteworthy. In relation to a company's sustainability performance, eco-design encourages a deeper dedication to environmental care, making it a crucial practice in green supply chain management.

The expanding relationship between technology and the construction sector has repeatedly led to environmental difficulties. Green information systems (GIS) have arisen as a key pillar of green supply chain management (GSCM) in response to this dynamic interplay, which demands for sustainable approaches to address these problems. Green information systems weave together a number of procedures, software programs, and related technologies to serve as the industry's lynchpin for environmental sustainability. The purpose of this tapestry is to improve an organization's long-term performance while also advancing it toward the accomplishment of a variety of goals, from those that are personal and organizational to those that are more general like those related to society and the environment (Recker, 2016). A potential risk to a company's sustainability performance is the violation of environmental laws and regulations. Modern statistical approaches must be used in order to examine these important elements in an efficient manner. This is especially important in the context of Pakistan, where there is a distinct lack of recent research. So, now is the perfect time to make a concentrated effort to learn more about how green information systems may help the construction industry become more environmentally sustainable.

However, despite the obvious significance of green information systems, there is still a dearth of study in this area. This gap highlights the need for thorough investigation to shed light on the advantages these technologies offer and how they might be more effectively utilized. Policymakers' attention has been moved from a narrow focus on economic performance to a wider panorama of sustainability performance as a result of a paradigm shift in GSCM practice. This larger viewpoint encompasses the various aspects of a company's growth, including—and this is crucial—advances in environmental preservation.

Our study will examine how green supply chain management (GSCM) techniques affect sustainability because there is a lack of research especially on Pakistan's construction sector. Our research aims to investigate this topic because earlier studies neglected to consider the significance of environmental constraints. In particular, we'll look at how teamwork and environmental cooperation relate to GSCM practices and sustainability. In plainer terms, we're attempting to comprehend how improving environmental cooperation will help construction companies better manage their supply chains, ultimately assisting them in being more sustainable.

By examining how several facets of Green Supply Chain Management (GSCM) affect the sustainability performance of construction enterprises in Pakistan, this study seeks to close a gap in the body of existing work. Additionally, it will look into how environmental cooperation can lessen these effects. This study will also add to the body of knowledge by examining how GSCM can assist

businesses in enhancing their sustainability performance over the long run. The utilization of primary data in this study distinguishes it from others. This will be gathered through surveys of a number of Pakistani construction industries, including those building dams, large-scale projects, bridges, and other things. Through the lens of GSCM and its components, it is hoped to gain a better understanding of sustainable performance.

While there is some research examining the impact of GSCM on sustainability performance, there is limited work looking at the moderating role of environmental collaboration Therefore, this study seeks to address this gap by focusing on the sustainability performance of the construction industry using primary data.

This research intends to investigate the effect of Green Supply Chain Management (GSCM) elements on sustainability performance in the construction sector of Pakistan. It aims to address the voids in empirical studies on sustainability performance by pursuing the following objective:

1. Explore the influence of eco-friendly production and sustainable procurement on the performance of sustainability.
2. Explore the role of green information system in sustainability performance.
3. Evaluate the influence of Eco-design on sustainability performance.
4. Examine the regulatory impact of environmental collaboration on the connection between Green Supply Chain Management practices and the performance of sustainability.
5. By meeting these objectives, the study aims to provide a comprehensive understanding of how GSCM practices can enhance the sustainability performance of the construction industry in Pakistan.

This research is concentrated on comprehending the sustainability within the construction industry of Pakistan. We are investigating four key components of Green Supply Chain Management (GSCM) which encompass eco-friendly manufacturing, sustainable procurement, ecological design, and green information systems.

Basically, we are exploring how making and buying environmentally-friendly products, designing with the environment in mind, and using technology to help us be more green can improve the sustainability of Pakistan's construction industry.

This study is extremely important for policymakers since it provides them with knowledge about how eco-friendly methods might improve and sustain the construction industry. The performance of Pakistan's construction sector has generally been evaluated in the context of economic downturns, but the sector's environmental effects also have a substantial impact on sustainability performance. In light of this, the study aims to provide a distinctive viewpoint on educating environmentalists and policymakers on how the green supply chain may improve the sustainability of the sector. The rest of this article is divided into the following sections: The first section reviews the body of research. The study's approach for evaluating the conceptual model is described in the second section. The analysis and results are discussed in the third section. The article concludes with a discussion and conclusion section.

Literature Review

All of supply chain management's focus is on controlling the various components involved in creating commodities. This include managing inventories, dealing with buyer-seller interactions, purchasing resources, manufacturing, and all other tasks related to producing goods (Kannan et al., 2019). However, green supply chain management (GSCM) adds even another level to this. It involves controlling all internal business operations while monitoring their environmental impact. Making ensuring that the procedures for creating and delivering items are environmentally friendly is the aim. Numerous studies have demonstrated how GSCM can improve an industry's sustainability performance. This indicates that GSCM aids in maximizing resource utilization while minimizing environmental impact (Amarasena., 2023). Businesses are increasingly implementing GSCM as a tactic to boost their performance in sustainability and competitiveness (Rao, 2005; Yang et al., 2013). It gives companies a chance to distinguish themselves in the marketplace in addition to being more ecologically friendly.

As environmental concerns become increasingly paramount, many businesses are aiming to reduce costs and enhance product quality. Due to this change in emphasis, green production now takes a more all-encompassing approach, covering everything from product creation to life cycle

management. Adopting eco-designs, recycling techniques, cost-effective product reuse, and clean production are a few examples of how to do this (see Chavez et al., 2016)

Green operations are thought to be related to both products and the environmental practices that go along with them, according to existing literature on environmental management. This not only lessens product damage but also has a favorable effect on resource-intensive supply chain procedures (Choi and Hwang, 2015). For a company to perform well, it must be able to carry out its environmental policies and maintain operations. Academic literature has long recognized the benefits of environmentally friendly production and manufacturing, but the contribution of upstream suppliers to performance improvement has not received enough attention. Systems for managing the supply chain sustainably reduce environmental risks and the impact that product manufacturing and disposal have on the environment.

Today, more and more people are choosing organic foods, green technology, and sustainable energy. Researchers have tried to figure out why people decide to buy these green products (Abbas et al., 2019). It turns out, these choices are good for both the Earth and the people living on it. Interestingly, people often don't mind paying extra for products that are better for the environment. This opens up opportunities for governments to create policies that encourage more environmentally friendly practices (Peattie, 2001). A study in China found that people's values, attitudes, and behaviors are the main factors that drive them to buy green products (Keles, 2013).

Eco-design can be understood both as a principle and a strategy. It places the Before an item or service ever starts its life, it must be protected from the environment. This is the principle underpinning eco-design, which focuses entirely on minimizing damage to the environment. Eco-design is applied at every stage of a product's life, including the procurement of raw materials, production, usage, and disposal. Businesses that adopt eco-design take into account each phase of the manufacturing and sales processes. They take everything into account, from the procurement of raw materials to the point at which consumers are utilizing the product (Arshad Ali et al., 2020). More than simply nature is involved in environmental sustainability. It encompasses social, organizational, and environmental aspects as well as how people feel and think. Consequently, in order to achieve sustainability, This implies that it addresses both micro and macro issues, as Melville noted. There is still much to learn about the developing topic of green IT, despite research efforts (Jenkin et al., 2011). In order to cut operating expenses and eliminate environmental risks brought on by various business processes, organizations choose green IT for their systems (Dedrick, 2010). In addition to this, more significant drivers for the adoption of green IT include its inherent advantages, such as raised employee morale and admirable corporate responsibility. Additionally, this improves the company's reputation and aids in complying with regulations. However, further study is needed to determine the viability of green IT services, especially with regard to employee buy-in and environmental activities (Azhar et al., 2022).

Collaboration on environmental concerns is crucial for sharing innovative sustainable solutions. By doing this, partners can create brand-new goods and services that are more environmentally friendly. This collaborative effort can aid in resolving environmental issues for the benefit of all parties (Jain et al., 2022). Businesses might find it challenging to balance social and financial objectives, but sustainability aims to do just that (Steger et al., 2000). Even yet, implementing more cost-effective, environmentally friendly methods can help cut costs for a business. Environmentally conscious behavior is an excellent first step in accomplishing sustainable development objectives. They enable businesses to lessen their adverse environmental impact (European Commission, 2012). For instance, cutting waste can increase a business's operational efficiency (Delmas et al., 2018)

In 2006, Klassen outlined how businesses might lessen their environmental effect in South Carolina by establishing cooperative activities. The effectiveness and profitability of supply chains can be increased through collaborative environmental efforts within the supply chain of a good or service, such as exchanging environmental expertise.

Some authors use the term "environmental collaboration" to refer to the idea of an organization's interaction with its suppliers and consumers when discussing the environmental performance of a business (Chin et al., 2015). Customers and suppliers are expected to cooperate in a collaborative setting in order to lessen the environmental impact of their activities. As a result, environmental collaboration is predicated on a shared desire to learn about one another's operations,

plan, and establish environmental improvement objectives (Ananda et al., 2018). Understanding each other's roles inside businesses is essential for effective environmental collaboration (Ramanathan et al., 2014). Daskin looked at the effects of supply chain collaboration on costs and CO2 emissions in a study published in 2013. In a study by (Ramanathan, et al., 2014).

Resource base and Natural based view:

Our study delves into how eco-conscious supply chain management practices impact long-term performance. In addition, we assess the role of environmental collaboration as an intermediary factor, taking into account the Natural-Resource-Based View (N-RBV) theory and resource-based perspectives. The principle of resource-based theory, now a core component of strategic management, sees increasing application in relevant fields like supply chain management and other management subdivisions, such as industry-oriented studies (Kannan., 2019; Amarasena., 2023). Noor (2019) suggested that the unique traits of supply chain management often convert it into a powerful mechanism for achieving enduring competitive benefits as per the resource-based theory. It is crucial to scrutinize the location of supply chain resources as coming from upstream and the enhancement of internal resources. Academics have acknowledged that resource-based theory principles align suitably with supply chain management, acting as a lever for competitive advantage. However, making a distinct linkage between RBT and ongoing supply chain management has proven difficult to clearly delineate (Peattie, 2001). Sustainability can aid firms in enhancing their brand image and reputation, bolstering their market appeal, and increasing profits from their goods and services. This becomes crucial in giving them an edge over competing suppliers, not just standalone firms. The resource-based theory posits that the resources and raw materials used in product production are often highly valuable, difficult to replicate, and lack direct substitutes, thereby contributing to the firm's long-term success (Hitt et al., 2016).

Researchers have established that the principles of resource-based theory harmonize with the practices of supply chain management, functioning as a competitive lever. Still, it has been challenging to explicitly identify the correlation between resource-based theory (RBT) and stable supply chain management (Peattie, 2001). By embracing sustainability and environmental considerations within the Natural-Resource-Based View (N-RBV), firms can enhance their brand image and reputation, boosting their market appeal and leading to substantial profits from their goods and services. This strategy is vital for organizations, allowing them to establish a competitive advantage over other suppliers, not just isolated companies. Resource-based theory proposes that the resources and demands that form the basis of product creation are highly valuable, difficult to replicate, and lack clear substitutes. This uniqueness contributes to the firm's sustained success in the long term (Hitt et al., 2016).

Impact of green manufacturing on the performance of sustainability

The rising environmental concerns have led to an increased focus on green supply chain management by both scholars and business practitioners. Standards for green manufacturing necessitate considerations such as significant safety measures, no health threats to employees and product handlers, and zero environmental pollution, along with effective disposal (Fiem et al., 2023). Green manufacturing in industries encompasses strategics manufacturing and management to monitor energy use, greenhouse gas emissions, and waste management. The goal of green manufacturing is to diminish municipal waste by enhancing the efficiency of companies (Azizian et al., 2017). In light of the Natural-Resource-Based View (N-RBV) and resource-based theory perspectives, several hypotheses are proposed. These will explore how diverse collaborations over time lead to the integration of similar risk management practices within a company's supply management processes.

H1: Green manufacturing greatly influences the sustainability performance within Pakistan's construction sector.

Impact of green purchases on sustainability performance

Green purchasing signifies a commitment to the economic prosperity and advancement of a nation, whilst maintaining resource conservation and environmental amenities. The drive towards a green economy constitutes a part of the strategic policy agenda that promotes advancement where economics and environment intersect (Cherian, 2012). This methodology can stimulate economic diversification by fast-tracking technological transformations and enhancing sustainability performance. Green procurement practices concern a company's procurement management, targeting the control of waste production. Green procurement strategies boost a firm's sustainability

performance, assisting them in building a positive market reputation (Ayyaz., 2022). Moreover, eco-friendly procurement practices enhance sustainable performance over time by guaranteeing that businesses procure environmentally mindful products (Bulent et al., 2018). Stemming from these research studies, we propose the subsequent hypothesis:

H2: Green purchasing has a significant impact and influences the sustainability performance within Pakistan's construction sector.

Impact of eco-design on sustainability Performance

Eco-design, as explained by Kuo et al. (2018), is about designing production methods in businesses in a way that reduces harm to the environment and ecosystems. Companies can become more efficient and productive by using eco-design to manage environmental risks related to the production process. This might involve using environmentally friendly energy sources for manufacturing, which can boost the company's productivity (Aziziankohan et al., 2017). Using environmentally friendly raw materials and eco-design principles, the design of green products and processes can reduce the energy and materials used in production. Based on the research mentioned above, we propose the following theory:

H3: The performance of Pakistan's construction industry in terms of sustainability has been identified as being significantly impacted by eco-design.

Impact of green information systems on sustainability performance

According to Bulent (2018), the green information system uses information systems to promote environmentally friendly operations and sustainable performance. This approach improves how businesses act and behave in relation to green innovations and the use of clean energy. In order to help coordinate green supply chain processes, it is an essential component of green supply chain management (Frost, 2019). Green information system deployment improves a company's performance and competitive advantage, which has a beneficial effect on sustainability performance (Kannan et al., 2019). This is partially attributable to its capacity to consume less energy than traditional IT systems. However, the value of Green IT goes beyond merely reducing energy use (Fiem et al., 2023). Natural alternatives will receive more funding, with higher. Hence, the following hypothesis is proposed based on the aforementioned literature:

H4: Green information System greatly influences the sustainability performance within Pakistan's construction sector.

The moderating effect of environmental collaboration on the relationship between green manufacturing and sustainability performance.

Businesses, through environmental collaboration, are encouraged to comply with environmental regulations, thus bolstering the link between green production and sustainable outcomes (Noor et al., 2019). Ayyaz (2022) underlined the correlation between environmental collaboration and Green Supply Chain Management (GSCM) in their research, incorporating data from 347 Pakistani constructions. All types of environmental collaboration are beneficial to all firms without inflicting harm (Noor et al., 2019). In light of the resource-based theory, an increase in accessible resources is necessary to fulfill the growing demand within a green supply chain, thereby boosting sustainability. Organizations are more inclined to excel in sectors like green manufacturing when there's environmental cooperation. Thus, we formulate the subsequent proposition:

H5: The influence of environmental collaboration serves as a moderating factor between green production and the sustainable performance of the construction industry in Pakistan.

The moderating impact of environmental collaboration on green purchases, and sustainability performance

The adoption of green purchasing practices, such as waste recycling and waste management, can be influenced by environmental collaboration within a nation (Habib et al., 2021). By addressing the environmental effects of their activities, this collaborative strategy can direct a company toward long-term sustainability success. According to Abid's research from 2017, sustaining environmental quality and limiting greenhouse gas emissions depend heavily on the effectiveness of business operations and financial growth. Green purchasing skills significantly influence GSCM practices. The resource-based approach contends that green purchases boost demand for green production, giving companies an edge over rivals. As was previously mentioned, environmental collaboration can significantly influence green purchasing. The following idea is therefore put forth:

H6: Environmental collaboration has a moderating role in the connection between sustainable procurement and the sustainability performance within the construction sector in Pakistan.

The moderating impact of environmental collaboration on eco-design and sustainability performance

The employment of eco-friendly production techniques in a business is emphasized by environmental collaboration (Dubey et al., 2015). Environmental collaboration can help companies increase their efficiency and competitiveness by motivating them to avoid harming the environment (Qianli, 2017). Coercive pressure, normative pressure, and mimetic pressure all exert moderating effects to varying degrees, but environmental collaboration has been found to have a significant positive impact on supply chain relationship management and sustainable supply chain design (Habib et al., 2021). These studies show that different levels of environmental collaboration have an impact on supply chain management methods. Based on the above-mentioned studies, the following hypothesis is created:

H7: Environmental collaboration has a moderating role in the connection between sustainable procurement and the sustainability performance within the construction sector in Pakistan.

The moderating impact of environmental collaboration on the green information system, and sustainability performance

Environmental collaboration can prompt companies to adopt green information systems, facilitating environmentally friendly operations. Various countries have launched environmental protection programs, which are successfully implemented by local institutions. The practice of Green Supply Chain Management (GSCM) is strengthened by organizations devoted to internal environmental management across many industries (Ayyaz et al., 2022). The resource-based approach holds that a corporation has a competitive advantage when its resources are valued and irreplaceable. Utilizing green information systems in GSCM procedures helps to improve sustainability performance. The extent of environmental cooperation, however, can have a big impact on this effect (David, 2019). Drawing on these literary discoveries, the study suggests the following:

H8: The theory we're suggesting is that environmental collaboration influences how much a green information system can improve the sustainability of Pakistan's construction industry.

This implies that an increase in environmental cooperation magnifies the impact of the green information system on the industry's sustainability. From our deliberation, we've constructed a theoretical framework to guide our investigation. This is depicted in figure 1: the figure in your study would likely visually illustrate the relationships among environmental collaboration, green information systems, and sustainability performance within the construction industry

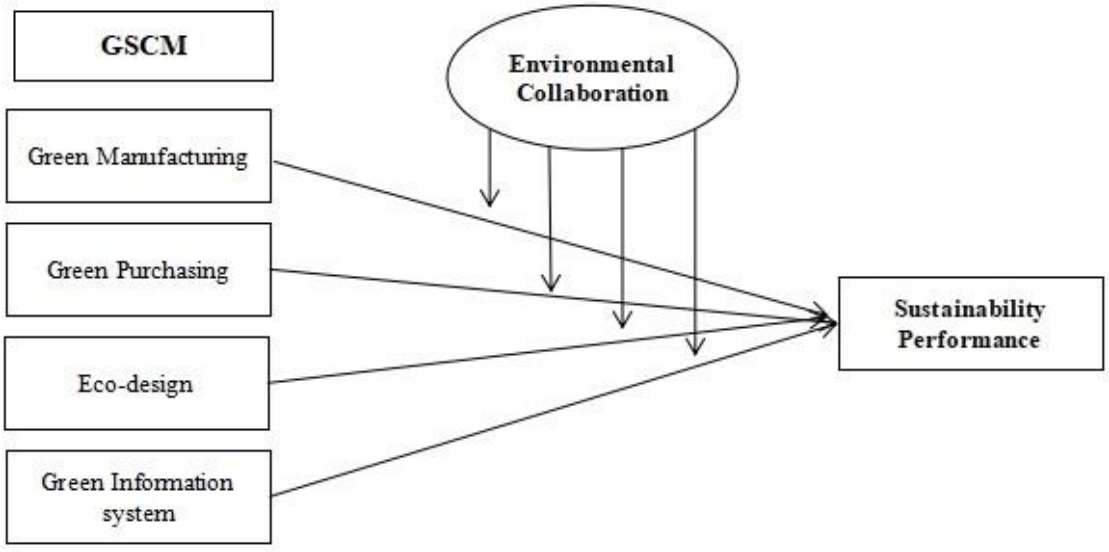

Figure 1: theoretical framework

Research Methodology:

The principal considerations during the data gathering stage of a study pertain to population and sample selection. The population denotes the designated participant group from which the researcher aims to extract data. Essentially, the population symbolizes the cohort of individuals from which the investigator is expected to select a sample for the study (Blerkom, 2008). In scenarios where the total population size is indeterminable, Morgan (1970) proposes that the sample size should be established

at 347. In the current study, a survey method was employed to gather information from the participants via a structured questionnaire. The questionnaire that was used had been sourced from earlier studies and was validated by seasoned professionals in the research field before its use.

Data analysis and results:

In this study, we used different ways to look at the data and understand the relationship between Green Supply Chain Management (GSCM) and sustainable performance. First, we used descriptive analysis. This means we used software called SPSS to calculate basic statistics, like averages and ranges, for our data. Then, we used something called Structural Equation Modeling (SEM) and Confirmatory Factor Analysis (CFA). These are methods that help us see how different variables are related to each other and to hidden factors that we can't directly measure. Lastly, we used regression analysis. This helps us understand how changing one thing (like the use of GSCM) might affect something else (like sustainable performance).

Confirmatory factor analysis:

Table 1 shows the results of a method we used called confirmatory factor analysis. This method lets us see how well our theoretical model fits with the actual data we collected. We checked several values to see how well our model fits. These included the CMIN value, the goodness of fit index, the incremental fit index, the competitive fit index, and the root mean square error of approximation. The CMIN value tells us about the difference between our expected and observed data. A good value is 3 or less. In our study, it was 1.766, which is good. The goodness of fit index gives us an overall measure of how well our model fits the data. A good score is 0.80 or higher, and we got a score of 0.850, which means our model fits the data well. Finally, the root mean square error of approximation measures the difference per degree of freedom. The value we got was 0.048, which is less than the ideal maximum of 0.08. This shows that our model is reliable and valid.

Figure 1 shows a screenshot of the confirmatory factor analysis (Please note that the figure is not provided here but should be included in your report).

CFA indicators	CMIN/DF	GFI	IFI	CFI	RMSEA
Threshold value	≤3	≥0.80	≥0.90	≥0.90	≤0.08
Observed value	1.766	0.850	0.956	0.957	0.048

Table 1: CFA results

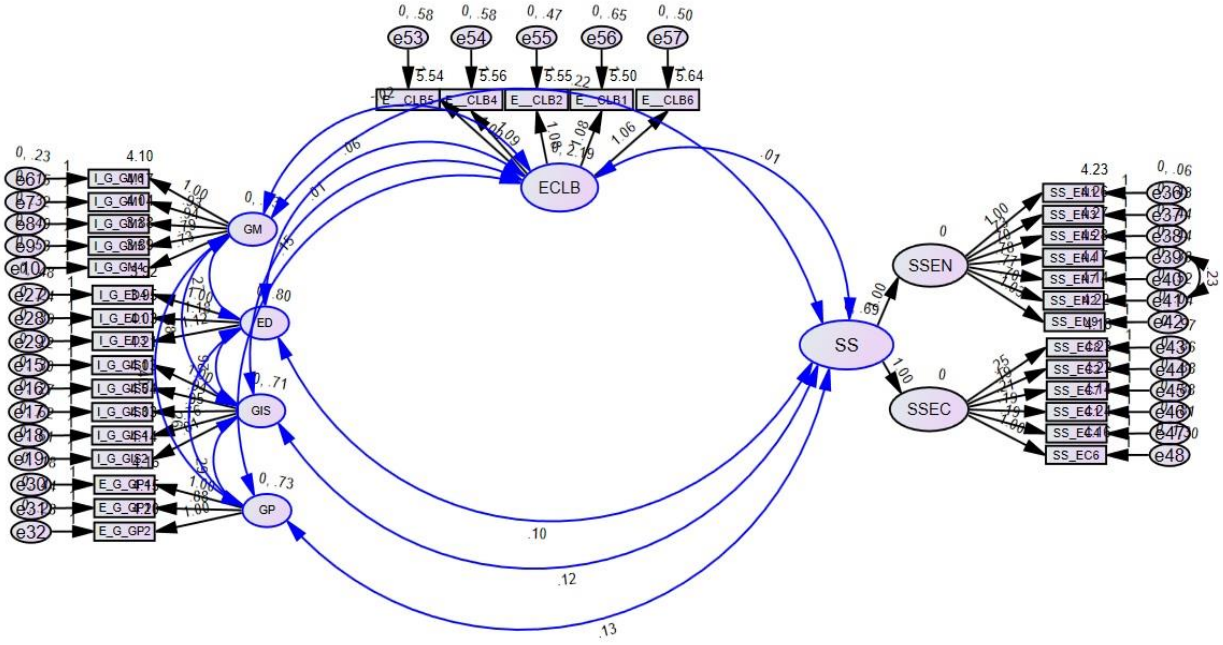

Figure 1: CFA overall Model

Structural equation modeling:

Table 2 shows the results of Structural Equation Modeling (SEM). SEM is a statistical method that helps us understand the relationships between different variables. This approach allows us to see how

multiple variables interact with each other and helps us understand complex relationships in our data. The details of these relationships would be found in the table.

			Estimate	S.E.	C.R.	*P*
Regression						
SP	< —	GM	0.138	0.050	2.633	0.007
SP	< —	GP	0.162	0.057	3.363	0.000
SP	< —	ED	0.321	0.081	3.616	0.000
SP	< —	GIS	-0.010	0.064	-0.167	0.866
Moderation						
ZSstP	< —	IPxGM	0.041	0.038	0.843	0.028
ZSstP	< —	IPxGP	-0.046	0.041	-1.005	0.315
ZSstP	< —	IPxED	0.152	0.012	3.259	0.001
ZSstP	< —	IPxGIS	-0.002	0.041	-0.057	0.955

Figure 2 shows the structural equation modeling's path diagram, which depicts how the variables' direct and indirect effects on one another are represented.

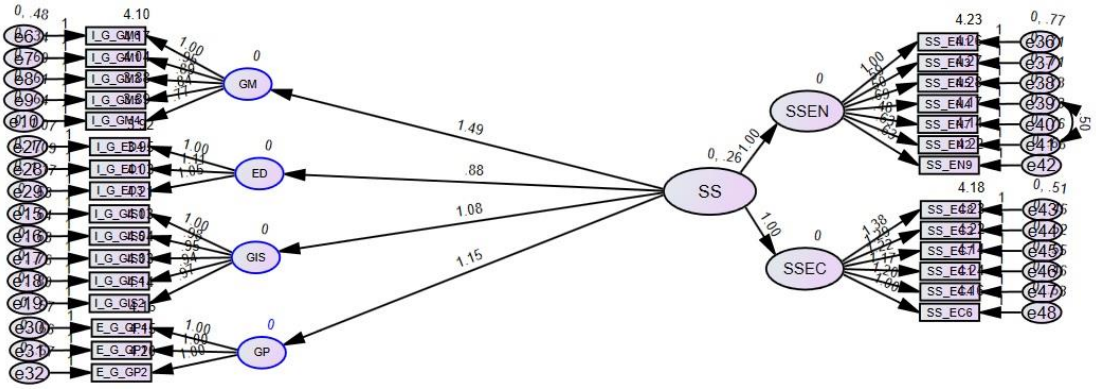

Figure 2: SEM Model

Conclusion and implications of the study:

This study wants to find out how using green manufacturing, buying green materials, using eco-friendly designs, and green information systems can help businesses perform better in terms of sustainability. We're not just looking at how a business impacts the environment, but also how it does its everyday activities. We're also looking at how working together on environmental issues might change things. We're considering this as an influencing factor in our study. In this study, we're mainly focused on sustainable performance. We're interested in seeing if the green practices we mentioned can make a difference. To help us find this out, we've come up with some hypotheses that we'll test.

In this research, we evaluated the premise that "green manufacturing has a substantial impact on sustainability performance," and our findings endorsed this concept. Our results indicated that businesses can enhance their sustainability performance through the increased use of green manufacturing processes. Prior research by Abdul-Rashid et al. (2017) conveyed that production waste and inferior manufacturing practices can create societal issues. They advocated that the adoption of green manufacturing practices can aid businesses in elevating their sustainability performance. Further studies have implied that enhanced sustainability performance can bring about economic advantages for businesses. Fien's 2023 research proposed that green manufacturing might be pivotal for future growth as well. Implementing green manufacturing practices could help businesses prepare for what lies ahead, trim costs, and decrease the volume of waste from production. These findings are also backed by Chin et al. (2015), who suggested that green acquisitions can considerably contribute to economic expansion. This concept has captured considerable interest in recent academic investigations.

Ayyaz Ahmad (2022) extended this discourse by spotlighting the considerable role of sustainable procurement in the economic progression of any economy. Green purchasing entails progressive practices adoptable by any organization striving for sustainability. Given this, the researchers have viewed the link between sustainable procurement and sustainability as both notable and positive. The research further put forth a third hypothesis stating that the "impact of eco-design on sustainable performance is considerable." The analysis of the data produced a significant value that corroborated this claim, thus it was accepted. The outcomes highlight a positive correlation between eco-design and sustainability performance. Relevant literature underscored the pivotal role of eco-

design, functioning as a design strategy for parallel environmental conservation and operational efficiency. In essence, eco-design can be viewed as establishing business processes with an eco-aware approach to mitigate their effects on the environment and society.

The study also suggested that the "impact of green information systems on sustainable performance is insignificant," in line with Ayyaz Ahmad's assertion (2022). However, this hypothesis was refuted in our research due to the trivial value unveiled in the examination. The data couldn't validate a robust linkage between green information systems and sustainability performance. Furthermore, the analysis showed an insignificant moderating role, leading to the rejection of this hypothesis. Essentially, our results indicated a negative value for the correlation between green information systems and sustainability performance.

Significance of the study:

Following is the study significance:

(1) Environmental Protection: The adoption of green practices, such as minimizing the use of hazardous materials, is vital for protecting the environment. This highlights the industry's potential to contribute to global sustainability goals.

(2) Management Engagement: The need for top management involvement indicates that change must come from within the organization. This stresses the role of leadership in driving sustainable changes.

(3) Competitive Advantage: Compliance with environmental regulations can offer a competitive edge, suggesting that sustainability can also be a smart business strategy.

(4) Monitoring and Improvement: The requirement for constant monitoring and control of green initiatives emphasizes the need for an ongoing commitment to sustainability, implying that it's not just a one-time effort.

(5) Applicability to Other Industries: The fact that this study was limited to the apparel construction industry indicates the potential for similar benefits to be reaped in other industries, suggesting a broader applicability of the study's findings.

Overall, underscores the need for and benefits of sustainable practices, not just in construction, but across various sectors, highlighting the universal importance of sustainability in today's business world.

Theoretical implications:

This study examined the correlation between Green Supply Chain Management (GSCM) practices, eco-friendly purchasing and manufacturing, sustainable design, and green information systems, and their impact on sustainability performance within the construction industry. The study also considered environmental collaboration as a moderating factor. The investigation yielded positive and significant results for three direct relationships, and found the two moderating factors to be significant. These findings offer valuable contributions to existing research and can serve as a guide for future researchers and policymakers, especially those involved in the construction sector and broadly within all corporate entities of the country. To expand our knowledge further, a comparative study could be pursued within other industrial sectors, thereby enriching the understanding by juxtaposing these findings with those of the current study.

Discussion of the study:

The findings of this research show the need for more green, or eco-friendly, practices in the construction industry. Using less harmful materials helps protect the environment and meets the growing demand from people who want businesses to be more sustainable. It's important for leaders in these companies to get involved. They can help make big changes in how things are done, and create a company culture that values sustainability. Also, it's good for businesses to follow environmental rules. This can give them an edge over competitors, as people and governments are caring more about protecting the environment. Finally, businesses need to check and manage how well they're doing with their green practices. This can make sure they're really making a difference.

Limitations and future research directions:

Future research in the construction sector is necessary to delve deeper into the findings of this current study, especially when contrasted with similar investigations. To expand the range of future investigations, the incorporation of one or two innovative variables into the existing model is recommended. However, there were notable limitations in this study. Primarily, it was self-financed with no sponsorship contributing to the execution of the research. Data collection was solely reliant

on the contributions from project directors, engineers, consultants, and employees within the construction industry, which formed the basis for the subsequent analysis and interpretation. Furthermore, this study is limited as it only reports findings from a single sector, emphasizing the need for a more expansive scope in future research.

Recommendations:

Drawing from the study's outcomes, it is recommended that the construction industry implements green practices to curtail the use of hazardous and toxic materials. The study also suggested various measures such as enhancing the involvement of top management, adhering to environmental regulations, and actively monitoring and controlling green supply chain initiatives. Despite being confined to the Export Development Board-registered apparel construction industry, the insights gained from this study hold potential for application in other industrial and service sectors. Thus, extending this research to other domains could yield valuable information about sustainable practices across various sectors.

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