

# Green Supply Chain Management Practices for Green Apparel Supply Chain

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**Abstract**—In order to achieve environmental sustainability in the apparel supply chain, the aim of this manuscript is handed into three folds. Primarily, this paper is presenting the green supply chain management (GSCM) practices through extensive literature review, which are closely relevant to the apparel supply chain. Secondly, proposing a model for green apparel supply chain (GASC) for the apprehension of environmental sustainability. Finally, some future research direction has been provided to proposed green apparel supply chain model. Incorporation of those GSCM in the apparel industry can enhance environmental performance by reducing environmental negative effect and may help the industry maintain their desired levels of quality, costs, reliability and energy efficiency.

**Index Terms**— Environmental sustainability, GSCM practices, Eco-design, Green purchasing, Reverse logistics, Traditional apparel supply chain, Green apparel supply chain (GASC).

## 1 INTRODUCTION

Environmental issues and global warming are becoming more attention drawing issue in the apparel industry. Such issues become even more complicated, when entire supply chain is considered [1]. In these consequences, organizations must look forward how to greening their manufacturing farms in the supply chain for sustainability. Though greening the supply chain might not bring direct economic benefits for the organization, still following variables may come into consideration why company should make their supply chain green; Customers demand on environmental friendly products, government subsidies or tax-cut and environmental friendly infrastructure, company's competitive advantages, and ethical stand are among the most common points [2]. Green supply chain management practices are related to internal environmental management, green procurement and eco-design.

However, main purpose of each organization is to maximizing their profit rather than just focusing on environmental consciousness but no organization can ignore the environmental issues for their sustainability.

Ameer, R., Othman, R., & Mahzan, N. (2012) [3] agreed that if companies want to improve their financial performance, they need to accept environmental sustainability program. Similar thought was proposed by another author Harijani, Ali Mirdar, et al, [4] that significant cost minimization can be achieved by environmental sustainable programs.

Although, many researchers have focused on green practices, but most of them have paid attention particularly on manufacturing process, green marketing, green branding, green supplier and reverse logistics of apparel industry [5-7]. In these consequences, this paper is comprises of three parts. Firstly, to accumulate all GSCM practices based on literature review. Secondly, a green apparel supply chain model has been proposed comparing with traditional apparel supply chain. Finally, some future research direction has been provided based on proposed model for the future apprehension of the research.

## 2 METHODOLOGY

Primarily, an extensive literature review has been carried out to identify various GSCM practices which are commonly used in automation, food and agriculture, electronics, home appliances, leather production etc. After getting different GSCM practices, we have done two interviews for

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getting appropriate practices for green apparel supply chain. First interview was conducted with clothing industrial experts including general manager, sourcing manager and environmental auditor. Second interview was completed with three scholars (Two Professors and one Assistant professor). Based on the literature review and interview result, a green apparel supply chain model has been designed in this article.

### 3 GREEN SUPPLY CHAIN MANAGEMENT PRACTICES

The idea of green supply chain management is getting popularity among those organizations who are interested to improve their organizational environmental performance and corporate image [8]. Although different authors have defined green supply chain management in different patterns but, they have used some common terms in their explanation such as green innovation, green purchasing and procurement, supply chain environmental management, green logistics and, sustainable supply network management, green marketing etc [9,10]. In addition to that, the GSCM practices are mentioned in many literatures based on their research interest for example; SAR Khan (2017) [11] has considered five independent variables for measuring green supply chain practices, those are eco-design, green manufacturing, cooperation with customers, green purchasing, and green information systems. In the review paper on green supply chain management (GSCM) practices, Sarkis, J. et al, [12] has shown some general terms as GSCM practices in the conceptual framework; those are internal cleaning practices, internal supply chain practices, supplier oriented practices and customer-oriented practices.

Pourjavad & Shahin (2018) [13] suggested green design, green purchasing, green manufacturing, reverse logistics are the dimensions for evaluating green supply chain management performance; at the same time the authors also mentioned regulation, environmental performance and economic performance are the criteria for green design; enforcement of stake holders, supplier-customer collaboration and quality regulations are the measure for green purchasing; green packaging, green stock politics, green technology are the criteria for green manufacturing; recycling, remanufacturing, reusing, dis-

posal are the criteria for reverse logistics. According to ABL de Sousa Jabbour (2017), [14] green purchasing, cooperation with customers and environmental performance are the construct for green supply chain management practices. For the green purchasing, the variables are suppliers' ISO 14001 certification, cooperation with suppliers for environmental objectives, providing design specification to suppliers that include environmental requirements for purchased items, second-tier supplier environmentally friendly practice evaluation and environmental audit for suppliers' internal management. For environmental performance evaluation variables are the emission of pollutant/waste, compliance with environmental legislation, company's environmental reputation and overall environmental performance. In the Table: 1 GSCM practices and implementation criteria are shown clearly.

Table: 1 GSCM practices are identified by literature review [15-20]	
GSCM Practices	Implementation criteria
Green Design / Eco-design	Low materials and energy consumption.
	Biodegradable product design.
	Reusable, recyclable, recoverable materials and component parts design.
	Avoiding or reducing hazardous substances during product design.
Green purchasing	Cooperation with customers for eco-design.
	ISO 14001 certification mandatory for supplier.
	Cooperation with suppliers about environmental issues.
	Considering environmental issues in the second-tier supplier.
Green manufacturing	Applying environmental audit for suppliers' internal management.
	Waste reduction in manufacturing processes.
	Renewable energy use during lighting and heating.
	Using eco-friendly packaging.
Customer cooperation	Returnable, reusable and recyclable packaging.
	Sharing information and making collaboration with customers.
	Involving customer for green innovation or

	developing product.
Green Logistics	Less CO <sub>2</sub> emission supporting transport use.
	Grouping order rather than smaller batches during shipment.
	Considering environmental effect planning for vehicles routes.
Reverse logistics	Involving suppliers for returning and replacing defective or out of specification products during production.
	Collecting finished products which are out of specification, damaged in transportation, malfunctioning, etc.
Life Cycle Assessment	Analysis of natural resources consumption of each product.
	Using recycle materials during production considering environmental effect.
	Assessment of generating solid waste, water and energy use during production and consumption.
Supplier integration	Collaboration with supplier for environmental purposes between a focal company and its suppliers.
	Information sharing and managing cross-firm business with supplier.
Green Marketing	Promoting environmental friendly products to the consumer.
	Increasing consumer awareness about products with environmental characteristics.
Waste management	Classifying solid wastes which are generated in the production process.
	Proper planning for solid waste management.
	Waste water treatment before disposal to the environment.

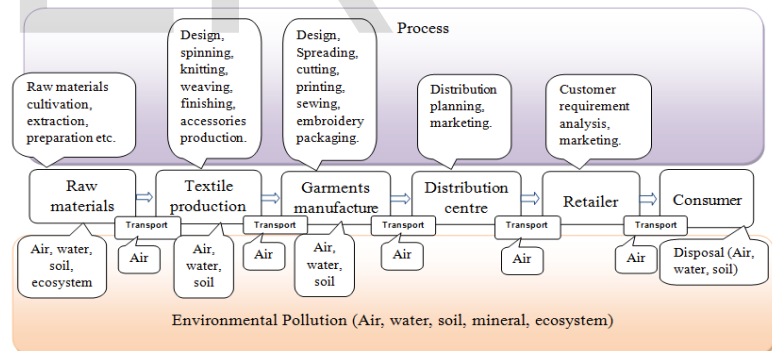
**4 DESIGNING GREEN APPAREL SUPPLY CHAIN COMPARING WITH TRADITIONAL SUPPLY CHAIN**

Supply chain is considerably complex in nature because it contains huge number of phases with many supplier and sub supplier, for instance, apparel manufacturing unit of the western fashion companies have around 500 suppliers in the first tire. Moreover, supply chain becomes more complex when second tire suppliers and their suppliers are taken into account. This in turns drastically

increases environmental damages in the supply chain, as it is difficult to monitor environmental regulation in such a gigantic sector. Aside from the complexity of the supply chain, consumer driven trendy, fashionable product (fast fashion) demand have added more essence in the sector of environmental damages , as it require continuous change of design, as well as a short time gap between production and distribution process. Thereby, fast fashion is generating more and more products thrown in the landfill endangering the environment. Figure 1, shows a basic open loop supply chain where apparel products continuously polluting air, water and soil in its whole processes. After rigorous literature review and interviews some important variables have been found to solve this situation of apparel supply chain. Using those variables, a green apparel supply chain has been proposed in this study (figure 2).

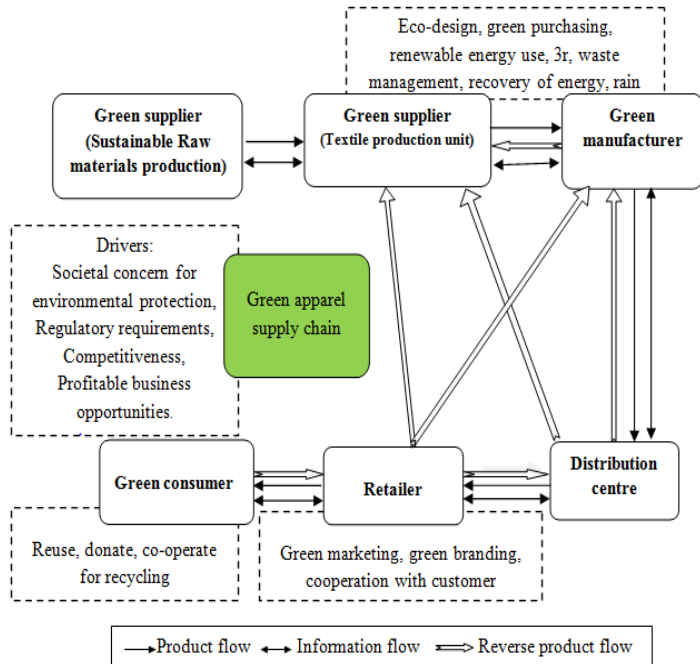
Green apparel supply chain is actually comprises of several close loop supply chain instead of open loop supply chain or one close loop supply chain. In the apparel supply chain reverse logistic flows in the opposite direction of product flow, it helps reduction of after use products disposal.

Figure 1: Traditional apparel supply chain.



On the other hand transportation needs to travel long distance. As a result huge amount of CO<sub>2</sub> gas emission occur. Solution has been shown in the figure 2. If retailer collects unused apparel from the customer, retailer will provide that apparel to the closest textile production unit or the manufacturer instead of traveling long way from retailer-distribution centre-manufacturer. Thus, green apparel supply chain can improve environmental performance as well as economic performance of the company.

Figure 2: Green apparel supply chain



## 5 CONCLUSIONS

In the conclusion, present study finds that, due to environmental sustainability concern GSCM practices in the apparel supply chain have become extremely vital simultaneously for practitioners and researchers. In the apparel supply chain, manufacturer can play a vital role to select green supplier and communicate with retailer to enhance the process of green marketing. In addition to that recycling and recollection are possible through appropriate reverse logistic system. It is also necessary to provide green product information to the market and their contribution for environmental sustainability, so that consumer can understand the necessity of green products. In addition to that availability of green apparel product in the market needs to be increased. Co-operation with suppliers and customer are the main key to establish green apparel supply chain. However, it is clear that all the activities in the traditional apparel supply chain are continuously damaging three vital elements of environment (Air, water and soil). To mitigate this situations our propose model can enhance sustainability throughout the apparel supply chain with the support of some particular green practices such as, green marketing, green branding, and green supplier and, reverse logistics.

## 6 Future Research

Huge number of used apparel products and accessories are discarded in each and every year. In addition to that, the quantities of their processing waste and discarded products are increasing beyond control, which in turns raises the concern for escalating green practices in the apparel supply chain. This high flourishing nature of apparel industry also raises the concerns for doing more research in the area of GSCM practices. Future research can focus on collection efficiency of used apparel products to enhance the process of reuse and recycle. Furthermore, as it provides evidence that used apparel collection program can improve the brand impression [21]. So, it is also necessary to do farther research on economical benefit of used apparel collection in the green apparel supply chain. In addition to that retail oriented green marketing program could also be a good research direction in the future. Research on multi loop apparel supply chain could be a suitable research direction in future. Influence of retailer in the apparel supply chain for sustainable practice is also an appropriate research area.

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