

# Conceptual Framework of Green Supply Chain Management in Manufacturing Firms of Bangladesh

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**Abstract**—The need for adopting environment-friendly strategies is echoing all over the world. Everyone now is concern about the detrimental effects of environmental pollution from industrialization and excessive carbon emission for producing goods and services by large corporations. Business leaders are looking for ways forward to get rid of it. In this aspect, green supply chain management (GSCM) can play a vital role by obviating the environmental wastes along with the chain and ensuring the best use of resources that will eventually be financially beneficial for the firms also. This study aims at drawing a conceptual framework of green supply chain management and finding out the influential factors of the GSCM in the manufacturing firms in Bangladesh. The study is an exploratory research based on secondary data. Based on a rigorous review of the existing literature, a conceptual framework has been prepared and various factors of GSCM have been identified in the context of Bangladesh. A model of GSCM has been proposed for the manufacturing firms in the socio-economic condition of Bangladesh. This model will immensely help the industry partitioners, especially the top management of firms, adopt GSCM strategy in their firms. The study will also help understand those factors that might influence the adopted GSCM strategy and develop counter measures.

**Key Words:** *Supply Chain Management, Green SCC Model, Green Economy, Sustainable Strategies, Carbon emission*

## 1. Introduction

In the modern industrialized world, environment pollution is an alarming problem. That may cause the extinction of humankind and another biodiversity on

the earth [1]. The world's environment is becoming the priority to the researchers as well as to the practitioners in the current prospect. According to the recent requirement, supply chain management is also designed to patronize environmental issues. In the modern era, the development of economic activity has crossed the countries boundary line. The world business activities are turned into an accumulative form. Competitive nature of the business phenomenon is influenced the manufacturing firms to achieve a mass optimum volume of production. Manufacturing firms primarily depended on the extraction of the natural resource for excerpting raw material and fuel to attain their production target [37].

Supply chain management performs in a structured format in the manufacturing sector. Early phases of supply chain management concept cover the area of procurement and logistics arena but the further development of the supply chain management focused on the creating value through the improvement of the product and service which is delivered to the end-user of the product [2]. Improvisation of the business pattern affect the profitability. But it is required to foster the system to optimization like as introduce to green practice [3]. Over the past two decades, the developed supply chain management focused on competitiveness and organizational effectiveness. Reduction of total cost and determination of responsiveness to customer satisfaction were included in the supply chain area

The concept of sustainable advancement has been a buzzing word in the current world and exposing as a prominent rule for establishing and overlooking the

rational strategies, since the 2005 declaration of the Kyoto Protocol, [4],[5]. Recently developed manufacturing industry draw deep attention to the operational activities of supply chain management which affects the natural environment too [6]. The previous objective of supply chain management has been changed. Green supply chain management is a growing, sustainable concept which is increasing the interest regarding this topic among researchers and practitioners of Supply chain management [7]. Green Supply Chain Management (GSCM) deals with some paramount objectives related to environmental performance, risk control, and meeting market price [8].

GSCM is an integrated concept which decants the ecofriendly concentration with the traditional supply chain management practice, to add environmentally aspects in the designing, procurement, process, distribution and the activity of value-added activity of supply chain. GSCM incorporate environmental concern into conventional SCM which is oriented to emerge management as a holistic environmental approach [9]. The goal of GSCM is to ensure sustainability in environmental and economic consequences with the enhancement of the value. GSCM is considered as an important corporate strategy deployed for the development of sustainability which creates a competitive advantage in the manufacturing sector [10], [8]

The environmental performance can be expanded by applying GSCM and thus the industry become more sustainable [11]. GSCM elevate the economic benefit by assuaging the environmental issues [12]. Cost or a combination of costs and non-cost performance is mainly two types of supply chain performance measures. Inventory cost and operating cost are considered as a cost measure. Contrary lead time, quality, fill rate, stock-out probability, and firm ability to switch productions and to introduce new products are also the essence that may emphasis the performance of Supply chain performance [18]

Bangladesh is spreading her contribution to the world economy premises. Ready garments product, leather product, medicine are the prominent booming manufacturing sectors of Bangladesh. The manufacturing industry is a competitive industry where the main concentration of the firms is to enhance their capacity to attain a large economic scale, cost minimization and responsiveness to the customers. But related stakeholders are apathetic to

the environmental issues which lead the issues of climate change, environmental hazard, less energy efficiency, insufficient waste management, discharging greenhouse gas directly to the atmosphere [13]. Green supply chain practice should be obligatory initiative in Bangladesh considering the current alarming pollution rate of environment. Wastage of manufacturing industry affects the air, land, and water vehemently.

So, it is high time to measure the acuteness of pollutions that impact on the environment and raise the intention to adopt the GSCM as soon as possible. The goal of the study is to find out the factors which influence the manufacturing industry in Bangladesh, to analyze the determinant and to propose a model which can support the manufacturing industry to adopt GSCM. Theses study conducted based on secondary data. This study assists manufacturing firms to measure determinant and develop their GSCM practice with economic benefit which will also contribute to flourish the environmental elements in a consistent manner.

The prime objective of the study is to draw a conceptual framework of green supply chain management in Bangladesh which is being practiced in the manufacturing industry. The other objectives include

- To find out the factors which are influencing the green supply chain management in the manufacturing industry in Bangladesh
- To introduce public and industry perception which affects the performance of green supply chain management in the manufacturing industry in Bangladesh.
- To propose a model which can support the manufacturing industry to adopt GSCM in Bangladesh

## 2. Literature Review

Green Supply chain management is associated with various environmental functions which are influenced by risk control, complying regulations, achieving commercial performance, etc. [8]. GSCM amplifies the scope of the supply chain management to cut down or to obviate the environmental wastes along with the chain and ensure the best use of resources [14]. The win-win relationship between environmental and economic outcome is balanced by the consistent

practice of GSCM. Entire supply chain environment and limited resources are the main substance of the green supply chain management which generate long term benefits for the strategic partnerships among players of GSCM [15]. Supply chain planning important urban environment as well as categorized environment is specified and contributed by the development of the supply chain management [16]. The benefits are attainable for both individual firms as micro-level and nations as macro-level [1]. For micro concept which related to individual firms are facilitated with the competitive advantage of lower cost, greener products and the advanced mobilized collaboration with suppliers. GSCM in the macro application which is inlaid with the national prospects exiles the markets of green product and the adoption of the effective environment practices. The complete product life cycle management which starts from the pre-manufacturing functions to last point of the product life even many often GSCM states after the product life depending on the effect of the product scrap

The green supply chain is a vast term but comparatively narrower than sustainable supply chain management in terms of objectives. Green supply chain management organizational objective is to ensure the maximization of the benefit relating to the environment as well as economic. Besides Sustainable supply chain management add the benefit of the society along with the existing objectives of the GSCM [19]. Green supply chain management discusses some prominent issues which are involved in different stages of GSCM-green purchasing, green production, green market, green consumption and reverse logistics [1].

For the purpose of manufacturing green products, a large volume of eco-friendly materials and other office products are ordered from environment-friendly producer. Green purchasing refers to certain activities which minimize the wastage of resources through the recycling of materials and reuse of the products in the purchasing phase [14], [33]. Prominent key factors of green purchasing such as the specific design of purchasing which include environmental measurement with eco-friendly orientations, objectives, internal management, and suppliers' ISO14001 certification are identified by Zsidisin & Hendrick (1998). In the manufacturing sector, quality is an emergent driver and integrated suppliers' chain is developed for ensuring the continuous process of improvement through monitoring supplier's

performance that begets the consequences of the effectiveness of business performance and determines the roadmap and proficiency of suppliers

Green production is also involved in the green manufacturing industry. Wastes are exceedingly procreated during the production process in manufacturing firms. Green production assists to maintain the large aspect of environmental interest at the time of production of goods and services

Greenmarket, green consumption, reverse logistics and organization culture are also contributing to the performance of the green supply chain in a sequential manner after concluding green purchasing and green production. Only green production initiative is not enough for the manufacturer to enhance the application of GSCM. Buyers should place priority to purchase the green product. An environment facilitated market would be patronized by the green customer's involvement. Consumers purchasing choice affects the environmental awareness and concentration of firms [38]. Chronologically in the 1980s and early 1990s, consumers demanded the goods which had to supply in the right time, at the right place, at the right price along with the proper quality of goods. Products are utilized by consumers and different performing value-adding functions are being reclaimed the further usage of the product by the end-users besides that ensures the proper disposal of the products which becomes an eco-friendly instinct [16].

Integrated environmental management was become expressly compelled as the quality revolution of the 1980s and the supply chain revolutions of the 1990s [9]. Supply chain practice has been transformed according to the demand. The situation of the global market is drifting regulation and perception. These have generated heavy environmental accountability and fetched the causes into ministerial obligations [17]. Today, the production technology becomes developed and the simplest products are passing through a highly complex process considering the production technology, required knowledge and the efficiency in different stages [2]. Green supply chain management (GSCM) is an emergent form of supply chain management concerning the environment reservation along with the best utilization of the resources. The basic target of green supply chain management is to abate the negative consequences on environment across the supply chain practice through compromising the environmentally friendly manufacture procedures. GSCM is an environmental

supply chain management that pursues purchasing and related functions that influence the reduction of wastages and maximize utilization of resources in organizational phenomenon along with the best application of recycling, reuse, and the substitutions of the excess use of the materials.

Four distinct phases are involved to GSCM (1) input stage (2) throughput stage (3) output stage (4) end to start / inverse phases [22]. The sequences begin from the input stages. In the input stage, green purchasing and green inbound logistics are included. In the second phase, throughput phase, practitioner conduct different type of green exercise-1) green manufacturing; 2) design for environment; 3) green building; and, 4) internal environmental management is the prominent precepts. Green Supply chain extended the outbound logistics in outbound stage that includes 1) green marketing; 2) green packaging; 3) green transportation; and, 4) green waste management [23].

The GSCM aims to obtain optimum resources utilization with the best usage of reducing manufacturing waste. Three levels value chain is involved in the manufacturing industry- upstream, midstream and downstream. Material, owner equipment, transporter, contractor and architect are the elements of upstream level. Green design, green material, green construction, green marketing, green purchase, and green environment are the main concentrations of the midstream level which is usually developed through green education and social responsibility and green post-treatment is maintained in the downstream level [24]. The manufacturer is directly depending on their suppliers for the raw material and other emergent materials of products. The production process of environment-friendly products and the concluding consequences depending on the utilization capacity along with reuse and regenerate substance for the further usage is motivated through upstream, midstream and downstream levels [5]. Industries of manufacturing can set up environment criteria for ensuring the green process in all phases of product life. Green supply chain management is screening as the summation of green purchasing, green manufacturing, green distribution, and reverse logistics. The performance of the green supply chain

management is depending on the contributions of these factors of the GSCM [25].

The manufacturing industry is becoming the most reliable sector which is boosting the contribution to the country's economy through local and international trade. Lack of environmental practices is a common phenomenon in Bangladesh which lead the consequences of environmental pollution, climate change, less efficiency in the application of energy, poor waste management and more carbon accumulation [13]. Environmental issues create a natural trait which have an impact on the overall aspect of the supply chain management from the beginning part of the location selection to final product disposal. Within the process of GSCM, technologies employment, product design, manufacturing process, packaging, energy consumption, logistics, raw material purchase chain, marketing, worker safety, sales, etc. those are affecting the output levels are included in GSCM. In the prospect of Bangladesh, a large amount of initial cost for the conversion in SCM oscillates the manufacturing industry to adopt the GSCM. The practice of GSCM in Bangladesh is comparatively poorer than in European countries. Building up a brand and developing the brand value is one of the effective incentives for the enhancement of green supply chain management [25].

## Research Methodology

For conducting the study on green supply chain management in the manufacturing industry, data and supported information is collected through secondary sources. The objective is to define the actual problem and analyze the problem with potential recommendations. Constraints of time and accessibility in manufacturing firms are the main limitations in the data collection process. Secondary data is being used in the study to abate the limitations of the study. Secondary data such as articles, e-book, conference publications, different web portals, observations, and research papers are used in this paper. The paper is focused on qualitative data. In this study, data is expressed in a descriptive way.

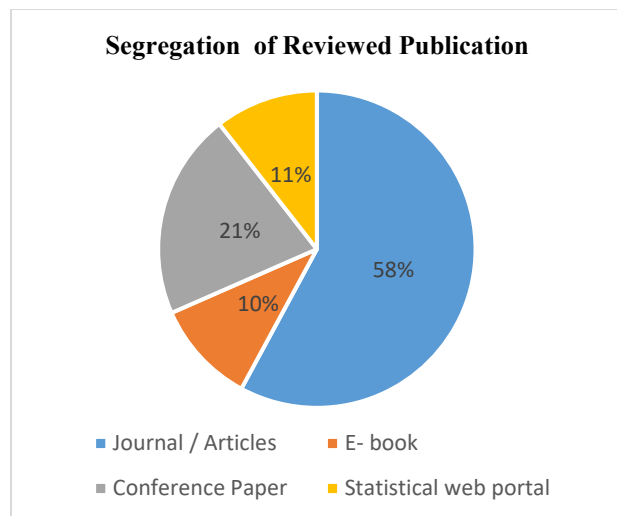


Figure 1: Types and segregation of reviewed literatures.

For carrying out the work, the literatures which related to green supply chain management and supply chain management are being followed. Among total 38 reviewed papers 22 papers and sources are focusing on green supply chain management and rest 16 reviewed literatures and sources are concentrating on traditional supply chain management. Among these 38 reviewed literatures 22 (58%) are from different journal, 4 (10%) are from existing e-book, 8 (21%) are from different international journal, 4 (10%) are from various reliable statistical web portal.

Table1: Contribution and development of reviewed literatures and research gap

Types of Literatures	Contribution/ Development	Research Gap
Literatures on Green supply chain Management	Factor analysis, challenges issues, standard development, factor implementation, Drivers of factors, assessing performance, drivers on environmental sustainability, overview and implementation, urban characterization, systems thinking perspective, integrated framework, performance and outcome,	<ul style="list-style-type: none"> <li>GSCM elements practice and environmental performance in manufacture firm of Bangladesh</li> <li>Identified factors and sub-factors in GSCM in Bangladesh prospect</li> <li>Potential model of Green Supply Chain Management in manufacturing industry of Bangladesh</li> </ul>
Literatures on supply chain Management	Industrial production, concept development, performance measurement, integration and resilience, environmentally responsive, fundamental of SCM, historical view, tools of integration	

The existing reviewed literature are prominently cover in the several potentials are of supply chain management as well as in the new concept known as green supply chain management. Factor analysis, challenges issues, standard development, factor implementation, Drivers of factors, assessing performance, drivers on environmental sustainability, overview and implementation, urban characterization, systems thinking perspective, integrated framework, performance and outcome etc. arena have already well focused in the reviews literature of green supply chain management. Besides Industrial production, concept development, performance measurement, integration and resilience, environmentally responsive, fundamental of SCM, historical view, tools of integration etc. prospects have studied in the existing literatures of SCM. But some research gap could be figured out which is developing in this study. This study is contributing to develop a potential model of green supply chain management in manufacturing industry of Bangladesh, point out the GSCM elements practice and environmental performance in manufacture firm of Bangladesh and mention to

Identified factors and sub-factors in GSCM in Bangladesh prospect

#### 4. Green Supply chain management in Bangladesh

The manufacturing industry plays a momentous role in the growing economy of Bangladesh. In the fiscal year 2019-2020, the manufacturing industry creates 20.4% employment opportunity in the country. The manufacturing industry is considered as the fast-growing sector in Bangladesh [13]. The estimated GDP of Bangladesh in the recent year of 2019 is 286.00 USD Billion which is projected to turn around 305.00 USD Billion by 2020. Manufacturing industry contributes all-time high of 25730.30 BDT million in 2019 and a record low was estimated 7383.40 BDT million in 2006 [26]. Manufacturing industry contributes the lion share to the GDP in Bangladesh. But the adverse part of the manufacturing industry is the industrial wastages. The volume of solid wastage in municipal including manufacturing industry in

Dhaka, Bangladesh is generating in urban area-3000 tons per day [28], [19]. According to REHAB (2014), there is belonging to a total 1081 number of construction companies in Bangladesh [27].

In Bangladesh green supply chain, is not practicing well comparing to the European countries. For ensuring the effective use of green materials, Bangladesh national building code (BNBC) required to be revised. An extensive amount of waste which is generated in Bangladesh due to unplanned industrialization, fast urbanization, and unconscious lifestyle. Lack of Public awareness and industrial responsibilities are pelting the environment to face hazardous consequences [13].

The existing main objective of the manufacture firms in Bangladesh is to maximize the profit or to minimize the cost along with ensuring the maximum customer satisfaction according to the target. On the other side, consumers are very much sensible to the product price and cost. Consumers are not much concern about environmental issues which can be improved by wastage management, resource utilization, and green management. As the consumers are not much responsive to environmental issues, the manufacturing

firms are focusing on the different tools of supply chain management which ensure the product on the right time, at the right place, on right form, to right customer which meet the demand of customer but ignoring the environmental impact in supply chain management [29].

According to the investigation of Aziz and Hafez (2003) over the past 40 years, the worldwide outcome rate and productivity of manufacturing industry have become falling; lean production process can be a better way to improve the situation [30]. A number of organizations like the environment agency the UK government, BREEAM (Building Research Establishment Environmental Assessment Methodology), the construction industry board (CIB), Building Research Establishment (BRE) Waste concerns, Bangladesh Association of Construction Industry (BACI), the Construction Products Association (CPA), US Environmental Protection Agency (EPA) etc. have started their concerns to make sustainable of the construction and manufacturing sector [15]. Green supply chain management is a little fresh field for Bangladesh but much valuable part to attain sustainability

Table 2: The distinction between traditional suppliers, green suppliers, and sustainable suppliers

	<b>Organizational Objectives</b>	<b>Relationship in Supply Chain</b>	<b>Evaluation Standards</b>
<b>Traditional Suppliers</b>	Maximum benefit of economy	Short-term and rival strategy	Price, quality and delivery
<b>Green Suppliers</b>	Maximum benefits of economy and environment	Green cooperation and competition	Economy and environment
<b>Sustainable Suppliers</b>	Maximum benefits of economy, society and environment	Partner for creating new value through SSCM	Considering the TBL factors

Source: Zhou and Xu, 2018

Supply chain management emphasizes the maximization of economic benefit which is applicable for short term. Customer satisfaction is one of the main objectives of the supply chain. Customer satisfaction generally depending on the customer's class, customer's social status, customer's choice along with product specification, availability of the product and price of the product, etc.

Price and quality of the product are the evaluation standards which used to measure the traditional suppliers [21]. In Bangladesh traditional supply chain management usually used in the manufacturing industry to attain cost-benefit and customer requirement.

Green supply chain management is the most vibrant topic in the supply chain world. For attaining the

sustainability in resources management with the efficient operation of chains, the green supply chain is the earlier phases of sustainable supply chain management. Green supply chain management focuses on the maximization of economic benefit by nourishing the elements of the environment [15],[20]. Green supply chain management is engaged to ensure the best use of resource for production. Though in Bangladesh green supply chain management is a new concept, there is a vast scope to develop the factors of GSCM and applying the new appreciable model in the manufacturing industry.

Sustainable supply chain management pays more attention and significant concern about the sustainable choice of sustainable suppliers. Sustainable initiative in the upstream choice of sustainable suppliers is directly related to the fame of the umbilical firms [21]. Sustainable suppliers are mostly related to the sustainable supply chain management that considers the triple bottom line (TBL) factors. In triple bottom line includes the environment, social and economic factors. Sustainable supply chain management (SSCM) develops the relationship with sustainable suppliers and maximize the benefits of economy, society and environment through the collaboration of supplier that pretending as a partner for creating new value through Sustainable supply chain management. In Bangladesh sustainable concept is not frequently practiced in the manufacturing industry. SSCM is lagging behind because of less interest and less consciousness of publics as well as firms. Besides less involvement in conventional education can also be a cause of less adoption of SSCM in Bangladesh.

The green supply chain management assists in implementing eco-friend supply chain through consistent practice of environment concern aspects. Green supply chain management is a new concept for Bangladesh. But it has a great impact on international business. GSCM is still limited to environment-friendly supply chain management. The foundational elements of corporate environmental management are relatively a new area of study and practice [25]

Green supply chain management is an environmental concern practice which usually maintained through green procurement (GP); green design (GD); reverse logistics (RL), green manufacturing (GM); internal environmental management (IEM), Investment recovery (IR); Co-operation with customers (CWC), green distribution (GD) [11]. Green production

apparently performs to ensure the solution of an environment-related cost-effective process of conventional business to direct a selection of product services that respectively alleviates the negative impact on the environment [15]. Developed countries are mostly purchasing raw material and raw products produced by developing countries. If those developing countries who play the supplier's role, do not maintain the standard of green suppliers, the accumulative objective of the green supply chain is being disdained.

Green Design is an initial requirement for building a green supply chain process. In manufacturing intensive country like Bangladesh green design is highly required for managing the wastage of this industry which may carry the responsibility for health risk of the citizen. The green design creates a wide scope in various discipline of product safety, occupational health safety, resource conservation, eco risk management and waste management [11].

Green manufacturing process converts the traditional manufacture process to ecofriendly process considering equipment, raw material, and other products related to the manufacturing process. The equipment which is using in the manufacturing process is fast, reliable and efficient and in process of input is used reasonably less impact on the environment with high effectiveness and little or no pollution [25]. In the prospect of Bangladesh, green manufacturing implementation primarily increase the initial capital cost and a huge volume of machinery and equipment can become abandoned that also enhance the economic and social risk. At the beginning of the adaptation of green manufacturing process, proper planning and feasibility examination are required for attaining a long term economic and environmental benefit.

Reverse logistics refers to a group of functions that are exercised after the sale of the product to regain the value and recirculate the product life cycle. The process of reverse logistics includes recollect the product from the final user and returning the product to the manufacturer for further production that is known as recycling. Recovery is an aggregated formation of remanufacturing, reuse and recycles. Bangladesh deals with the urban area- avg. 3000 tons of dry waste per day. There is lying a huge potentiality to use this waste for further production with the assistance of reverse logistics.

Table 3: Waste generation segregation in different cities of Bangladesh

Cities	Total Waste Generation (tons per day)	Total Waste Generation (ton per annum)
Barisal	59.53	21,727.36
Chittagong	1,008.81	368,215.65
Comilla	86.00	31,390.00
Dhaka	3,347.74	1,221,925.10
Gazipur	48.29	17,625.85
Khulna	174.79	63,798.35
Narayangan	178.50	65,152.50
Rajshahi	124.88	45,581.20
Rangpur	105.08	38,354.20
Sylhet	152.27	55,578.55

Source: Bangladesh waste database, 2018

There are basically three types of manufacturing firms belonging to Bangladesh. These are large, medium and small. Accumulating all these three types of firms, there are 35,993 numbers of manufacturing firms installed all over Bangladesh but only 20 firms are working on recycling purpose. RMG is the prior export good Bangladesh. The sum of the RMG industry reaches to 88.4% and most of the garments industries are established in Dhaka, near about Dhaka, Chittagong, and Narayangan. Moreover, many electronic industries, cement industry, and leather industry are also established on near about Dhaka, Chittagong, and other cities. According to the Bangladesh waste database 2018, Dhaka and Chittagong are highly responsible for waste generation. Both are manufacturing base cities. Manufacturing industries are also responsible for waste generation. It impacts adversely on the environment but there is a high potentiality to establish more recycling firms to regain the raw material and to reuse the product.

Green supply chain management support to accomplish advance management practice which includes internal environmental management (IEM). It assists to develop the environmental performance with the object of reducing the manufacturing waste. The process of IEM includes a different level of assistance these are- senior manager commitments, mid-level manager's support, and cross-functional assistance,

total quality management, environmental compliance auditing program, and an ISO 14001 certification, etc. [31]. Green distribution influences the outbound supply chain management that includes the distribution and transportation which are forced to ensuring transparency regarding the environment saving attitude in distribution practice.

Bangladesh is an economically progressive country in Asia. Still, Bangladesh is belonging in developing country's status. There is a very flimsy portion of GSCM which adopted in the manufacturing industry. Lack of legislation implementation, less consciousness, insufficient knowledge, poor management, co-ordination is responsible for less adaptation of GSCM [13]. Most of the consumers in Bangladesh, are concentrated on the price and quality of the goods rather than considering environmental issues. Besides Firms are only focusing on the profits. Eventually, the firms are ignoring the business responsibility to society as well as to the environment. As GSCM enhance the capital cost in order to convert the conventional supply chain management to green supply chain management. And the consumer is less responsive to the product on environmental prospects. So, manufacturing firms are less interested to adopt GSCM. Manufacturing firms in Bangladesh are focusing on the immediate benefit but GSCM required initial investment with long term economic and environmental benefit.



Table 4: GSCM elements practice and environmental performance

Authors	GSCM practices	Country Focus		Industry
		Developed Country	Developing Country	
Wan Mahmood et al., 2013	<ul style="list-style-type: none"> <li>• Green Production</li> <li>• Green design</li> <li>• Reverse logistics</li> </ul>	Malaysia		Manufacturing companies
Vijayvargy and Agarwal, 2014	<ul style="list-style-type: none"> <li>• Green procurement</li> <li>• Green Distribution</li> <li>• Reverse logistics</li> </ul>		India	Organization
Holt and Ghobadian, 2009	<ul style="list-style-type: none"> <li>• Internal environmental management</li> </ul>	UK		Manufacturing companies
Zhu et al., 2013	<ul style="list-style-type: none"> <li>• internal environmental management</li> <li>• Green procurement</li> <li>• Green design</li> <li>• Co-operation with customers</li> <li>• Investment recovery</li> <li>• Green manufacturing</li> </ul>	China		Manufacturing companies
Jr et al., 2012	<ul style="list-style-type: none"> <li>• Co-operation with customers</li> <li>• Green Distribution</li> <li>• reverse logistics</li> <li>• Investment recovery</li> </ul>	USA		Manufacturing companies
Ortiz et al., 2009	<ul style="list-style-type: none"> <li>• Green Production</li> <li>• Green design</li> <li>• Green manufacturing</li> </ul>		Colombia	Construction industry
Chun, et al., 2015	<ul style="list-style-type: none"> <li>• Green Production</li> <li>• Reverse logistics</li> <li>• Green manufacturing</li> <li>• Investment recovery</li> </ul>	Korea		Construction companies
Shah and Muraduzaman, 2013	<ul style="list-style-type: none"> <li>• Green Production</li> <li>• Reverse logistics</li> <li>• Green marketing</li> </ul>		Bangladesh	Manufacturing companies

In this table, the green supply chain practice of few developing and developed countries in significant industries have been upheld. The practice of GSCM in different countries may vary but the main goal is to improve the concentration regarding environmental impact along with economic output. The European country is comparatively much concern about the GSCM prospects and environmental issues. India, Thailand, and Indonesia which are belonging in a developing country have practiced GSCM. Moreover Switzerland, USA, UK, Canada, Australia, Malaysia, Korea, China [32] which are belonging in developed countries and have established GSCM in the manufacturing and construction industry.

In Bangladesh, the green supply chain is a fresh field that means most of the firms in the manufacturing industry of Bangladesh are still not competitively adopting GSCM. Few RMG firms, medicine firms,

and handy craft firms in Bangladesh are little moving forward to take the different initiative that supports to start GSCM practice. Green purchasing, green marketing and green manufacturing practice of some firms, mostly in RMG, medicine and handy craft firms, influence to enhance the exercise of GSCM [25]. Previously only handy craft firms exercised reverse logistics. But now, some RMG firms and few other manufacturing firms are also ensuring the waste management program and practicing reverse logistics to create a competitive green standard of the products. Leather, electronics paper manufacturing industry of Bangladesh are highly recommended to practice GSCM. These manufacturing firms are much sensitive to the environment besides these manufacturing firms are also taking possession of the country's economy. So, it is high time to start GSCM in Bangladesh to keep state with worldwide practices.

#### 4.1 Factors of GSCM in Bangladesh

The factor analysis of GSCM is empirically classified into six factors. These are- internal environmental management, green purchasing, cleaner production, recovery, eco-design, and pollution. Sub-factors also influence directly to the practice of GSCM as well as the performance of supply chain management. 34 sub-factors those work for measuring the factor's responsiveness, introduced by Hamideh Shekari, Skandar Shirazi, Mohamad Ali Afshari and Said Mehdi Veysseh, 2011

The major six factors are dominated by described 34 sub-factors. These factors are influencing the complete GSCM in manufacturing prospect. But in Bangladesh, GSCM is not a well-practiced management tool. GSCM is still in Bangladesh at the primary level. The more factors can be involved considering the prospect of manufacturing firms in Bangladesh. The manufacturing firm in Bangladesh is acting as a fresher in the field of GSCM. Green production factor and Recovery factor are usually using in the manufacturing firms of Bangladesh. Eco-design factor in the manufacturing industry is practicing very little [25]. But firms are starting to build up the knowledge of GSCM little progression is estimated in some firms of RMG sector but the number of firms is very few. Better performance can be attainable through green supply chain management.

Apart from these factors, primarily consumer perception and awareness of local people is also important to flourish the concept of GSCM in Bangladesh. Education, knowledge sharing, open discussion program, seminar and these types of soft infrastructural initiatives help to develop the intention of adopting GSCM and build up awareness focusing on environmental issues. This practice should not be limited to a certain social community. Any people from the urban area as well as from the remote area

can be a potential worker, potential customer, potential supplier, and potential employer, etc. So, the concept of GSCM should be reached at the remotest area of the country to attain the maximum output from GSCM. On the other hand, local manufacturing industries are focusing on the short-term monetary benefit [35]. Firms are contributing to society through different initiative for the development of social drawbacks. But most of the firms are less concern regarding the responsibility to the environment.

Through the development of public awareness regarding the impact on the environment, the practice and process of supply chain management influences and lead the manufacturing firms to maintain a certain standard considering environmental issues. One of the basic objectives of a firm is to maximize the satisfactory level of customer. If customers are much concern about environmental issues, the manufacturing industry will focus much on GSCM practice for meeting customer demand. In other part, firms should also deliberately emphasis on green supply chain management to attain their competitive advantage [34]. In developed country firms take the different initiative to enhance the practice of GSCM as well as the initiative to make the customer more concern about the impact on environmental issues and make the customers understand about the consequences of environmentally unfriendly practices. Both firms and customers are positivity related. Customer's demands influence the firm's practice of supply chain. Similarly, firms can build up public awareness through the different public motivational initiative. The root-level practice of GSCM is required to pulling out the maximum output. Awareness or public perception is a soft factor involved with GSCM that plays an important role to enhance or to build up the environment-friendly concentration in every level of customers, employees, suppliers, vendors and other related parties.

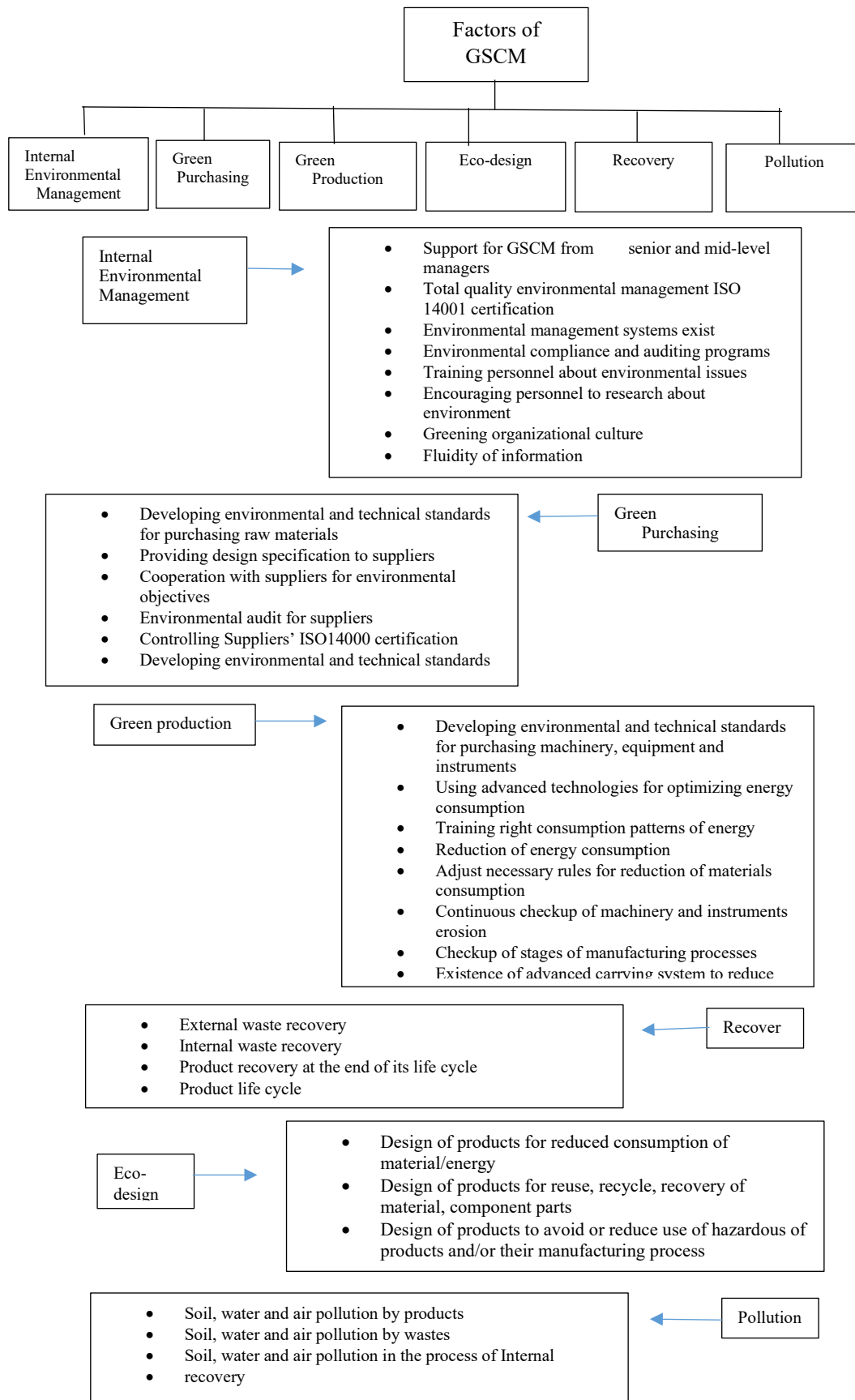


Figure 2: Identified factors and sub-factors in GSCM

## 5. Discussion and Findings:

Green supply chain management is an exigent issue for the world's economy. The environment has already been greatly hampered in the last few decades. Mass production, illogical resources extraction, unplanned waste management is also responsible for the deterioration of the environment [19]. Globally major manufacturing countries are developing different models of supply chain management to improve governmental practice by adopting supportive tools to diminish the harmful impact on eco-system. GSCM model is a combination of ecological modernization theory and waste behavior theory that underpinned the practice of waste reduction. Adopting different environmental practice with the consideration of institutional drivers and pressure inspire natural eco-system that intends to protect the environment. Technological support, environmental tools, and innovations increase the performance of GSCM. Environment management theory and industrial

adaptation are highly depending on the type of the industry as well as the different contextual pressures of environmental development.

Developed countries are usually more concern about green prospect comparing to developing countries like Bangladesh. In Bangladesh Green, supply chain management is not practiced with the mass operation. Very few manufacturing firms are primarily adopting GSCM. But there is no structured format or any signified model. So, the green supply chain management in manufacturing firms cannot be guided as well as there is no common standard which can ensure the efficient GSCM practice. There is a huge scope for improving GSCM in manufacturing firms of Bangladesh. In international trade, Bangladesh may also ensure comparative advantage through maintaining GSCM standards. A proposed model of GSCM is being proposed in this study that may potentially support the manufacturing industry in Bangladesh.

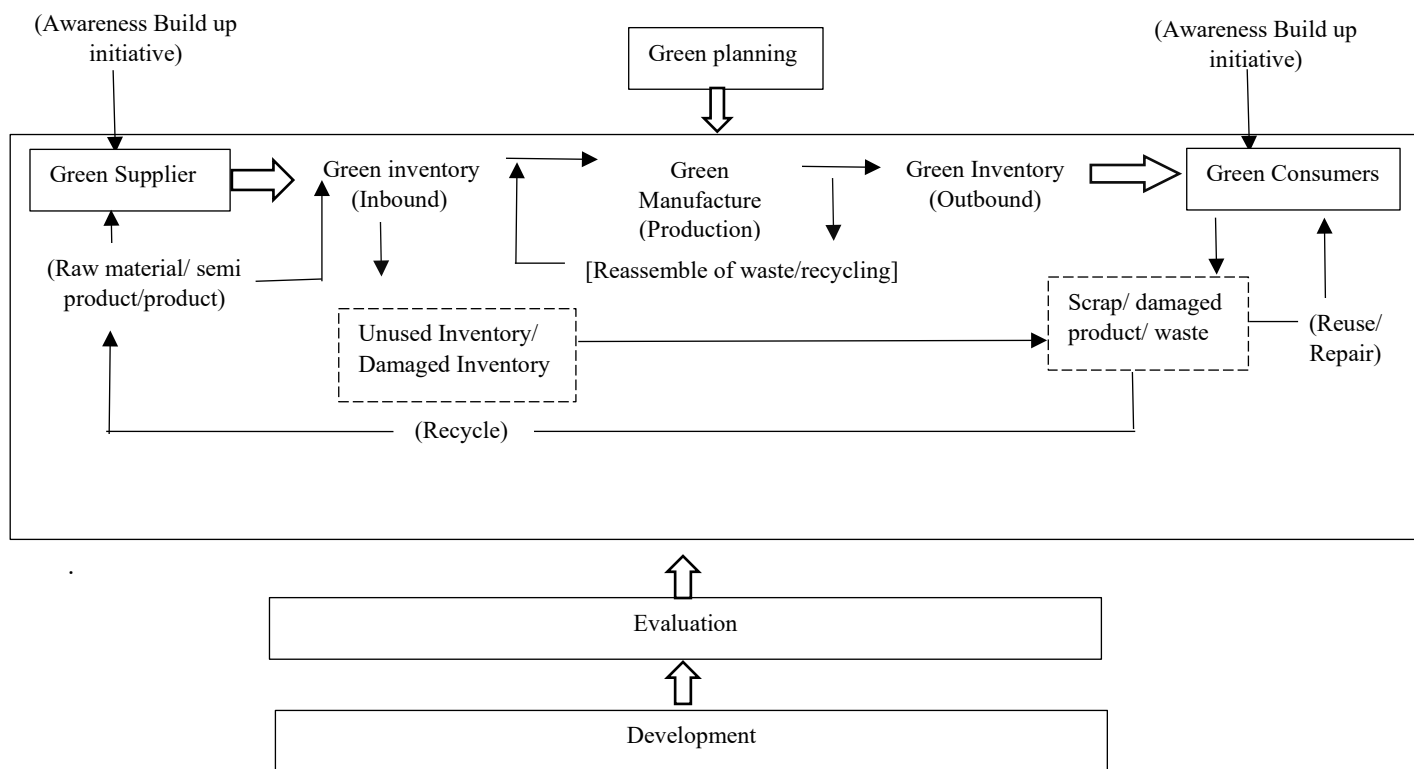


Figure 3: Proposed model of Green Supply Chain Management in manufacturing industry of Bangladesh

Worldwide green concept is highly appreciated. The supply chain is a vital part of operation management in manufacturing firms. In a developed country, green supply is belonging in the development stages. But in Asian developing countries green supply chain is not being practiced in an effective manner. The green supply chain concept is still a little fresh concept for Bangladesh. In international trade, manufacturing products of Bangladesh play a vital role that significantly contributes to the country's economy. There is belonging a mass potentiality to implement GSCM and to continue consistent practice GSCM. A GSCM model for manufacturing industry in Bangladesh is being proposed in this study.

Initially building up awareness is essential for spreading the practice of GSCM. Raw materials for manufacturing industry are supplied from rural, agriculture intensive area and many distributional channels are involved to reach the raw material at firms. Green suppliers ensure the supplies which should be environment concern and more effective comparing to traditional supply chain management. In manufacturing house, raw materials are processed to turn the raw material into semi-products or final product. Green manufacturing firms should design an environment-friendly procedure with less energy-consuming equipment. The green manufacturing process should also confirm the maximization of resource utilization. Manufacturing firms usually maintain a certain volume of raw materials and finished goods or semi-finished goods to mitigate the risk of unforeseen demands and supplies.

In the chain of supply, a predictable inbound inventory of raw material would be unused or damaged. These inventories may not add any value to this industry. But those inventories may be still useable for another industry. So those damaged inventories should send to suppliers. Suppliers are usually keeping well relationship with the manufacturing firms. So, it becomes easy for the supplier to move those inventories to other industries. A certain percent of the product would be damaged in the manufacturing process or outbound warehouses. Those damaged products or wastage may reassemble or reform for further production. The consumers consume the final goods. And after a certain duration, the lifeline of that product will be finished. And repair and reuse extend the utility of those goods to the consumers. At the end of the product lifeline, those products turn into scrap products. Recycling industries work with the scarp products and refurbish the raw material from that scarp goods and the existing wastage of those goods should be terminated through practicing waste management that assures the protection of the environment. According to demand, those refurbished products meet the demand of suppliers as well as production houses.

Green chain management is a consistent process to attain long term environmental and economic benefits.

Today's world is very fast. In GSCM, every spare of the chain should be evaluated after a certain duration of practice of GSCM. And few standards should be followed for maintaining the consistent performance GSCM in the manufacturing industry. The tools like – integrated cooperation, relationship with customers and suppliers, waste planning, proper resource allocation, and planning assist GSCM to obtain the primary goal of green concept. Integration is an applying concept in supply chain management to amplify the efficiency through logistics, procurement, operational activities and the flow of the material [36]. Research and development are an obligatory part of the betterment of GSCM. The concepts, tools, factors, and limitations can be pointed out through research and development. Even solutions of the GSCM problems and limitations can also be discovered through research and development. On the other prospect, development initiatives like- seminar, group discussion, open forum, and education make the different parties concern and responsive about green practices. Moreover, these parties are directly or indirectly involved with GSCM. Considering the vast prospect of GSCM in manufacturing firms of Bangladesh, these types of initiatives are required to increase the adoption capability of GSCM.

## 6. Conclusion:

The prime goal of GSCM is to ensure the maximum environmental and economic benefit through the proper exercising of green supply chain activities. Bangladesh is an economically growing country. RMG, medicine, paper yarn, jute goods, leather are the significant manufacturing industry in Bangladesh. Though few firms are adopting and exercising GSCM, Bangladesh is a high potential country to preface GSCM effectively. Bangladesh is a labor-intensive country that generates absolute advantage in a few sectors. Now the world's economy is becoming much sensitive regarding environmental issues. So, it is extremely potential for the manufacturing industry to earn a competitive advantage by practicing GSCM.

Many demonstrated factors are influencing the performance of GSCM. But most of the factors are affect after adopting the GSCM. There is another soft factor which is an influence to adopt the GSCM. Environmental awareness is one of the most significant factors that is acutely required to be developed the condition of GSCM in the manufacturing industry of Bangladesh. Moreover, the environmental awareness factor is depending on the public perception, industry's type, product's type,

quality, and motive. This factor usually works for improving the intention to adopt the GSCM. Education enhancement, seminar social publicity, motivation on those specific environmental issues and assessment of the consequences influence both micro and macro business prospect to attain the end objective of business that is ensuring consumer satisfaction. To adopt the GSCM, the initial capital cost is required. But GSCM works for attaining the competitive advantage.

This study is mainly literature-based. In this study, an effective soft factor is newly introduced with public and industry perception and consequences are also considered. Besides a proposed model is signified. The study is focused on qualitative analysis expressed descriptively. The only operational prospect of GSCM in the manufacturing industry of Bangladesh is considered in this study. Quantitative analysis, barrier assessment, sensibility analysis of factors and so on would be scope for future study. Few meaningful findings and recommendation are suggesting in this study.

Governmental initiative and patronization influence firms and the public to exercise GSCM. The government in Bangladesh tries to build up the platform of practice green concept in different sectors that ensure the overall sustainable economy. But awareness building up programs should be accelerated to influence public perception to use the green product. GSCM is a process of collective activities. A single party barely ensure the stability of GSCM concept. It is emergent to perform collectively. Cooperation, the fluidity of information, consideration and an integrated working environment among the parties support to flourish the performance of GSCM. In Bangladesh, most supply chain management in the

manufacturing industry is still performing at a traditional level that specifically works for inventory optimization and cost minimization. Legislative body supposed to pass relevant rules and provide that support the green concept and enforce public and firms to maintain the green standards. Considering the firm perception, most of the manufacturing firms in Bangladesh is focusing on the immediate benefit. As a consequence, they are not willing to invest furthermore for adopting GSCM. As GSCM is a new concept, a risk factor is belonging to continue operation through GSCM. Even customer is not concern about the green product. So, firms do not focus on the green supply chain management process. Firms in Bangladesh usually concern about immediate gratification rather than attaining long term competitive advantage. Firms usually concern merely about monetary benefit. Most of the time, Environment issues are ignored but GSCM usually facilitates firms to attain competitive advantage. The environment is a vital factor in sustainable business practice. Raw material and required fuel and energy are collected from the environment. It is highly required to nurse every element of the environment to ensure the endurance of nature and resources that also generates economic benefits. There is huge scope to develop GSCM in manufacturing firms of Bangladesh.

The contribution of the study is to add the knowledge in effective factors that affect pre and post functions of GSCM in manufacturing firms of Bangladesh. Moreover, public and industry perception is introduced and discussed how these affect the performance of green supply chain management in the manufacturing industry of Bangladesh. A potential proposed model of GSCM is mentioned in this study to generate a better result of GSCM which supports the manufacturing firms of Bangladesh.

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