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Abstract

Purpose: The garments/textiles industry is the second most polluting industry in the world. However, efforts to understand and curtail its adverse environmental impacts have not been commensurate, and previous works have largely been fragmented and disjointed. Therefore, a comprehensive and systematic green supply chain management (GSCM) investigation on this industry was necessary and is the focus here, where a multidimensional framework involving green supply chain practices and performance is developed, validated, and applied.

Design/methodology/approach: A framework consisting of twelve constructs (eight on practices and four on performance) and their underlying measures were developed through an extensive literature review. A survey methodology was used to obtain responses from 403 garment-manufacturing firms in Bangladesh, one of the leading garment producers in the world. Confirmatory factor analysis and structural equation modeling were used first to validate the first and second-order constructs and then test the hypothesized relationships.

Findings: Internal environmental management (IEM) and cooperation with stakeholders were identified as necessary precursors to implementing the second-order green supply chain practices comprising green design, green purchasing, green manufacturing, green transportation, green facilities, and end-of-life management. The implementation of green supply chain practices was found to have a (direct) positive impact on environmental, economic, and operational performance and an indirect positive impact on organizational performance. Similarly, both economic and operational performance was found to impact organizational performance positively. Surprisingly, a negative relationship (albeit low) was observed between environmental and organizational performance. Also, garment-manufacturing firms were found to have been unable to translate their IEM capabilities into strategic and long-term cooperation with stakeholders.

Research limitations/implications: The study fills a gap in the literature about applying/implementing GSCM in the garment industry. Future studies in the garment industry and elsewhere could utilize the framework to understand further the synergistic impact of green supply chain practices on performance.

Practical implications: The findings provide practitioners, policymakers, and organizations associated with the garment industry with critical insights on the various opportunities and challenges in adopting GSCM. Also, the positive impact of green supply chain practices on performance could provide the impetus for manufacturing firms to adopt GSCM.

Originality/value: A comprehensive GSCM investigation on the garment industry has not been previously attempted and constitutes the novelty of this work. Also, Bangladesh is the second-largest garment exporter worldwide, making this study contribution even more valuable.

Keywords: Green supply chain management, Garments, Bangladesh, Environmental, Economic, Operational, Organizational performance

1. Introduction

Environmental sustainability is a significant challenge of the twenty-first century (Balasubramanian and Shukla, 2020), where the case of garments/textiles, the second most polluting industry globally, is particularly concerning. Garments account for 10% of the carbon emissions (GHG), 20% of the industrial wastewater, and 4% of the solid waste globally; they also consume significant amounts of resources: around 93 billion cubic meters of water, 130 million tons of coal, and 30-35% of the chemicals annually (World Bank, 2019). With “fast fashion” continuing to be a rage (an average consumer now purchases 60% more items of clothing than in 2000, with each garment, kept for only half as long (World Resources Institute, 2019)), coupled with population-increase-based-demand-growth (demand is expected to increase from 60 to over 100 million tons by 2030 as per EIA-IEO (2013)), environmental degradations from this sector are only going to become worse in the future. Drastic remedial actions are therefore needed.

Garments' environmental implications are spread across their complex, globally dispersed supply chains: from raw material cultivation/processing to yarn/fiber, fabric, and garment production stages, to distribution, consumer wear, and end-of-life management of these garments (Pulse of the Fashion Industry, 2017). Greening of the sector, therefore, requires a supply-chain-wide perspective or what is referred to as green supply chain management (GSCM) (Srivastava, 2007; Balasubramanian and Shukla, 2017a). This means considering green practices’ implementation across each supply chain stage along with the associated environmental, operational, and short-term economic (cost) and long-term organizational performance implications (Green Jr et al., 2012; Khan and Yu, 2021). However, such an approach is missing in previous studies on garments.

Studies on this sector have only looked at specific aspects such as green design (Aakko and Koskennurmi-Sivonen, 2013), or green sourcing (Arrigo, 2020), or green manufacturing (Alay et al., 2016), or specific environmental performance outcomes from green practices such as carbon emissions (Bevilacqua et al., 2014) and garment waste (Alom, 2016). Others, such as Laitala et al. (2018), have attempted life cycle analysis (LCA) based on several assumptions and scenarios. This insufficient understanding means that policymakers and practitioners could (mistakenly) be addressing the wrong issues and ignoring the ones requiring greater attention. For example, which green practices are lagging behind others for garments is unclear. A clear understanding of the different green practices across the supply chain is essential, given that even a single environmentally-lagging stage (e.g., green design) could adversely affect the entire supply chain and its greening efforts. Similarly, it is unclear if going “green” improves the financial performance (e.g., in market share and profitability terms) or the improvement is only on the environmental front. This understanding is critical because many developing countries adopt green and sustainable practices to endure the global competition (Khan et al., 2021a).

The garment sector could benefit from a comprehensive investigation covering all key green practices’ implementation across the supply chain and their different performance impacts. Also, the relevance will be even more significant in developing countries that have started to realize the importance and benefits of green supply chain management but have witnessed limited investigation compared to developed countries (Khan et al., 2021a).

This forms the focus of this study, where a multidimensional GSCM framework for garments is first developed and then validated and applied to the Bangladeshi context. The specific objectives are:

- To develop and operationalize the green practices and green performance (GSCM) constructs for the garment sector
- To formulate the key interrelationships between these constructs and represent them in the form of a GSCM assessment framework
- To empirically test, validate, and apply the framework to Bangladesh's garment sector

The rest of the paper is presented as follows. The garment supply chain and its environmental implications are discussed in the next section. In section three, previous green-related studies on garments and those from other related sectors (e.g., manufacturing) are reviewed to develop the GSCM constructs. In section four, we propose a GSCM framework along with the relevant hypotheses. The research setting (of Bangladesh), its rationale, and the research methodology are discussed in sections five and six, respectively. The findings are explained in section seven, followed by implications in section eight. The study concludes in section nine with limitations and suggestions for future research.

2. The Garment Supply Chain and its Environmental Implications

The garment supply chain and activities, along with their environmental implications, are presented in figure 1. Some of these environmental implications are:

- Cotton cultivation requires up to 20,000 liters of water per kg (World Resources Institute, 2017)
- Around 10-16% of the natural raw fibers are wasted during the spinning process (Moazzem et al., 2018)
- The textile-dyeing process involves significant water consumption and pollution; for example, dyeing a pair of jeans requires around 2000 gallons of water, with the post dyeing water discharge typically going into local water systems and releasing heavy metals and other toxicants (World Economic Forum, 2020)
- The distribution of fast fashion garments by air involves significant emissions (Moazzem et al., 2018)
- Fast fashion garments are typically burnt or disposed of in a landfill; estimated to be a full truck per second globally as per the World Economic Forum (2020)
- The synthetic materials used in the garments take hundreds of years to degrade (200 years for polyester), and during this decomposition period, it continuously leaches into the soil and groundwater and polluting them

The above aspects highlight the seriousness of the environmental implications from this sector and the need for a GSCM oriented intervention.

Figure 1

3. Developing GSCM constructs and measures for the garment sector

Although the current understanding of GSCM in the garment sector is limited and disjointed, they provide a good starting point. Ideas were also borrowed from other related sectors such as manufacturing and chemicals that have seen significant GSCM-oriented investigations. Finally, secondary data from government and industry websites, reports, news articles, and magazines were also considered to ensure that the constructs and measures are practically relevant. Each of the constructs is individually discussed below.

3.1. Green Supply Chain Practices

The main goal of GSCM is to ensure efficient, effective, and extensive implementation of 'green supply chain practices or activities/initiatives to reduce the environmental footprint across the supply chain stages (Balasubramanian and Shukla, 2020). The green supply chain practices identified to be relevant for the garment sector are:

3.1.1. Green design

A significant part of a product's environmental impact is decided during its design stage. Therefore, environmentally-friendly design or green design is critical to lead a business towards greening its entire supply chain (Zhu and Sarkis, 2004; Khan and Yu, 2021). For instance, green design helps reverse logistics and waste reduction through reprocessing, reproduction, and refurbishment. It also helps in green purchasing and manufacturing (Khan and Yu, 2021; Khan et al., 2021b; 2021c). Not surprisingly, garment designers and clients face increasing pressure since their design is linked to other supply chain activities such as material sourcing, production methods, and end-of-life material recovery and recycling (Aakko and Koskennurmi-Sivonen, 2013). For example, considering natural or low environmental impact fibers (e.g., organic cotton) at the design stage has a positive life-cycle environmental impact. On the other hand, synthetic fibers are associated with significant emissions, and therefore considered environmentally damaging. For example, as per a study by the Chalmers University of Technology in Sweden, a polyester dress is associated with 17kg of carbon dioxide emissions compared to 2 kilograms of a cotton t-shirt (BBC, 2020). The choice of the fiber in garments also determines the extent of recycled content that can be used, its longevity, the extent of waste generated during manufacturing, the nature of the dyeing process and the choice of chemicals (with different environmental toxicity) used, the energy and water consumption during use (through ease of washing and drying), and its end-of-life recyclability (Pulse of the Fashion Industry, 2017). Therefore, garment companies' design teams spend considerable time and effort in evaluating the environmental impacts of alternative materials; e.g., Nike has developed a 'material sustainability index' to help assess the environmental impacts of over 57,000 different materials (Pulse of the Fashion Industry, 2017).

3.1.2. Green purchasing

Green purchasing or inclusion of environmental considerations in purchasing policies and actions (Varnas et al., 2009) involves purchasing environmentally friendly materials such as materials that are recycled, non-toxic, and low embodied energy (Balasubramanian and Shukla, 2017a). It also emphasis selecting suppliers based on their environmental performance and cooperating with suppliers to purchase eco-friendly materials that reduce the harmful effect on the environment (Khan et al., 2021b). For garments, this means choosing suppliers/supplier materials/products with eco-labels such as the Eco-management and Audit Scheme (EMAS) certification and Global Organic Textile Standard (GOTS); also, choosing environmentally vetted suppliers with this vetting extending to lower tiers (Pulse of the Fashion Industry, 2017). Further, collaborating/cooperating with existing and long-term suppliers to develop green products (Green Jr et al., 2012).

3.1.3. Green manufacturing

Green manufacturing involves the planning and deploying innovative environmental processes and technologies in manufacturing (Mutingi et al., 2014) to minimize material, energy, and water consumption and limit associated emissions and waste generation (Khan and Yu, 2021; Khan et al., 2021c). Garments have a long manufacturing process covering yarn, fabric, and garment manufacturing; around 47% of the sector's environmental impact arises at this stage (Pulse of the Fashion Industry, 2017). These impacts can be reduced by achieving the "three R's"—reduce, reuse, recycle through better process control. This includes optimization of resource usage through material substitution to replace existing material with more environmentally friendly and less hazardous ones; replacement/up-gradation of old manufacturing equipment with new, more energy-efficient ones; and use of more modern and efficient process technologies (Toprak and Anis, 2017). Manufacturers have started to use - advanced 'Emission Control Systems' to capture emissions that are very difficult to control using standard filtration systems; energy-efficient equipment/motors for spinning yarns; renewable energy such as solar to operate the machines; and installation of wastewater recycling technology (Singh et al., 2019).

3.1.4. Green facilities

Green facilities are resource and energy-efficient facilities (e.g., manufacturing, warehousing, and retailing) with lower environmental footprints than conventional facilities (Khan and Yu, 2021). The garment supply chain can benefit from green facilities/buildings that use solar panels, energy-efficient heating, lighting, and air-conditioning systems, including natural options and efficient thermal insulation systems (USGBC, 2017). More facilities, especially newer ones in the garment sector, are opting for the Leadership in Energy and Environmental Design (LEED) certification by the United States Green Building Council (USGBC). For instance, Bangladesh has the highest number of LEED Platinum-certified (highest environmental rating) garment factories globally (The Daily Star, 2019). Nike's warehouse facility in Belgium uses 100% renewable energy from its own wind turbines and solar panels (Pulse of the Fashion Industry, 2017).

3.1.5. Green transportation

These are practices to make transportation activities more environmentally sustainable (Balasubramanian and Shukla, 2017b). It includes the selection of environmentally friendly modes of transport and the use of energy-efficient vehicles (Khan and Yu, 2021). The garment sector involves significant transportation of raw materials, semi-finished and finished goods, typically across countries given the globalized nature of the garment supply chain, as shown in Figure 1. Therefore, transport-mode-related decisions are critical because air shipments cause 40 times more CO_2 emissions than container ships (World Shipping Council, 2020). Similarly, rail transport has a significantly lower environmental footprint than road/truck. Also, with regards to trucks, their optimal routing, full loading, use of energy-efficient (electric/hybrid), new vehicles choices, and their periodic maintenance all have the potential to reduce further the environmental impacts (Moazzem et al., 2018; Balasubramanian and Shukla, 2017a, 2017b).

3.1.6 End-of-life management

It refers to the environmentally friendly management of a product at the end of its useful life (Srivastava, 2007) and includes reverse logistics and circular-economy-based activities to maximize the recovery of the valuable elements and eco-friendly disposal of the rest (Sarkis, 2012; Khan et al., 2021b; 2021c). This includes breaking the product down into its component and melting, smelting, or reprocessing them into new forms (Khan et al., 2021b; 2021c).

In the case of the garment sector, end-of-life management is critical, given that only 1% of garments are recycled, while the remaining 99% are either burned or dumped in a landfill (World Bank (2019). Retailers and brands are starting to take initiatives to prevent customers' unwanted clothes from going to landfills. For example, H&M has implemented a garment collection scheme at its retail stores with the collections then sold as second-hand goods or reused/recycled if un-wearable (H&M, 2020). Guess has similarly launched a 'Wardrobe Recycling Program' in the US in partnership with i:Collect to collect, sort, and recycle clothes (Business Wire, 2018). The focus is now also on the packaging used in the deliveries given the increased online sales; global brands have started collecting the packaging used in the deliveries and reusing and recycling it. For example, clothing brand Toad & Co has replaced cardboard boxes with recycled vinyl packages that customers can return upon delivery (Vogue Business, 2020). Packaging waste is also an issue with the delivery of raw and semi-finished materials. Again, these could be recycled by the manufacturers themselves or sent back to the suppliers for reuse/recycling through a take-back scheme. This is also true for unwanted or excess purchased materials (yarn, fabrics, chemicals, dyes, etc.).

3.1.7 Internal Environmental Management (IEM)

Internal environmental management (IEM) is intra-firm facilitating practices to build internal resources and capabilities to realize environmental goals (Green Jr et al., 2012; Zhu et al., 2012). Garment firms could benefit from implementing IEM (Khan, 2016). IEM includes implementing Environmental Management Systems (EMS) and achieving ISO14001 certification (Balasubramanian and Shukla, 2017a). Also, regular environmental training programs for employees help them better understand their environmental obligations, enable self-assessment of facilities and improve compliance with environmental regulations (Sharpe, 2017). Environmental auditing can similarly help garment sector firms track non-compliance with environmental standards and ensure the achievement of environmental targets (Zhu and Sarkis, 2004; Zhu et al., 2008). The same studies have also shown green practices' implementation success to be intensely dependent on the strength of cooperation between departments and functions. For instance, design and manufacturing decisions are strongly interrelated, including from an environmental perspective; effective collaboration between them, therefore, enables a more holistically optimized (and consequently better) environment-related decision-making. Finally, green-related research and development are critical to developing innovative design, processes, materials, and environmentally superior products (Balasubramanian and Shukla, 2017a).

3.1.8 Cooperation with stakeholders

Cooperation and coordination between supply chain stakeholders (suppliers, manufacturers, and buyers) are identified as necessary for successful green supply chain practices implementation (Zhu et al., 2008; Zhu et al., 2012). Such cooperation, in the case of the garment sector, could be with the buyers (to improve environmental design standards), with the manufacturers (to improve green manufacturing practices), and with the suppliers for energy-efficient product transportation, green packaging, take-back of packaging waste and return of excess/unwanted input materials (Zhu et al., 2012; Yu et al., 2014). According to Mazumder et al. (2013), cooperation between stakeholders through sharing knowledge, information, risks, and benefits is an important strategic activity for greening the garment sector. For instance, collaboration/cooperation between manufacturers and buyers during the design stage significantly improves the manufacturing process on material and energy consumption and waste reduction (Pulse of the Fashion Industry, 2017).

3.2. Performance Benefits of GSCM

While GSCM's primary objective is to improve environmental performance (Zhu and Sarkis, 2004), a narrow focus on it alone could be detrimental to other performance aspects such as operational and short and long-term financial performance (Green Jr et al., 2012; Balasubramanian and Shukla, 2017a). A balanced perspective vis-a-vis the different performance aspects is therefore needed.

3.2.1 Environmental performance

It refers to the ability of firms to mitigate the environmental impacts of their operations (Khan et al., 2021b; Khan and Yu, 2021). The garment sector is responsible for significant carbon emissions and solid waste generation, as well as nitrous oxide emissions (300 times worse than CO2); also other air emissions like dust and lint, oil fumes, acid vapor, solvent mists, odor, and boiler exhausts (Toprak and Anis, 2017). Untreated wastewater from garment factories, which typically contains toxic substances such as lead, mercury, and arsenic, among others, and is dumped into the rivers, is another significant concern (Sustain your Style, 2020). Around 70% of the rivers and lakes in China are contaminated by wastewater generated by the garment industry (Ecowatch, 2017).

Another area of concern is the significant use of toxic chemicals for dyeing, bleaching, and wet processing of garments, also in farming and the production of raw materials. Cotton farming uses 24% and 11% of the insecticides and pesticides produced globally (World Resources Institute, 2017). Previous studies have reported that the frequent application of chemical fertilizer and harmful pesticides on agricultural plants have caused severe pollution of our food and living environment and potential harm to human beings (Yu and Khan, 2021). Finally, the garment production plants, especially in underdeveloped countries, are prone to frequent environmental accidents such as breakages, leaks, and fire (Shaik et al., 2019).

3.2.2 Economic performance

Economic or cost performance refers to the nature and extent of a firm's capability to minimize costs from implementing green practices such as through reduced material and energy consumption, lower cost of waste discharge and treatment, and fewer fines for environmental accidents (Zhu et al., 2008; Green Jr et al., 2012; Vijayvargy et al., 2017; Balasubramanian and Shukla, 2017a; Khan et al., 2021b; Khan and Yu, 2021). For instance, during manufacturing, water, energy, and chemicals costs can be reduced through reuse of water, steam condensate, and recovery of heat from the hot rinse water (NRDC, 2010). The potential to improve on each of these cost aspects for garments is enormous. According to estimates, more than 500 billion USD of value is lost each year due to the underutilization of clothing and lack of recycling (UN Alliance for Sustainable Fashion, 2020).

3.2.3 Operational performance

Several operational performance elements associated with green practices implementation are identified for manufacturing organizations, including for garments. They include increased efficiency with lower inventory and scrap levels, increases in product quality, product lines, and capacity utilization, and improved on-time delivery performance to customers (Zhu et al., 2008; Green Jr et al., 2012; Zhu et al., 2013).

3.2.4 Organizational performance

It captures the overall financial and marketing performance impacts/benefits of green practices for the organization (Khan and Yu, 2021). For instance, the adoption of green practices helps firms to build a positive image and reputation and increase their market share (Khan and Yu, 2021). Similarly, green practices translate into repeat buying of eco-friendly products and hence help in increasing sales and expanding market size (Khan and Yu, 2021; Khan et al., 2021b). The relevant performance aspects, as per the literature, including for garments, include increases in return on investment, sales, sales price, profits, and market share (Green Jr et al., 2012; Balasubramanian and Shukla, 2017a).

The above 12 constructs form the core of the proposed comprehensive GSCM framework. Such a framework has not been previously suggested/studied for the garment sector and constitutes a key contribution of this work. The underlying measures to capture these 12 constructs were synthesized from various studies highlighted in the above literature and are shown in Table 2.

4. Conceptual framework and hypotheses

The next stage is to understand the relationships between the constructs. This enables a practical understanding of both the scope of the problems and the opportunities GSCM (for the garment sector in this case). However, no GSCM-related framework is available in the literature for the garment sector. Hence, we reviewed frameworks from other sectors to develop the framework and related hypotheses for the garment sector (De Giovanni and Vinzi, 2012; Green Jr et al., 2012; Zhu et al., 2012; Zhu et al., 2013; Balasubramanian and Shukla, 2017a). The novel framework and hypotheses developed for this study are given in Figure 2.

Figure 2

4.1. Internal Environmental Management and Cooperation with Stakeholders

One of the major tenets of supply chain management is the cooperation/coordination among internal and external stakeholders across the supply chain. Previous GSCM studies have highlighted that cooperation with external stakeholders may not be successful without proper IEM (Zhu et al., 2012). Also, firms with well-developed intra-firm level coordination have a greater capability to develop/strengthen strategic and long-term cooperation with external stakeholders (Gonzalez et al., 2008; Zhu et al., 2013). Conversely, failure to coordinate across the inter and intra-organizational levels can cause poor performance and high coordination costs (Zhu et al., 2012). According to Green Jr et al. (2012), a firm looking at GSCM implementation must first focus its efforts internally and establish the environmental sustainability imperative among its employees; only then should it seek to expand its efforts on cooperating with external customers and suppliers. Similarly, De Giovanni and Vinzi (2012) highlighted that IEM promotes efficiency and synergy within organizations. When firms are internally green, implementing collaboration across organizations on environmental programs is less problematic. Therefore, we posit that:

H1: Internal environmental management positively impacts cooperation with stakeholders

4.2. Internal Environmental Management and Green Supply Chain Practices

Similar to H1, past studies have shown that once environmental sustainability is established as a strategic imperative and receives commitment and support from the employees and management, the organization can implement green supply chain practices (Green Jr et al., 2012). In fact, IEM has been identified as a necessary precursor to successful green supply chain practices implementation (Balasubramanian and Shukla, 2017a). As per Zhu et al. (2013), ‘having your house in order’, i.e., building internal environmental capabilities, usually sets the stage for enhanced green supply chain practices implementation. For the garment sector, knowledge of this relationship would enable the respective practices to be appropriately sequenced and applied to have an overall efficient and effective implementation. We, therefore, propose that:

H2: Internal environmental management positively impacts green supply chain practices (implementation)

4.3. Cooperation with Stakeholders and Green Supply Chain Practices

According to coordination theory, organizational practices such as GSCM are coordinated through the networks of communications and relationships that exist among inter-organizational actors and the strength of those networks (Zhu et al., 2012). Khan and Yu (2021) emphasized the importance of cooperation between all stakeholders for the effective implementation of green practices. For example, the success of green design mandates external cooperation with other stakeholders throughout the supply chain. Therefore, it could be argued that greater cooperation and coordination with supply chain partners is critical for implementing green supply chain practices in the garment sector. Hence our proposition is that:

H3: Cooperation with stakeholders positively impacts green supply chain practices (implementation)

4.4. Green Supply Chain Practices and Performance

4.4.1 Green supply chain practices and environmental performance

Generic empirical studies that have explored the relationship between green supply chain practices and environmental performance have mostly found a positive relationship between the two. For instance, Geng et al. (2017) observed a positive relationship (though of moderate strength) in a meta-analysis of 50 relevant studies. The authors found that the extent to which green supply chain practices impact environmental performance depends on the extent and the efficiency and effectiveness of the green practices. Similarly, a recent study by Khan and Yu (2021) in the manufacturing sector revealed that green supply chain practices significantly improve firms' environmental performance. Given that the implementation of GSCM in the garment sector is relatively recent, the findings will provide valuable insights on whether associated investments are generating the desired environmental results. Therefore, we propose that:

H4: Green supply chain practices positively impact environmental performance

4.4.2 Green supply chain practices and economic performance

There is insufficient clarity/consensus in the generic literature that green supply chain practices necessarily improve economic performance (Green Jr et al., 2012; Zhu and Sarkis, 2004), though a recent study by Balasubramanian and Shukla (2017a) found a positive association between the two. Knowledge of this relationship is important for the garment sector because it will provide a strong impetus for firms to implement green supply chain practices if found to be positive. Conversely, these firms, especially in low-cost locations like China and Bangladesh, would be reluctant to implement green supply chain practices if they adversely affect cost performance and competitiveness. Hence we propose:

H5: Green supply chain practices positively impact economic performance

4.4.3 Green supply chain practices and operational performance

Managers would be reluctant to implement new practices or make changes to existing ones, including green-related, if they are found to adversely affect their organization's operational performance. Several studies that have explored this relationship in the manufacturing sector, where operational performance is critical, have found it to be mostly positive (e.g., Geng et al., 2017; Zhu et al., 2012). We expect a similar positive relationship for the garment sector. For example, garments made of organic cotton that do not involve the use of chemicals (and hence environmentally superior) are quality-wise also superior (softer and more durable) than those made from conventional cotton (The Sleep Sherpa, 2017). Hence we propose:

H6: Green supply chain practices positively impact operational performance

4.4.4 Environmental, economic, operational performance, and organizational performance

Understanding the nature of these relationships is crucial as they provide a composite and long-term picture of the benefits of green supply chain practices, thereby enabling long-term investment decisions in these practices to be justified. For instance, improvement in a firm's environmental performance gives it a marketing advantage (better brand/corporate image), that in turn improves its organizational performance through increases in sales and market share; such firms can then expand their markets or displace competitors that are not invested in green supply chain practices (Rao and Holt, 2005; Balasubramanian and Shukla, 2017a). This is relevant for the garment sector, where leading global buyers (e.g., H&M, Zara), who are facing criticism of poor environmental practices of their second and lower-tier suppliers, are increasingly looking to place orders with those with proven environmental track records (CNBC, 2020). Often, one of the pre-condition for firms from developing economies such as Bangladesh to export to foreign markets, especially Western developed markets, is to meet a certain threshold in terms of the environmental performance of their supply chain (Ben Brik et al., 2013). Given the significance of export revenue to these firms, they need to demonstrate supply chain greening as as an integral part of their export strategy. Further, at the individual consumer level, as per a study, around 66% of global respondents aged 15-20 are willing to pay more for products and services from socially and environmentally committed companies (Nielsen, 2015). Previous studies in the manufacturing sector have found strong support for the relationship between environmental and organizational performance (Green Jr et al., 2012; Khan and Yu, 2021; Khan et al., 2021b; 2021c). Hence we hypothesize:

H7: Environmental performance positively impacts organizational performance

Similarly, an improvement in economic performance can enable organizations' to recover their investments quickly, thereby improving their return on investment. Further, a reduction in costs can directly translate to an increase in profits for the firm. Although we did not find strong support for this relationship (between economic and organizational performance) in the earlier literature (Green Jr et al., 2012), recent studies have shown a positive relationship between the two in the manufacturing sector (Khan and Yu, 2021; Khan et al., 2021b; 2021c). We expect it to be positive for the garment sector, given the significant cost reduction potential there. Hence, we propose the following:

H8: Economic performance positively impacts organizational performance

Finally, it is well known for any organization that operational performance improvement leads to improvement in organizational performance. In the GSCM context, Green Jr et al. (2012) found a strong positive relationship between the two in the manufacturing sector. For instance, on-time delivery of quality products to buyers/ customers enhances satisfaction/goodwill and increases sales and market share. A similar positive relationship can be expected for the garment sector. The increasing demand for sustainable clothing (Forbes, 2019) and consequent increase in sustainable product lines is likely to increase sales, sales price, and market share. Finally, improving capacity utilization and reducing inventory levels are known to boost profits and enhance organizational performance. Hence, we posit that:

H9: Operational performance positively influences organizational performance

5. Research Setting

The ready-made garment (RMG) manufacturing sector is predominantly based in low-cost emerging economies. We have chosen Bangladesh as the research setting as it is one of the largest producers and exporters of RMG (second highest in the world after China) (Sarkar et al., 2020). It contributes to approximately 80% of the total export earnings of Bangladesh (Ali et al., 2021). It is also interesting from an environmental perspective; its growth has come at the expense of lax industrial standards. Bangladesh struggles at 162 out of 180 countries on the Environmental Performance Index (EPI, 2020), which is primarily based on its RMG sector. For instance, the garment sector has, directly and indirectly, affected more than 200 rivers through pollutants discharge and played a significant role in groundwater depletion and energy scarcity (Restiani, 2016). However, it now faces pressure from its customers (leading multinational brands and retailers such as H&M and Levi's) who have committed themselves to be more environmentally responsible (Forbes, 2020). Therefore, significant environmental initiatives have been taken there recently, both by the government and the RMG sector. For instance, more than 90 garment factories have received LEED certification, with hundreds of others waiting to do so. Several of these have also won the Green Factory Award for their contributions to environmental sustainability (The Daily Star, 2019). Therefore, the Bangladesh RMG sector provides an ideal context to understand the adverse environmental impacts from the sector's growth and initiatives to lessen those impacts. With the garment sectors of many other emerging economies being in a similar situation, the learnings from this study would be relevant to them.

6. Methodology

A survey-based approach was used to test the framework and hypotheses. The underlying measures for each construct (see Table 2) were organized in the form of a survey questionnaire with a 5-point Likert scale ranging from strongly agree (5) to strongly disagree (1) being used to capture the responses. The survey instrument was pre-tested with five experts (two academics and three industry professionals) with knowledge/experience of the garment sector. The pre-test process with the participants involved checking the relevance/appropriateness of the questions and their readability and ease of understanding from a real-world perspective (Balasubramanian and Shukla, 2017a). After incorporating their suggestions, a pilot survey with 31 participants was conducted, which provided valued insights on the response rate, dropout rate, and average time for the survey completion. Also, useful suggestions were also obtained on the open-ended questions, survey length, and the order of questions. The survey measures used are provided in Table 2.

For conducting the survey, the 4363 Bangladeshi RMG manufacturing organizations registered with the Bangladesh Garment Manufacturer and Exporter Association (BGMEA) were considered because BGME is one of the largest trade associations in the country representing the RMG industry. Hence, members of the association are a good representative sample of the Bangladesh RMG industry (BGMEA, 2018). The participants' email and phone numbers were obtained from the BGMEA website. The survey instrument with demographic questions (See Table 1) and GSCM measurement scale (see Table 2) was sent via email to all members of the BGMEA list, along with an invitation letter and consent form to participate in this research study. QuestionPro survey platform was used for this study. To improve response rate, in addition to reminder emails, the researcher also contacted most firms over the phone to remind them of the survey and provide clarifications if required regarding the study. The overall data collection process took five months to complete.

A total of 422 responses were obtained, a response rate of approximately 10%, comparable to other GSCM studies such as De Giovanni and Vinzi (2012) – 10%, Green Jr et al. (2012) – 8%, and Chiou et al. (2011) – 7.9%. Of these responses, 19 were removed due to incompleteness, leaving 403 usable responses for analysis. This sample size was greater than the recommended 354 responses obtained from the sample size calculation at a 95 percent confidence level and 5 percent margin of error (SurveyMonkey, 2020). The demographic characteristics of the survey participants are provided in Table 1.

Table 1

The obtained sample size was sufficient to conduct structural equation modeling (SEM) to test the study hypotheses. Previous studies have recommended using PLS-SEM in a similar context, given that it is a reliable procedure to deal with complex models and can handle the problem of non-normal data distributions associated with survey data (Khan et al., 2021b; Khan and Yu, 2021).

However, before we executed the partial least squares structural equation modeling (PLS-SEM) to test the study hypotheses, we ran the prerequisite Kaiser-Meyer-Olkin (KMO) test for sampling adequacy and Bartlett's test of sphericity, which is used to test the null hypothesis that the correlation matrix is an identity matrix. An identity correlation matrix indicates that the variables are unrelated and not suitable for factor analysis. A statistically significant result ($p<.05$) indicates that the correlation matrix is indeed not an identity matrix and hence rejects the null hypothesis (Michael et al., 2020). The Kaiser–Meyer–Olkin sampling adequacy measures of this study were 0.706, above the recommended 0.70, thus indicating that factor analysis will yield distinctive and reliable factors (Michael et al., 2020). The results of Bartlett's test of sphericity (Approx Chi-square 20659.1, df = 2145) rejected the null hypothesis at $p <.001$, reaffirming that the factor analyses were appropriate.

Next, it was essential to ensure that the data collected was valid and reliable. As seen in Appendix 1, all the measures considered in the study are sufficiently normally distributed with skewness and kurtosis coefficients within the acceptable -2 and +2 range (Green Jr et al., 2012).

Further, the data was checked for common-method bias (CMB), a potential problem because the survey data involving multiple constructs were gathered from a single respondent per firm (Lee et al., 2013). This was tested using the Harman's single factor test, the most widely used method to check for common method bias (Podsakoff et al., 2003). If the majority of the variance (>50%) is explained by one factor, then CMB exists (Podsakoff et al., 2003). The results of the exploratory factor analysis by constraining all items to one factor revealed that the total variance was only 21.3%, demonstrating that CMB was not an issue in this study.

7. Findings and Discussion

Before proceeding with the main analysis, it was essential to establish the statistical appropriateness of the first and second-order constructs of the framework. The unidimensionality of the GSCM constructs was determined using convergent and discriminant validity. The Cronbach's alpha coefficient and composite reliability (CR) were used to examine the reliability of each construct.

7.1 First-order Construct Validity and Reliability

7.1.1 Convergent Validity

Assessment of convergent validity was carried out using confirmatory factor analysis (CFA) in Smart PLS (v.3.3.2) software. Usually, a higher standardized factor loading (>0.5) and a corresponding critical ratio above 1.96 show evidence of strong construct validity (Anderson and Gerbing, 1988). As shown in Table 2, of the 58 items, 49 items loaded to their respective construct with factor loadings greater than 0.50 indicating strong convergent validity of the theoretical constructs. Of the nine items that failed to load, three items (GRD3, ECP4, and ORG2) were retained, given that the lower threshold for retaining the factors is 0.4 (Stevens, 2012). CWS3, END3, END4, ECP3, OPP2, and OPP3, which had a factor loading of less than 0.40, were removed from the subsequent analysis. The average variance extracted (AVE) of the constructs (with retained items) were above the recommended cut-off point of 0.50 except for the economic performance (ECP) construct, which is only marginally below the cut-off at 0.49 (Fornell and Larcker, 1981; Yu et al., 2014). Based on these results, we conclude that the constructs have sufficient convergent validity.

Table 2

7.1.2 Discriminant Validity

A low correlation, ideally less than 0.5 between the latent constructs, indicates strong discriminant validity. Table 3 shows that the correlation between constructs is less than 0.5, in support of discriminant validity. The other condition for discriminant validity is that the square root of each construct's AVE should be greater than the bivariate correlation with the other constructs in the model (Fornell and Larcker, 1981). As shown in Table 3, the square root of the AVE of each construct is much higher than its correlation with other constructs, further demonstrating discriminant validity.

Table 3

7.1.3 Reliability of Constructs

The Cronbach's alpha and composite reliability scores were used to check the reliability of the constructs (Lee et al., 2012). As seen in Table 3, the Cronbach's alpha coefficient and composite reliability (CR) scores obtained for all twelve constructs were well above 0.7, the acceptable threshold for reliability (Fornell and Larcker, 1981).

7.2. Operationalization of GSCM as a Second-Order Construct

Now that we have established the validity and reliability of the first-order constructs, the next task was to check the operationalizability of green supply chain practices as a higher (second)-order latent construct. A second-order CFA was therefore conducted. The SmartPLS second-order CFA output is given in Appendix 2. All underlying first-order constructs of green supply chain practices can be seen to be significantly correlated with the second-order construct at $p<0.05$. Overall results imply that green supply chain practices could be operationalized as a second-order construct with underlying first-order constructs of GRD, GRP, GRM, GRT, GFT, and END.

Next, the study examined the descriptive statistics at both the construct and the item level to identify their relative importance as per the respondents.

7.3. Descriptive Statistics

The composite mean (X̄) and standard deviation (SD) of the constructs are shown in Table 3, while the mean and SD of the individual items are provided in Appendix 1. As seen in the table, four of the six green supply chain practices, i.e., green design, green purchasing, green manufacturing, and green facilities, have a mean score above 4 (on a 1-5 scale), thereby demonstrating that they are well implemented/established in the sector. Of these, green facilities have the highest score of 4.44, which is not surprising given the recent significant increase in the number of LEED-certified facilities there (The Daily Star, 2019). The findings also support the claims in the literature that there is a significant improvement in green manufacturing practices (X̄=4.25) in the Bangladesh garment sector (Hassan and Bhagvandas, 2017). While the relatively low score for green transportation (X̄=3.45) and relatively higher SD (>1) (shows considerable variation among firms) is a concern that needs to be addressed. Even more concerning is that end-of-life management emerged with the lowest score with X̄=2.51, supporting the literature claims that very little used clothing is being recycled into new garments (World Bank, 2019). In terms of individual items, as seen in Appendix 1, two items emerged with a mean score above 4.50, namely GFT5 (*LEED and other related green certifications are obtained for facilities*) and GRP5 (Conducts environmental evaluation of second-tier and lower-tier suppliers). The latter is encouraging, given that the garment sector has generally been criticized for lack of transparency with lower-tier suppliers.

In terms of supporting factors, IEM emerged with a strong score (X̄=4.25). This is encouraging as it answers the calls in the literature of 'having your house in order.' i.e., building internal environmental capabilities first before green supply chain practices implementation (Zhu et al., 2013). However, there is considerable room for improving the relatively moderate score for cooperation with stakeholders (X̄=3.72). With the increasing push from leading brands and retailers and new initiatives such as the United Nation's alliance for sustainable fashion, this score will (hopefully) improve in the coming years.

Finally, in terms of performance benefits, environmental performance and overall organizational performance emerged with a mean score above 4.00. The relatively high score for environmental performance is not surprising, given that the raison d'etre for implementing green supply chain practices is environmental performance. The relatively high mean score for organizational performance is encouraging for the sector as it supports the claims in the literature that GSCM does make sense from a business perspective (Balasubramanian and Shukla, 2017a). However, there is still room for improving economic performance (X̄=3.83) and operational performance (X̄=3.53). To some extent, the former back the literature claim that the garment sector is not fully leveraging the cost benefits from green practices (UN Alliance for Sustainable Fashion, 2020).

The following section explains the statistical procedure used for testing the hypotheses and the test results.

7.4. Hypothesis testing and results

Partial Least Square Structural Equation Modeling (PLS-SEM) used Smart PLS (v.3.3.2) software to test the study hypotheses. The PLS-SEM output is provided in Appendix 3 while the structural equations are provided in Appendix 4. The hypotheses test results are given in Table 4. Results corresponding to each hypothesis are discussed in the following section.

Table 4

7.4.1. *Internal environmental management and cooperation with stakeholders (H1)*

As seen in Table 4, the negative and non-significant relationship between IEM and cooperation with stakeholders (β=-0.018, p>0.05) indicates that our hypothesis H1 is not supported. This is concerning, especially because, despite having well-established IEM ($\bar{X}$=4.49), the garment-manufacturing firms have not translated their intra-firm level capabilities into strategic and long-term cooperation with key stakeholders. This is in stark contrast to the findings in the literature (Gonzalez et al., 2008; Zhu et al., 2013) and do not support the claim that when firms are internally green, implementing collaborative inter-firm environmental programs is less problematic (De Giovanni and Vinzi, 2012). Garment firms, therefore, must revisit and make an effort to realign their IEM practices to achieve greater cooperation and coordination with external firms.

7.4.2. *Internal environmental management and green supply chain practices (H2)*

The significant and positive relationship between IEM and green supply chain practices (β=0.402, p<0.001) supports our hypothesis H2. The results clearly imply that IEM is a necessary precursor to the successful implementation of green supply chain practices in the garment sector in agreement with the literature (Green Jr et al., 2012; Balasubramanian and Shukla, 2017a). This is because IEM provides the essential internal implementation climate, the absorptive capacity of new technology and processes, and organizational readiness capabilities to facilitate the implementation of green practices (Balasubramanian and Shukla, 2017a). The results also support the recent findings of Khan and Yu (2021) from the manufacturing sector that the IEM is a prerequisite and a backbone for green supply chain practices and that it injects the ideology of sustainability into the organizational strategy. It also indicates the awareness and commitment of senior management on green-related issues and their commitment towards the implementation of green supply chain practices (Khan and Yu, 2021). Garment firms, therefore, must prioritize the implementation of IEM first before implementing various green supply chain practices.

7.4.3. *Cooperation with stakeholders and green supply chain practices (H3)*

The significant and positive relationship between cooperation with stakeholders and green supply chain practices supports our hypothesis H3. However, the strength of the relationship is moderately low (β=0.260, p<0.01). This is not surprising given that most of the cooperation with stakeholders for environmental issues has started recently, and with time, we expect this relationship to get stronger. Garment firms should also make more concerted efforts to develop closer and deeper cooperation with stakeholders. For instance, early engagement with buyers at the design stage (as opposed to later) would enable more opportunities to develop designs that reduce life cycle environmental impacts. Previous studies have stressed the importance of collaboration between stakeholders to implement green practices effectively (Khan and Yu, 2021).

7.4.4. *Green supply chain practices and environmental performance (H4)*

While the results support the hypotheses, it is important to note that this relationship is relatively weak (β=0.195, p<0.001). This shows that the implementation of green practices alone is not sufficient. The efficiency and effectiveness with which the sector implements these practices are critical for achieving environmental performance goals. One possible reason for this relatively lower strength is the fact that GSCM is relatively new in the garment sector and that many firms have not yet established well defined environmental performance measures that are critical for evaluating performance and determining future courses of action (Björklund et al., 2012; Balasubramanian and Shukla, 2017a). The findings of this study call for a greater alignment of green supply chain practices with environmental performance. Nonetheless, a significant positive relationship, albeit small, is a good starting point for the garment industry and supports the findings of recent studies that green supply chain practices have a positive role in the betterment of environmental performance (Khan and Yu, 2021),

7.4.5. Green supply chain practices and economic performance (H5)

Similar to H4, the results support our hypothesis (H5), but the strength of the relationship is weak (β=0.161, $p<0.01$). Yet, for a sector in which GSCM is relatively new, a positive relationship (albeit a low one) is encouraging and should provide an impetus for more firms to implement GSCM. Similarly, as for environmental performance, garment firms must develop clear economic performance measures and set performance targets to achieve the desired goals. As GSCM implementation in the garment industry matures, we expect to see much stronger relationships in the future. Recent studies from the manufacturing sector are promising as it shows a strong linkage between green supply chain practices and higher economic performance (Khan and Yu, 2021; Khan et al., 2021c),

7.4.6. Green supply chain practices and operational performance (H6)

The results support our hypothesis H6. A relatively strong relationship between green supply chain practices and operational performance was found (β=0.453, $p<0.001$). This will likely remove any associated doubts regarding the implementation of green supply chain practices among plant managers from an operational standpoint. It implies that producing an environmentally friendly product may create a final product that is safer and less costly and which has higher, more consistent quality and greater scrap value. Previous research has also shown that green supply chain practices can improve operational performance (Zhu et al., 2012; 2013; Yu et al., 2014). Overall, the results will provide further impetus for garment firms, especially those looking to improve their operational performance, to consider implementing green supply chain practices.

7.4.7. Environmental, economic, operational, and organizational performance (H7-H9)

Contrary to our proposed hypothesis (H7), the environmental performance was found to have a significant negative relationship with organizational performance (β=-0.111, $p<0.05$). Hence, H7 is rejected. In other words, the results do not support the notion that improvement in environmental performance is likely to bring in more business (Rao and Holt, 2005; Khan and Yu, 2021). This is surprising vis-à-vis previous studies. One possible reason for this could be that while firms have improved their environmental performance, the investments, training, and other associated costs to implement green supply chain practices were too high, adversely impacting the profit margin and return on investment (components of organizational performance). The other explanation could be the lack of consumer awareness in developing countries on environmental issues, which translates into them not buying eco-friendly products or paying higher prices (Khan and Yu, 2021). Also, firms may not have applied the requisite marketing efforts to communicate and leverage the environmental performance achievements in the marketplace to increase their reputation and image, which could have translated to increased sales, sales price, and market share, the other components of organizational performance). Therefore, it could be said that improvement in environmental performance does not automatically translate into an improvement in organizational performance; instead, concerted branding and marketing efforts are needed.

On the other hand, a significant positive relationship (β=0.197, $p<0.001$) between economic and organizational performance shows that firms can make considerable savings from green supply chain practices to affect the organizational performance, such as increased profits and return on investments, thereby supporting our hypothesis H8. The results are in line with the recent findings in the manufacturing sector that higher economic performance leads to organizational performance (Khan and Yu, 2021; Khan et al., 2021b).

Similarly, the improvement in operational performance was found to enhance organizational performance as hypothesized (H9), though the strength of the relationship is moderate (β=0.152, $p<0.01$). The results support the findings of Green Jr et al. (2012), who found a strong positive relationship between operational and organizational performance in the manufacturing sector. The results are not surprising given that there is a general agreement in the literature that quality, delivery, flexibility, and cost are the core and most often mentioned competitive areas that lead to superior organizational performance (Yu et al., 2014).

Overall, the significant and positive relationship between green supply chain practices and environmental, economic, and operational performance is an indication that a "win-win" outcome is possible with GSCM. Moreover, despite the negative relationship between environmental performance and organizational performance, the total indirect effects of green supply chain practices on organizational performance mediated through environmental, economic, and operational performance is positive and significant (β=0.079, $p<0.01$).

8. Implications

The implications of this study are manifold. The theoretical, research, and practical implications are discussed in the following sections.

8.1. Theoretical Implications

The study findings support the practice-based view (PBV) suggested by Bromiley and Rau (2014), an advanced version of prominent resource-based view theory. PBV explicates the variations in firms' performance due to the adoption of transferable and inimitable business practices, where practices are "an established activity or set of activities that various companies may perform" (Bromiley and Rau, 2014). Recent studies have started applying PBV to explain green supply chain management practices and performance outcomes (Khan et al., 2021b; 2021c). From a PBV standpoint, our results show that the adoption of green supply chain practices (explanatory variables) could stimulate firms' socioeconomic and environmental outcomes (dependent variables) (Khan and Yu, 2021). Hence, looking through the theoretical lens of PBV, the sector-wide greening of the RBV sector requires most firms to adopt efficient and effective adoption of green supply chain practices and that any variability in adoption and outcomes much be addressed through effective policies/interventions to encourage diffusion/transfer of environmental knowledge, expertise, and skills across firms in the sector.

The other theoretical contribution of the study is that it was able to identify the critical practices and performance aspects of GSCM for the garment sector and develop them into theoretically robust and managerially relevant constructs. Also, the study was able to test and validate each of the GSCM first-order constructs as well as operationalize green supply chain practices as a second-order latent construct. Given that construct development and validation is at the heart of theory building (Venkatraman, 1989), this study significantly contributes toward the theoretical advancement of GSCM in the garment sector and in general. The operationalization of green supply chain practices as a second-order latent construct in itself is a significant theoretical contribution. It shows that implementation of GSCM requires an all-encompassing effort rather than being oriented toward the adoption of one or two practices in isolation.

8.2. Research Implications

This research contributes to the literature of GSCM. Given that no previous study has made a comprehensive and systematic inquiry on GSCM in the garment sector, this study's framework and findings are both novel and significant. Also, Bangladesh is the second-largest garment exporter worldwide, making this study contribution even more valuable. Organizations and policymakers could benefit from the survey-based research design and validated measurement scale proposed in this study to measure green supply chain practices implementation and their subsequent performance outcomes. Furthermore, given the conceptual comprehensiveness of the framework, researchers could adapt the framework to the broader apparel industry or specific industries such as footwear or leather industry. Finally, researchers could also extend the framework to include the enablers/drivers and barriers to understand their role in promoting or hindering GSCM in the garment sector.

8.3. Practical Implications

The study framework and findings are helpful for practitioners and policymakers in Bangladesh and other emerging countries to understand the opportunities and challenges afforded by GSCM. Policymakers could make informed policy decisions that directly or indirectly encourage firms to adopt green supply chain practices. This could include a robust mechanism of rewards and punishment. Rewards could be low tariffs, subsidies, and tax exemptions, while the punishment for firms violating the environmental laws and polluting the environment could be the cancellation of licensing and a considerable financial penalty for non-compliance (Khan and Yu, 2021).

Further, to promote sector/countrywide green practices, policymakers and industry groups could encourage diffusion/transfer of environmental knowledge, expertise, and skills from large firms with superior environmental knowledge to small firms through programs, collaborative partnerships, and mentoring opportunities and/or by encouraging large firms to pressurize small firms to implement environmental practices (Balasubramanian et al., 2020; 2021). Similarly, linking up and building relationships between foreign firms from developed countries (with significant expertise in environmental matters) and local firms can help transfer/diffuse environmental practices. Additionally, governments looking to lower their environmental footprint should encourage foreign firms, especially developed countries, to establish subsidiaries there (Balasubramanian et al., 2021).

Next, to advance investigation and practice in GSCM, valid and reliable measurement scales are needed (Zhu et al., 2008). Practitioners in the garment industry and other related sectors could adapt or modify and use these scales as a continuous improvement tool to identify the strengths and weaknesses of their green supply chain practices implementation in their respective organizations. Similarly, policymakers in Bangladesh and elsewhere could use these measurement scales to assess 'the current state of GSCM' in the garment industry and make necessary interventions to improve their situation in their respective countries.

For managerial practice, the study found the extent of implementation of the various green supply chain practices in the garment sector, including the least and most implemented practices. Unfortunately, end-of-life management, despite its importance, was found to be the least practiced. Policymakers and practitioners should take note of this and make an urgent intervention to improve the situation. This is because end-of-life management is important from an environmental and economic standpoint, as there are plenty of opportunities to generate revenue from it.

Further, the results reemphasized the importance of IEM as a prerequisite for the implementation of green supply chain practices and established the importance of cooperation between all stakeholders for green supply chain practices implementation (Khan and Yu, 2021). This positive impact of practices on all four dimensions of performance should provide the impetus for firms in the garment industry to adopt GSCM. However, a surprisingly weak negative relationship between environmental and organizational performance shows that the former does not automatically translate into the latter and that a concerted branding and marketing effort is required to translate environmental gains to organizational gain, especially in a sector/country setting with a poor environmental reputation such as Bangladesh. Previous studies have highlighted the need to increase consumer awareness on environmental issues, especially in developing countries, since environmentally conscious customers may be more eager to buy green products, which increases sales volume and market share (Khan et al., 2017c; Khan and Yu, 2021). In addition, a low and insignificant relationship between IEM and cooperation with stakeholders shows that firms must revisit/realign their internal implementation climate to facilitate heightened stakeholder cooperation.

9. Conclusions

This study examined the underlying linkage between IEM and cooperation with stakeholders with green supply chain practices; and their impact on environmental, economic, operational, and organizational performance. The survey data gathered from the garment manufacturing firms in Bangladesh was used to test the study hypothesis using the PLS-SEM technique. The study found that stakeholder collaboration and IEM positively impacted green supply chain practices. The results also demonstrate a win-win opportunity to simultaneously improve environmental, economic, operational, and organizational performance from green supply chain practices implementation, although the strength of the relationships is low to moderate.

9.1. Future Research

This study provides opportunities for future research. Given that GSCM is relatively new in the garment sector, the proposed framework needs to be further strengthened through refinement and validation across different countries. In the case of the Bangladesh garment sector, future studies could use multiple case study methodology, similar to ones seen in other sectors (e.g., Balasubramanian and Shukla, 2017b) to test the GSCM framework and hypotheses qualitatively and to obtain a rich micro-level understanding on various aspects necessary for greening the sector. Also, future studies could use qualitative modeling techniques such as the Delphi method and the fuzzy analytic hierarchy process (FAHP) to understand better and manage the key drivers and barriers to green supply chain adoption in the garment industry in Bangladesh and elsewhere (Ali et al., 2021).

9.2. Limitations

This study has some limitations. Even though the study is quite extensive, the proposed framework may not have covered every facet of GSCM in terms of practices and performance. For instance, there could be additional sector-specific and country-specific aspects that may not have been considered. The other limitation is related to the sample size of the study. Although this sample size is acceptable for this study, the response rate is still relatively low and could affect the generalizability of the findings. The other potential limitation is that the model fit of the GSCM framework is not established in this study. The non-reporting of model fit is because of the use of model fit indices, its interpretation and reliability are not sufficiently understood in the PLS-SEM literature, and it is recommended that researchers refrain from reporting it (Hair et al., 2017; SmartPLS, 2020). In the future, researchers could use covariance-based SEM (CB-SEM) to check the model fit of the proposed GSCM model. The other limitation is the use of perceptual measures for environmental, economic, operational, and organizational performance, though, in this case, this is justified because of the lack of availability of published performance data. It is recommended that, when the data become available, future research can focus on using actual and preferably more objective data on performance (Balasubramanian and Shukla, 2017a).

Despite the limitations, we believe that the proposed GSCM framework and the findings can help practitioners in the garment sector and elsewhere better understand, develop, and manage green supply chains. Moreover, the validated survey instrument and study framework is expected to encourage more researchers to explore the application of GSCM in the garment sector and contribute to the field's theoretical advancement.

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Appendices

Appendix 1: Descriptive Statistics, Skewness, and Kurtosis of Individual Measurement Items

[Insert Table – Appendix 1]

Appendix 2: Second-order CFA results

[Insert Figure – Appendix 2]

Appendix 3: PLS-SEM Results

[Insert Figure – Appendix 3]

Appendix 4: Structural Equations

$CWS = \beta 1\ IEM + \varepsilon_1$

$GSCP = \beta 2\ IEM + \beta 3\ CWS + \varepsilon 2$

$ENP = \beta 4\ GSCP + \varepsilon 3$

$ECP = \beta 5\ GSCP + \varepsilon 4$

$OPP = \beta 6\ GSCP + \varepsilon 5$

$ORG = \beta 7\ ENP + \beta 8\ ECP + \beta 9\ OPP + \varepsilon 6$

Table 1 Respondents' demographic profile

Respondents' characteristics	Frequency	Percent
Primary product type of organisation		
Woven	214	53.1
Knit	189	46.9
Total	403	100.0
Number of employees		
Less than 500 employees	16	4.0
501 to 1000 employees	33	8.2
1001 to 2000 employees	68	16.9
2001 to 3000 employees	152	37.7
More than 3000 employees	134	33.3
Total	403	100.0
Firm age		
Less than 5 years	15	3.7
5 to 10 years	17	4.2
11 to 15 years	146	36.2
16 to 20 years	123	30.5
More than 20 years	102	25.3
Total	403	100.0
Position		
Director/CEO	84	20.8
Head of Department	85	21.1
Plant Manager	234	58.1
Total	403	100.0

Table 2: First order-confirmatory factor loadings

Constructs and items		Standardized Loading
Internal Environmental Management (IEM)		
IEM1	Promote cross-functional cooperation for environmental improvements	0.649
IEM2	Conducts (internal) auditing to check for environmental compliance	0.850
IEM3	Conducts employee environmental training programs	0.840
IEM4	Conducts green/environmental-related research and development	0.850
IEM5	Have established environmental management system	0.763
IEM6	Have obtained ISO 14001 or related certification	0.711
Cooperation with Stakeholders (CWS)		
CWS1	Cooperation with buyers are considered at the design stage itself for environmental improvements	0.939
CWS2	Collaboration with buyers/suppliers are considered for green/environmental manufacturing	0.952
CWS3	Cooperation with suppliers for green packaging/take back packaging	0.135
CWS4	Cooperation with suppliers/buyers for using less energy during product transportation	0.908
Green Design (GRD)		
GRD1	Promotes design of products with low embodied energy (e.g. reused or recycled material and/or components are considered)	0.980
GRD2	Promotes design of products that facilitates recovery, reuse and recycling of materials and/or components at the end of products useful life	0.884
GRD3	Promotes design of products that avoids or reduces the use of hazardous/toxic raw materials and/or manufacturing process	0.412
Green Purchasing (GRP)		
GRP1	Ensure eco-labelling of suppliers/their products	0.834
GRP2	Cooperate with suppliers for environmental improvements	0.929
GRP3	Conducts environmental audit of suppliers'	0.903
GRP4	Mandates ISO 14000 and related-certification for suppliers	0.604
GRP5	Conducts environmental evaluation of second-tier and lower-tier suppliers	0.557
Green manufacturing (GRM)		
GRM1	Provision for waste water recycling is considered in the manufacturing process	0.757
GRM2	Use of energy efficient technology/renewable energy sources is considered in the manufacturing process	0.767
GRM3	Processes for waste minimization is considered in the manufacturing process	0.722
GRM4	Use of hazardous/toxic materials is avoided/minimized in the manufacturing process	0.780
GRM5	Emission control systems are used to capture CO2 and other greenhouse gas emission emitted during the manufacturing process	0.678
GRM6	The 3Rs (reduce, reuse and recycle) are considered in the manufacturing process	0.648
Green Transportation (GRT)		
GRT1	Use of energy efficient vehicles/environmental-friendly mode of transport is considered	0.525
GRT2	Shipment consolidation is considered for full vehicle load transportation	0.891
GRT3	Vehicle routing is considered to minimize travel distances	0.591
GRT4	Periodic maintenance/replacement of old vehicles is considered for improving fuel efficiency	0.886
Green Facilities (GRF)		

GFT1	Energy-efficient lighting systems is considered in the facilities (e.g., warehouses, manufacturing plants)	0.570
GFT2	Natural ventilation and natural lighting is considered in the facilities to minimize artificial lighting and ventilation	0.750
GFT3	Efficient thermal insulation is considered in the facilities	0.645
GFT4	Renewable energy sources such as solar panels are considered in the facilities	0.856
GFT5	LEED and other related green certifications are obtained for facilities	0.758
End of Life Management (END)		
END1	Take back provision of unused/unwanted clothing from customers for reuse/recycling is considered	0.882
END2	Take back provision of packaging waste from buyers/customers for reuse/recycling is considered	0.870
END3	Return unused/unwanted materials/components to suppliers for reuse/recycling is considered	0.313
END4	Environmental considerations are made in handling and disposing of landfill waste	0.255
Environmental Performance (ENP)		
ENP1	Reduction of air and GHG emissions	0.955
ENP2	Reduction of solid wastes	0.933
ENP3	Reduction of waste water	0.890
ENP4	Decrease in frequency for environmental accidents	0.942
ENP5	Decrease in consumption for hazardous/harmful/toxic materials	0.727
Economic Performance (ECP)		
ECP1	Reduction in material costs	0.523
ECP2	Reduction in energy costs	0.859
ECP3	Reduction in waste treatment costs	0.273
ECP4	Decrease of fee for waste discharge	0.427
ECP5	Decrease of fine for environmental accidents	0.856
Operational Performance (OPP)		
OPP1	Increase in amount of goods delivered on time	0.692
OPP2	Decrease in inventory levels	0.050
OPP3	Decrease in scrap rate	0.105
OPP4	Improvement in product quality	0.587
OPP5	Increase in product line	0.845
OPP6	Improvement in capacity utilization	0.833
Organizational Performance (ORG)		
ORG1	Increase in return on investment	0.834
ORG2	Increase in sales	0.411
ORPG	Increase in sales price	0.879
ORG4	Increase in profits	0.569
ORG5	Increase in market share	0.825

All retained factor loadings are significant at $p<0.001$

Table 3: Descriptive Statistics, Reliability, AVE and Correlation between Constructs

Construct (No. of items)	Mean	SD	α	CR	SQRT AVE	IEM	CWS	GRD	GRP	GRM	GRT	GRF	END	ENP	ECP	OPP	ORG
IEM (6)	4.49	0.49	0.87	0.90	0.78	1	-0.02	0.01	0.09*	0.01	0.15**	0.05	0.11*	0.09	0.08	0.04	-0.02
CWS (3)	3.72	1.05	0.94	0.96	0.94		1	0.08	0.07	0.08	0.11*	0.07	0.03	0.10*	0.01	0.12**	0.04
GRD (3)	4.19	0.81	0.85	0.82	0.79			1	0.08	0.08	0.18**	0.09	0.08	0.06	0.05	0.16**	-0.01
GRP (5)	4.23	0.72	0.84	0.88	0.78				1	0.13**	0.23***	0.04	0.06	0.02	0.06	0.27***	0.03
GRM (6)	4.25	0.67	0.83	0.87	0.73					1	0.23***	0.06	0.02	0.14**	-0.02	0.19***	0.06
GRT (4)	3.45	1.11	0.70	0.82	0.74						1	0.16***	0.06	0.24***	0.16**	0.46***	0.12*
GRF (5)	4.44	0.53	0.77	0.84	0.72							1	0.02	0.01	0.11*	0.10*	0.01
END (2)	2.51	0.74	0.85	0.93	0.93								1	0.08	0.04	0.12*	-0.01
ENP (5)	4.15	0.78	0.94	0.95	0.89									1	0.10*	0.11*	-0.07
ECP (4)	3.83	0.88	0.62	0.77	0.70										1	0.24***	0.22***
OPP (6)	3.53	1.12	0.73	0.83	0.75											1	0.19***
ORG (5)	4.21	0.80	0.75	0.84	0.73												1

α- Cronbach's Alpha; CR- Critical Reliability

**** Correlations significant at $p<0.001$; ** significant at $p<0.01$; *significant at $p<0.05$*

Table 4: Summary of hypotheses test results

Hypothesized relationship				β	t-statistic	p-value	Result
H1	IEM	→	CWS	-0.018	0.337	0.736	Not Supported
H2	IEM	→	GSCP	0.402	3.808	0.000***	Supported
H3	CWS	→	GSCP	0.260	3.315	0.001**	Supported
H4	GSCP	→	ENP	0.195	3.857	0.000**	Supported
H5	GSCP	→	ECP	0.161	2.946	0.003**	Supported
H6	GSCP	→	OPP	0.453	10.451	0.000***	Supported
H7	ENP	→	ORG	-0.111	2.205	0.028*	Not Supported+
H8	ECP	→	ORG	0.197	3.756	0.000***	Supported
H9	OPP	→	ORG	0.152	3.046	0.002***	Supported

****Significance at p <0 .001; **Significance at p < 0.01; *Significance at p < 0.05; β - standardized coefficients; +hypothesized relationship was positive*

Appendix 1: Descriptive Statistics, Skewness, and Kurtosis of Individual Measurement Items

Construct Items	Mean	SD	Skewness	Kurtosis
IEM1	4.59	0.49	-0.38	-1.87
IEM2	4.38	0.49	0.51	-1.75
IEM3	4.55	0.50	-0.19	-1.98
IEM4	4.42	0.49	0.34	-1.90
IEM5	4.54	0.50	-0.18	-1.98
IEM6	4.48	0.50	0.08	-2.00
CWS1	3.73	1.07	-0.50	-0.26
CWS2	3.67	1.02	-0.56	0.08
CWS4	3.76	1.06	-0.62	-0.04
GRD1	4.11	0.77	-0.18	-1.28
GRD2	4.00	0.95	-0.01	-1.90
GRD3	4.46	0.72	-0.94	-0.47
GRP1	4.15	0.77	-0.27	-1.27
GRP2	4.00	0.81	0.01	-1.48
GRP3	4.24	0.77	-0.43	-1.21
GRP4	4.21	0.64	-0.22	-0.66
GRP5	4.57	0.60	-1.08	0.16
GRM1	4.34	0.66	-0.50	-0.74
GRM2	4.42	0.59	-0.47	-0.66
GRM3	4.47	0.60	-0.64	-0.54
GRM4	4.27	0.71	-0.44	-0.95
GRM5	4.07	0.69	-0.10	-0.90
GRM6	3.93	0.74	0.11	-1.16
GRT1	3.73	1.04	-0.60	-0.16
GRT2	3.39	1.13	-0.47	-0.35
GRT3	3.25	1.17	-0.40	-0.55
GRT4	3.44	1.09	-0.51	-0.15
GFT1	4.39	0.49	0.47	-1.79
GFT2	4.49	0.50	0.06	-2.01
GFT3	4.32	0.69	-0.51	-0.82
GFT4	4.50	0.50	0.02	-2.01
GFT5	4.54	0.50	-0.15	-1.99
END1	2.59	0.76	-0.07	-0.33
END2	2.43	0.73	-0.01	-0.30
ENP1	4.08	0.78	-0.14	-1.35
ENP2	4.19	0.75	-0.33	-1.18
ENP3	4.13	0.78	-0.23	-1.32
ENP4	4.04	0.82	-0.08	-1.52
ENP5	4.33	0.76	-0.64	-1.01
ECP1	3.30	1.26	-0.24	-1.06
ECP2	4.20	0.40	1.50	0.25
ECP4	3.62	1.46	-0.76	-0.94
ECP5	4.21	0.40	1.46	0.13
OPP1	3.78	1.23	-0.36	-1.51
OPP4	3.44	1.11	-0.50	-0.26
OPP5	3.46	1.01	-0.48	0.01
OPP6	3.45	1.13	-0.50	-0.29
ORG1	4.07	0.82	-0.12	-1.50
ORG2	4.58	0.49	-0.33	-1.90
ORG3	4.21	0.76	-0.37	-1.19
ORG4	3.98	1.11	-0.67	-0.95

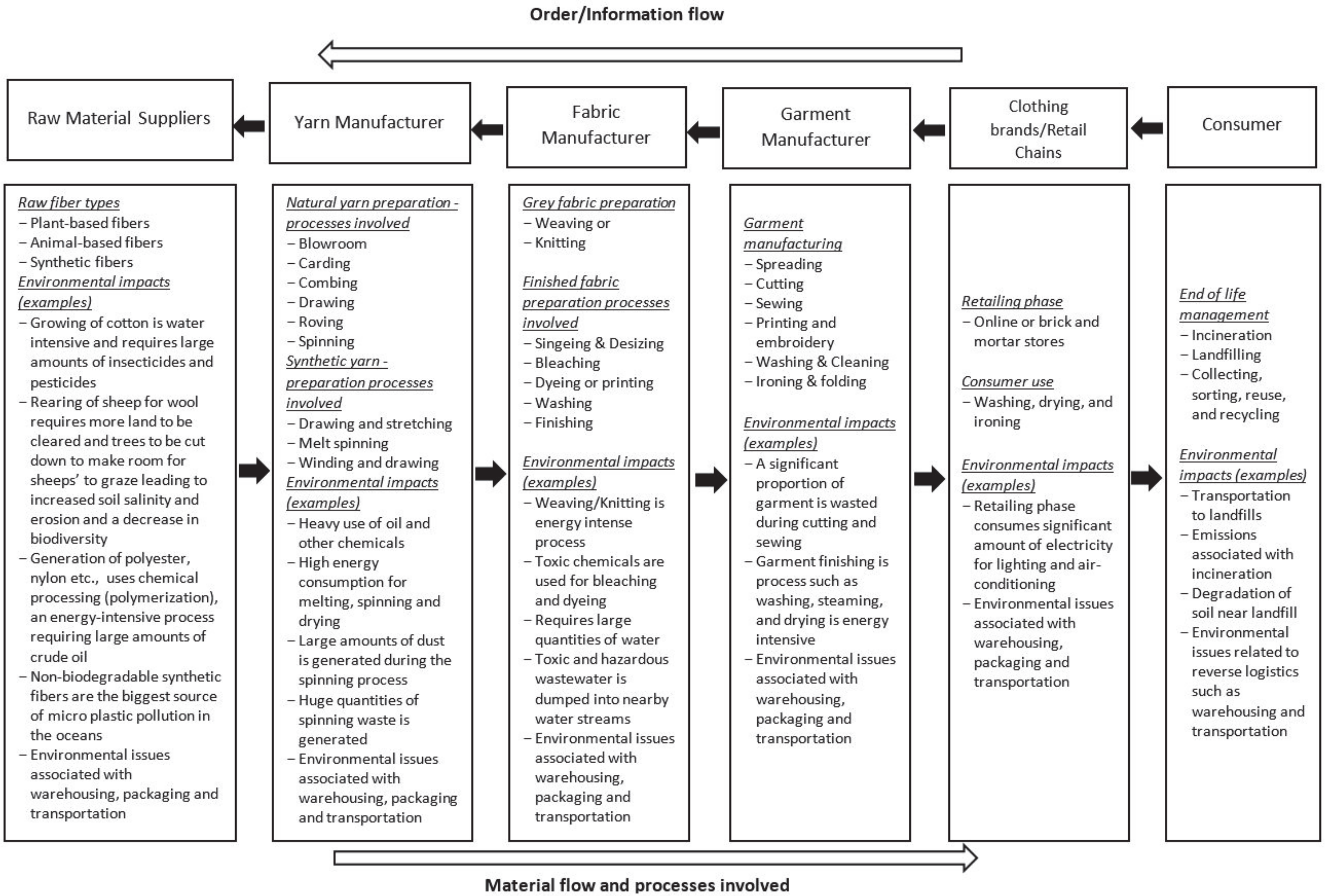


Figure 1: A typical garment supply chain (Source: Authors)

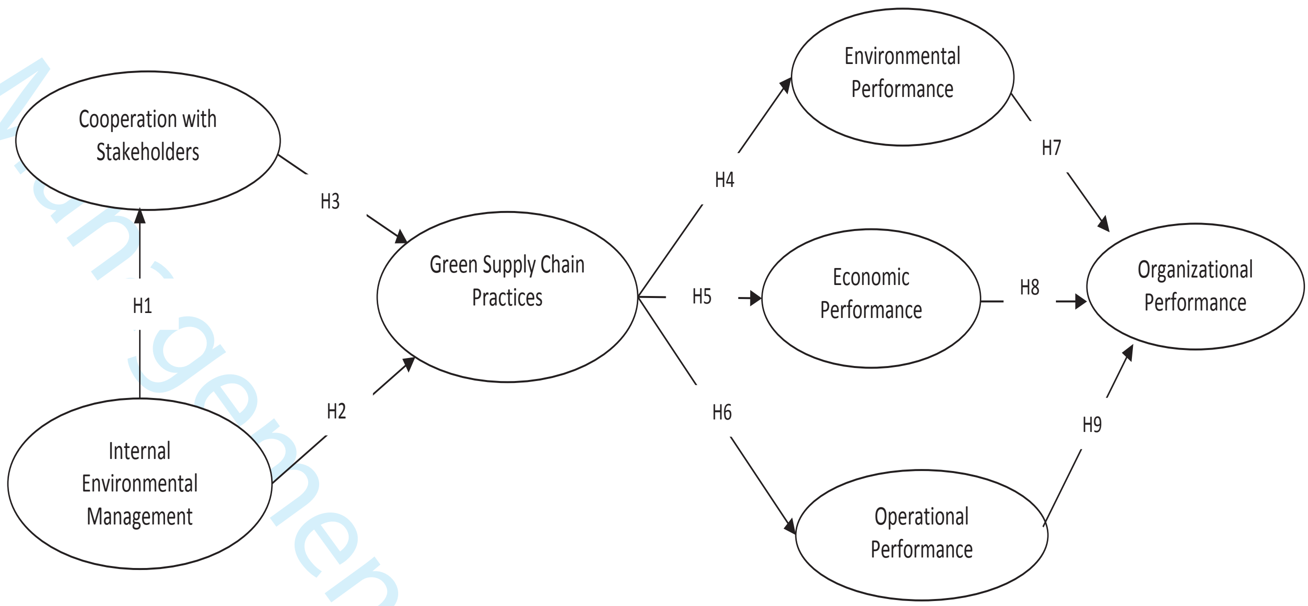
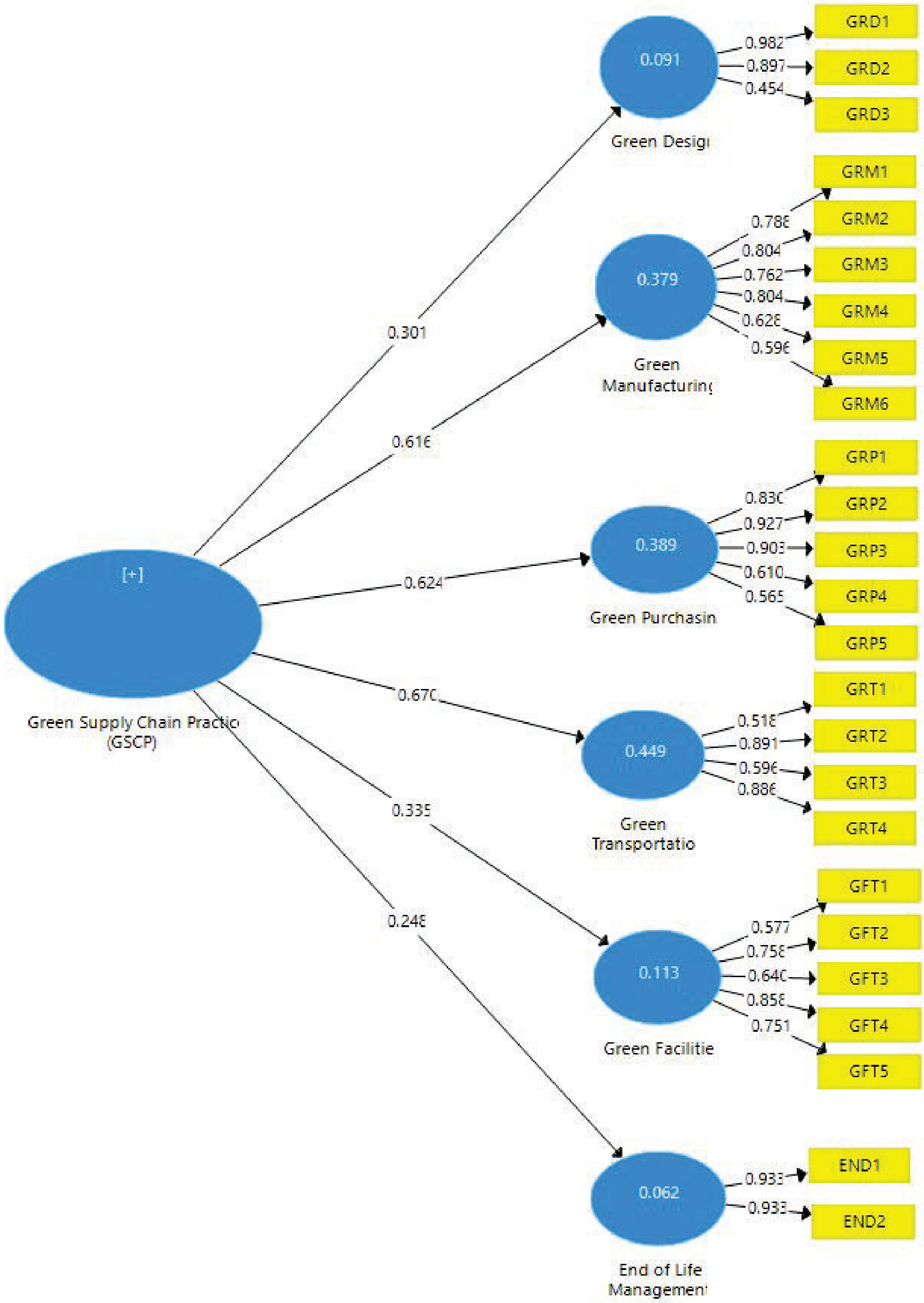


Figure 2. Proposed green supply chain management framework for garments

Appendix 2: Second-order CFA results



Appendix 3: PLS-SEM Results