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Analysing the Effects of Green Supply Chain Practices on the Environmental Sustainability of Ethiopian Small and Medium Scale Garment Manufacturers

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ABSTRACT

This paper examines the effect of supply chain practices on the sustainability of Ethiopian Small and medium scale garment manufacturers. One of the evaluation tools for manufacturers sustainability is environmental issue. Small and medium scale clothing manufacturers in Ethiopia have huge gap in implementing and practising sustainability in relation to the green supply chain concept. This study assessed small and medium scale clothing manufacturing enterprises' existing supply chain practices and operations in relation to sustainability. Due to the nature of small and medium-sized manufacturers, questionnaire survey was utilized assess their supply chain practices regarding with the sustainability of apparel supply chain. The Green Supply Chain Operations Reference (G-SCOR) model concepts were used to assess the supply chain sustainability practices of the participating companies. Using this model, the green or sustainable functions of SCOR processes were analysed. These green supply chain management functions were green procurement, green manufacturing, green distribution and green logistics. Survey result shows that, there is a gap in greening of the supply chain practices in the upside and downside. In order to fill this gap and improve the sustainability of these manufacturers, Green Supply Chain Operations Reference (G-SCOR) model was customized. This research also integrates the green supply chain operation reference model with the closed-loop supply chain concept.

Keywords: Apparel sustainability, Green Supply Chain Management, Green Supply Chain Operations Reference model.

1. Introduction

From the product to the logistics, supply chain management (SCM) is the active administration of supply chain operations. In order to fulfil the final client, all organisations in the SC must integrate and synchronise their inter-organizational procedures and coordinate their strategies (Handfield, 2020). It also focused on sustainability involving the triple bottom line (TBL)

principle: environmental, economic, and social dimensions principles. Green supply chain management (GSCM) focused on the environmental and economic performance of a supply chain (Kumar, 2015). Emphasizing the 'green', GSCM is a sustainable way to improve efficiency which also refers to cost-cutting method. It is a practice that would minimize or remove wastes along the supply chain (Biswas, 2015) Green supply chain management refers to the laws and practices that compel companies to assume responsibility for carbon emissions in order to benefit individuals, society, the environment, and enterprises. Green supply chain management practices, which include green manufacturing, green procurement, green distribution, and green logistics, have a positive effect on environmental sustainability. Only green manufacturing has a detrimental effect on environmental sustainability, according to the research (Aziz, 2020).

Businesses from a variety of industries have clearly made large investments in sustainability, particularly in recent years. Due to the usage of pesticides, hazardous colors that end up in waterways, production and post-consumer waste, as well as the destructive use of land and water, the fashion industry has been ranked as one of the "dirtiest" in terms of the environment. These claims are supported by statistics. Tight deadlines, demanding retailers, and the requirement for high-quality items all contribute to the complexity of the garment supply chain, which is a complex network of interconnected activities. In relation to this, the fashion supply chain needs to be sustainable. In Ethiopia, small and medium scale garment manufacturers have huge gap in greening of procurement process, manufacturing Process, distribution process, end of life Management (Nigatu, 2024). As the result, this study focused on analyzing the effects of supply chain practices on sustainability of Ethiopian small and medium scale garment manufacturers. This research identifies sustainable (green) supply chain activities in apparel manufacturing system, assess sustainability of Ethiopian small & medium garment manufacturers supply chain practices and asses their practice through Green Supply Chain Operations Reference model by integrating with closed loop supply chain management.

About 10% of worldwide carbon emissions come from the fashion business, which also uses the most water and pollutes the most out of all industries. However, the fashion industry's relative disregard for sustainability also suggests that there is a lot of unrealized potential once rival companies start making sustainable goals a priority in their corporate missions (Di Benedetto, 2017). When compared to other traditional methods and goods, sustainable fashion practices are environmentally friendly and help to lessen the impact that fashion has on the environment throughout its production, use, disposal. Products from the sustainable fashion sector have a great potential to save natural, non-renewable, and energy resources. The amount

of chemicals used to manufacture textiles, the ecological imprint of the resources, and the renewability of the raw materials are what define eco-fashion (Pandey, 2020).

In Ethiopia, small and medium garment manufacturers trying to improve their productivity and profit. In this regard these manufacturers giving less attention to their supply chain sustainability. Sustainable supply chain is linked with the green aspect of supply chain practices to reduce their negative impact on the environment. In this research, the green supply chain concepts are discussed and companies' supply chain practices are analyzed regarding with the sustainability. The response collected from these companies depicts that there is a gap in practicing green/ sustainable supply chain throughout their operation. In this era, sustainability issue is one of the critical aspects of business operation and companies across the globe are striving to have sustainable supply chain practices (Jensen, 2022).

A company can gain a competitive edge through supply chain management, which has been defined as the process of converting material resources into finished goods and shipping those goods to consumers. In the textile sector, the issue of sustainable supply chain management is becoming more and more significant. This is because businesses in the textile and apparel sector are especially vulnerable to social and environmental issues that arise along the supply chain and throughout the production stage. Based on a moral analysis of human responsibility for the environment, sustainable development aims to create a program that would integrate the various facets of human activity. Moral, ecological, technical, economic, legal, social, and political aspects are all related to this integration (Mohtashami, 2020).

The clothing industry's operational model serves as the foundation for the apparel supply chain. It is a dynamic partnership that continuously addresses the unpredictable demands of the market and consumers while maximizing revenues. The global apparel business has one of the most intricate supply chains, with widely disparate sourcing, production, and end-market locations. Due to the complex nature of the clothing supply chain, risk and uncertainty are important factors when assessing supply chain performance (Thilakarathna, 2015). One intricate global supply chain that raises concerns about sustainability and for which no suitable solutions have yet been found, particularly in the social domain, is the clothing industry. The increasing significance of social sustainability signifies a strategic shift in the industry, requiring the participation of many levels and outside parties to lessen the adverse social effects. Since the beginning of the process, the clothing industry has been regarded as one of the most polluting from a sustainability perspective. For instance, pesticides are used in the manufacturing of cotton, chemicals are used in the leather treatment and synthetic filaments processes, and frequently, these chemicals are toxic and seriously harmful to human health. It also consumes

a lot of natural resources, particularly water, which is used at every stage of manufacturing (about 10,000 to 20,000 L per kilogram) and has a short life cycle, which increases its detrimental effects on a big scale (Bubicz, 2021).

By incorporating environmentally friendly energy sources and green practices into current corporate operations, the green supply chain management idea offers a mitigation method for ecological degradation in the current period of environmental pollution and natural resource shortage. By lessening the detrimental effects of unsustainable manufacturing techniques, green supply chain management (GSCM), a new idea in current supply chain management (SCM), combines ethical and environmentally friendly issues with the conventional supply chain (Agrawal, 2023).

Samar Ali, (2019) distinguish sustainable and efficient performers from the average performers in the Indian manufacturing sector and to understand the degree of effect of supply chain management green practices based on their contribution to sustainable environment. The concept of CHAID (Chi-Square Automatic Interaction Detector) analysis is applied to define green logistics as the main driver for achieving ecological damage reduction and improving business performance.

A system for managing supply chain operations that is based on performance is the Supply Chain Operations Reference model. It gives businesses a framework for assessing and contrasting supply chain operations, allowing them to pinpoint problem areas and put best practices into action. The Supply Chain Operations Reference (SCOR) Model helps businesses improve their supply chain operations dramatically and quickly by offering methodology, diagnostic, and benchmarking tools (Thilakarathna, 2015).

In a traditional linear supply chain, garment products are produced, sold, and eventually discarded as waste. Given that businesses understand the systemic and strategic consequences of managing the various supply chain flows, creating the appropriate kind of supply chain can be crucial to addressing environmental sustainability. Businesses can promote the adoption and spread of eco-friendly practices and transition to a closed-loop supply chain by using a systems approach. Coordinated management of forward and reverse supply chains creates a "closed loop," and "cradle to cradle" responsibility which recognizes every stage of a product's lifecycle is becoming more and more seen as a competitive requirement. However, in a closed-loop supply chain practice, the lifecycle of the garment is extended through recycling, repurposing, or refurbishing. This approach aims to minimize waste, reduce environmental impact, and create a more sustainable fashion ecosystem (Ashby, 2018).

The textile and clothing industry generates much pollution and consumes a large number of resources. Improper uses and disposal of clothing products make the problems much more severe. Fast fashion products shorten the valid lifecycle and generate more waste than regular clothing products. Considering the features of fashion products, Hu, (2014) developed a system of a rent-based closed-loop supply chain is to improve the sustainability of fashion products.

Cruz, (2021) initiated the study to evaluate the state of green SC management practices in small clothing manufacturing firms. The researcher discovered that executives did not strictly enforce their green protocols, training was lacking for promoting environmental practices using the G-SCOR model, and the studied garment companies did not perform well in implementing green procurement and recycling of materials.

2. Research Methodology

This section discusses the research methodology of the study. It describes the research design, data collection method and analysis. The European Commission has defined enterprises as micro those employing less than 10 employees. Those employ between 10 and 99 are classified as small enterprises and those that employ between 100 to less than 500 are considered medium scale enterprises. This research focused on these type of garment manufactures in order to analyze their supply chain practices relation to sustainability concept. The study utilized qualitative approach by conducting preparing questionnaire to give answer for the research questions. Green SCOR model was used to analyze the existing supply chain practices, identify the gap and improvement opportunity.

Closed loop supply chain model was also used to analyze to analyze the reverse supply chain practices of these enterprises. The researcher randomly (simple random) selects 20 SMEs in Addis Ababa to analyze their supply chain practices using questionnaire. Among these, most of them are small enterprises because of their large number and their unstructured supply chain. The data were collected through closed-ended questionnaire which have different questions regarding with understanding and practices of green supply chain concepts (green procurement, green manufacturing, green distribution and green logistics) and closed loop supply chain activities. Green SCOR model was used to analyze the data obtained through questionnaire and different soft wares like MS excel for data analysis, MS Visio to draw diagrams during data analysis. The data that was collected to determine SC sustainability problems included the supply chain processes like plan, source, make, deliver and return process perspectives.

After the problems were identified from collected data, the mechanism of reducing the problem were proposed by using improvement opportunities based on green SCOR model concepts and

best practices. The current SC practices were mapped to identify the gap and improvement opportunities of the case companies and "To-Be" analysis also done by using G-SCOR model.

3. Results and Discussions

This section deals with data analysis result and discussion based on collected data by questionnaire method. The data includes green procurement which focus on selection of suppliers regarding with the green (sustainable) concepts, green manufacturing, green distribution which focused on the green packaging issues and also the green logistics concepts. The other issue regarding with environmental sustainability is certification of the companies with ISO standards and reverse logistics aspects. The SCOR processes related to each step of the supply chain are:

Plan process; based on the responses obtained from the questionnaire, companies did not implement sustainable (green) supply chain management system and this were risen from improper planning (Figure 1).

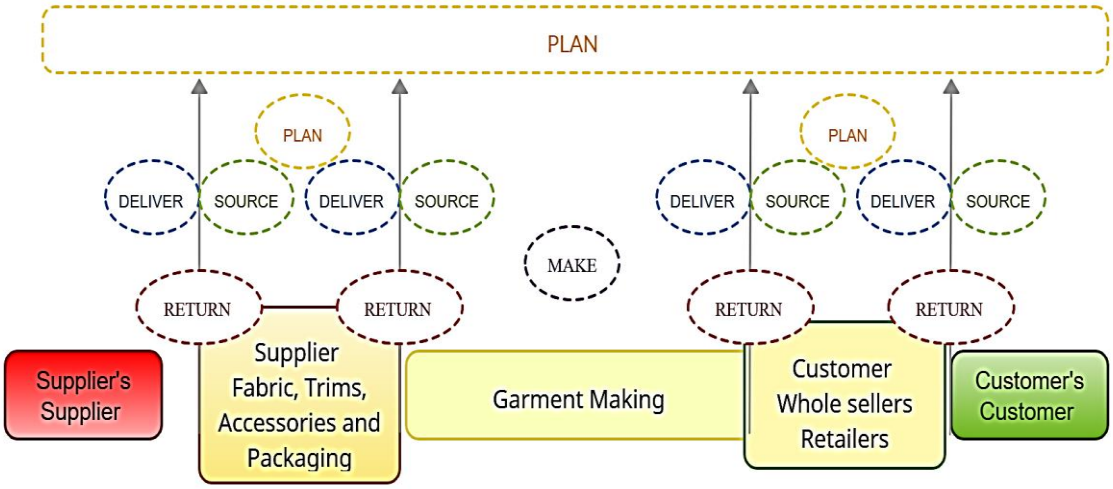

Figure 1: SCOR model for garment manufacturer (Source: Researcher's Draft)

In the planning process 73.3% of the respondents does not aware about "green supply chain practices" and this shows there is a gap regarding with planning for the implementation of green supply chain practices (Figure 2).

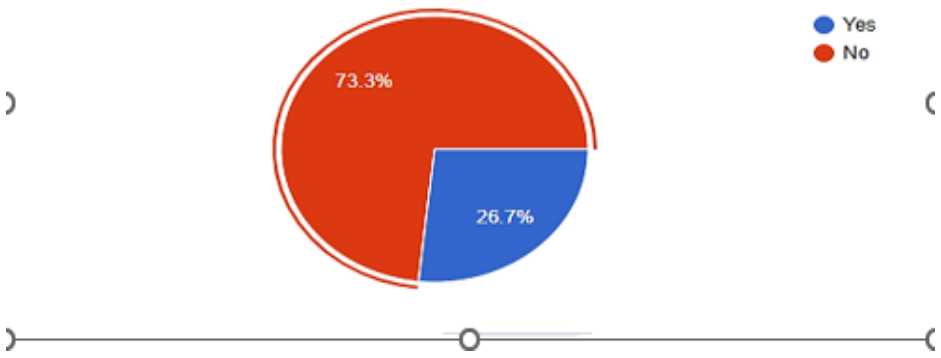

Figure 2: Response regarding with implementation of green supply chain (Source: Survey)

Sourcing Process; regarding with the sourcing, green supply chain involves the green procurement practices which constitutes many activities. In this research supplier selection system of the companies was assessed regarding with environmental competence of suppliers, technical &eco -design capability. In this regard garment manufacturers response shows 46.67% choose their supplier based on supplying capacity, 13.3% based on environmental capacity, 20% based on technical and eco design capability and reputation. Here, the environmental/ green aspect of supplier selection is less emphasized (Figure 3).

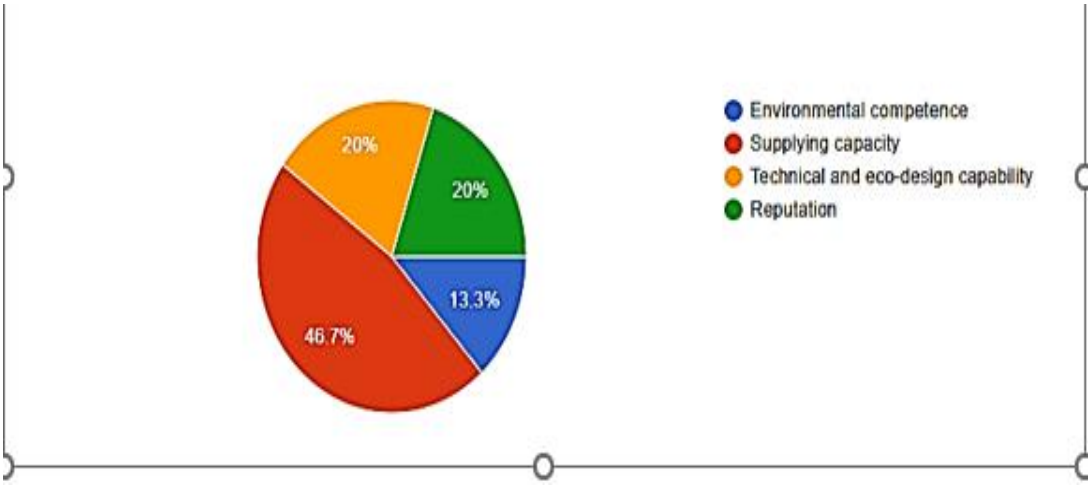

Figure 3: Respondents' response while selecting their supplier (Source: Survey)

In this research, the company's green procurement policy was analyzed and 86.7% of the respondent's response as they did not have green procurement policy. In sourcing process, the green sourcing policies are not practiced by these companies (Figure 4).

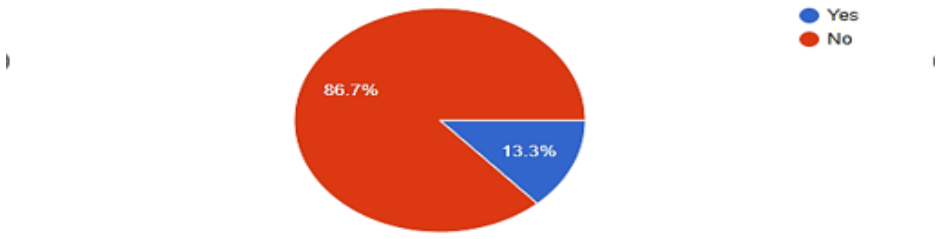

Figure 4: Respondents' response regarding with green procurement policy (Source: Survey)

The other issue analyzed in the sourcing process is, selection criteria mostly used by organization while buying garments. The response shows that 33.3% companies focus on the material type to make garments, 6.7% of them focused on recyclability, 13.3% of them focused on aesthetic value and 20% of them focused on the garment's ability to be environmentally friendly and 6.7% of them focused on supplier certification in relation to eco-management (Figure 5). In this regard, the companies did not give more attention to sustainable materials.

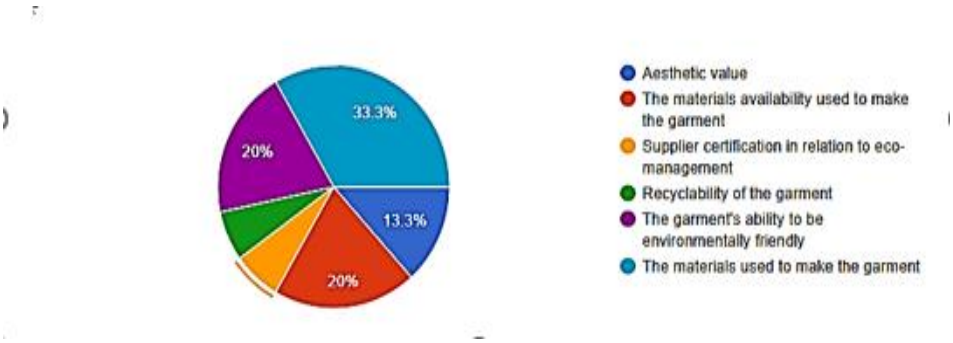

Figure 5: Respondents' response regarding to raw material selection (Source: Survey)

The other sustainable/green supply chain practice companies evaluated was, their main cooperation/agreement with their suppliers & buyers. As per their response most of them says they focus on the pricing aspects.

Making Process; the making process involves the green manufacturing function of GSCM. With this regard companies sustainable SC practices like 3R's (Re-use, Re-cycle and Reduce harming the environment) were analyzed and 60% of the respondents did not practice these issues. The other practice included in this process was the availability of emission control system and 60% of them did not have the emission control system.

Deliver Process; the deliver process of SCOR model is linked with the green distribution and green logistics aspect of green supply chain. In this process companies supply chain practice was analyzed regarding with the packaging and delivery system. Companies were requested to give their response regarding packaging practice they mostly use. 40% of response shows that

they are using low priced packaging materials rather than downsize packaging (0%), recyclable packaging (26.7%), re-usable packaging materials (0%) and easily accessible packaging materials (33.3%). The other issue is the type of packaging material frequently used by these companies and 60% of the respondents use poly bags to pack their garments rather than using cardboard, bio plastics and cloth bags (Figure 6).

Figure 6: Respondents' response packaging practice (Source: Survey)

In the delivery process there is also another issue which is the green logistics and transportation aspect. Companies' response was analyzed weather they are working with green logistics provider or not. 80% of the respondents say that they did not working with green logistics provider.

Return Process; The other issue analyzed in this SCOR process was weather the companies have a mechanism of collecting used garments and packaging materials from customers. In this regard 73.3% of the respondents did not have such mechanism. Here, companies' supply chain practice was analyzed regarding to the issue of returning packaging and products into suppliers for re-use. 93.3% of the companies did not practice it (Figure 7).

When we extend the SCOR model to environmental issues, it becomes the G-SCOR model to assess the environmental issues practicing by garment manufacturers. In this issue companies' supply chain practices were analyzed regarding with implementation of material sustainability index at design stage, certification to meet ISO environmental standards, environmental auditing practices, preparation & implementation policies of green supply chain management and regular environmental training program for employees. In these practices responses shows that there is a gap of practicing them. In order to fill this gap, the researcher customizes the following G-SCOR model by integrating it with the closed loop supply chain concepts.

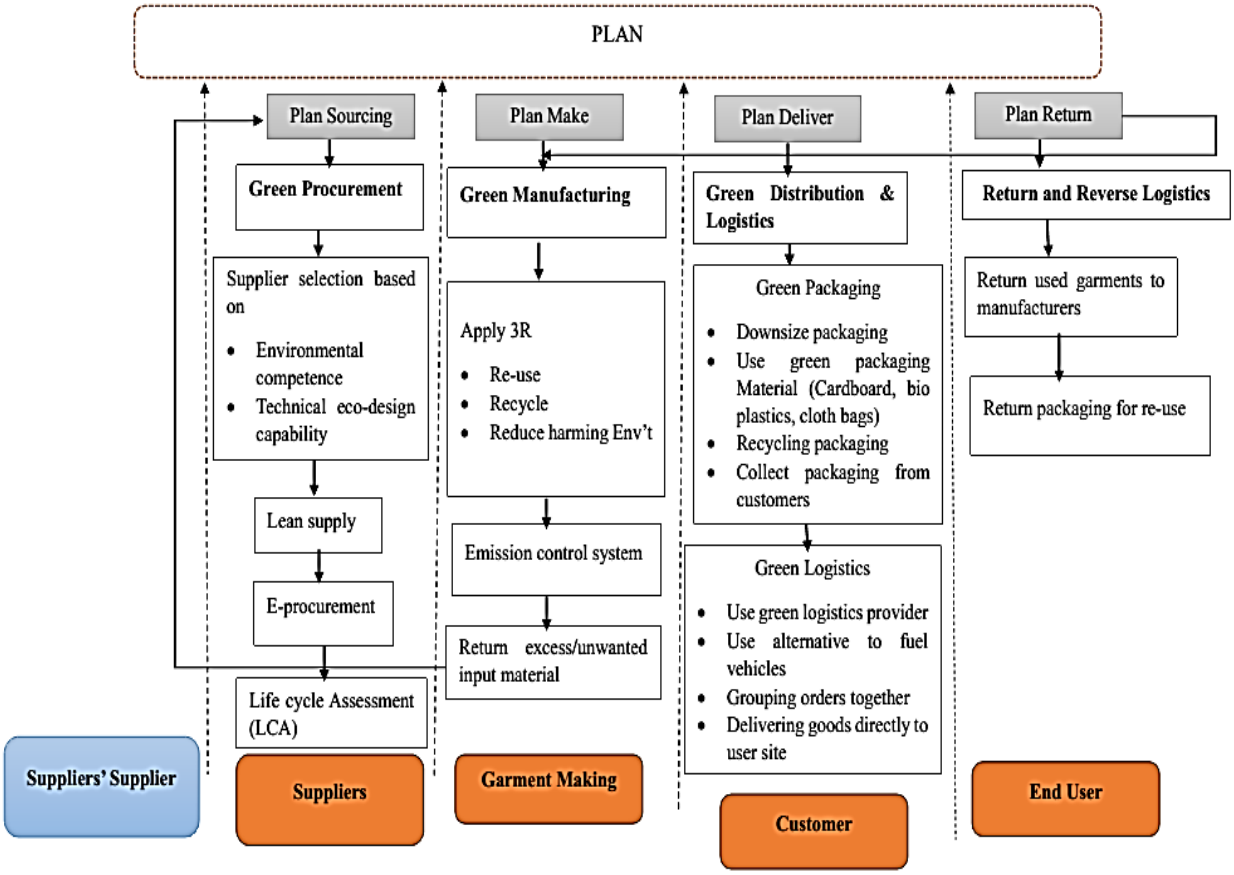

Figure 7: Customized Green SCOR model with Closed Loop SC

4. Conclusion

Sustainable supply chain management is essential for modern businesses seeking to balance economic growth with environmental issues and social responsibility. This concept is now treated as green supply chain management practice and which is one of the evaluation mechanisms in the global market. By integrating sustainability principles into every aspect of the supply chain from sourcing raw materials to delivering products companies can minimize their ecological impact, improve their competitiveness and meet regulatory requirements.

The adoption of sustainable practices not only leads to cost savings through improved efficiency but also fosters stronger relationships with stakeholders and consumers who increasingly prioritize ethical and environmentally friendly supply chain practices.

In summary, small and medium scale garment manufacturers have several gaps regarding with sustainable supply chain management and they should give more attention to the issue. This

will vital for achieving operational efficiency while addressing environmental and social challenges, ensuring that businesses thrive responsibly in today's competitive global economy.

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