

# **DISSERTATION FOR MPSM**

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## ACKNOWLEDGEMENT

This dissertation is prepared for the course named PSM-667: Dissertation. This is a graduation requirement for the Masters in Procurement and Supply Management (MPSM) degree under BRAC Institute of Governance and Development (BIGD), BRAC University. The topic of this dissertation is “Barriers to implement green supply chain management in manufacturing industries: Bangladesh leather industry context”

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My family members deserve special credit for giving me adequate hope and praise to prepare this dissertation with perfection. It was their spirit and continuous motivation which helped me to prepare a distinct quality of dissertation paper for my masters program.

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*Disclaimer: This dissertation is prepared purely for academic purpose. The contents of this dissertation are the sole responsibility of Showmik Das and do not necessarily reflect the views of the government of Bangladesh.*

## LETTER OF TRANSMITTAL

Dec 12 , 2016

Mr. Hasan Maksud Chowdhury

Assistant Professor

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**Subject: Submission of Dissertation for the Masters in Procurement and Supply Management (MPSM) degree**

Dear Sir,

It is a pleasure for me to submit the dissertation as per the University requirements and guidelines. It was a great experience for me and it also gave me the taste of practical research experience on finding out the barriers to implement green supply chain management in the manufacturing industries of Bangladesh. I am grateful to you for your help and guidance.

I hereby certify that I have not adopted any plagiarism while preparing the dissertation as submitted. The whole dissertation is prepared predominately using the primary data which was not tempered or manipulated by any means. All the data and analysis as presented in the dissertation are original work from me. I have tried to provide proper citation for the secondary data I have used for this dissertation.

I hope and request that you would be kind enough to accept the dissertation. Sir, if you need further information regarding this report, I am always ready to provide necessary information regarding this report.

Sincerely ,

Showmik Das

ID# 15382001

### **CERTIFICATION FROM THE INSTRUCTOR**

This is my pleasure to certify that the dissertation entitled “Barriers to implement green supply chain management in manufacturing industries: Bangladesh leather industry context” is the original work of Showmik Das which was completed under my direct guidance and supervision. As far as my knowledge, the dissertation is an individual achievement of the candidate’s own efforts, and it is not a conjoint work.

I also certify that I have gone through the draft and final version of the dissertation and found it satisfactory for submission to the Institute of BRAC Institute of Governance and Development, BRAC University, Bangladesh in partial fulfillment of the requirements for the degree of Masters in Procurement and Supply Management (MPSM).

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## Chapter 1 Introduction

### 1.1 Problem Statement

Due to rapid adaptation in the global industrial state, ecological and social responsibilities are playing more significant roles in handling any industries. There has been a worldwide growing concern for the environment over the last few decades due to pressures from environmental regulations, customers and competition in the market. Green supply chain management is being considered as a promising pathway to protect the environment from pollution and limit the consumption of earth's depleting resources so the "future" can have the same benefits that we had. Green supply chain refers to the way in which innovations in supply chain management and industrial purchasing is considered in the context of global environment. Business activities can pose a significant threat to the environments in terms of carbon monoxide emissions, discarded packaging materials, scrapped toxic materials, traffic congestion and other forms of industrial pollution.

Green supply chain management is considered as environmental innovation which integrates environmental thinking into supply chain management. Green supply chain management aims to minimize or eliminate wastages including hazardous chemical, carbon emissions, energy and solid waste along supply chain such as product design, material sourcing and selection, manufacturing process, delivery of the final product and end of life management of the final product.

In the Bangladesh context, the leather industry became most prominent in the early 90s and started to play a vital role in contributing to our GDP. But, since entering into 21<sup>st</sup> century, it

began to face increasingly serious problems , mostly related to social and environmental compliances in the face of increasingly stiff completion . As the pressure mounts more on the firms to adopt environmental measures , a greater role awaits on the supply chain management in influencing organizations environmental practices ( sarkis 2003 ) , because the scope of the supply chain is right from the birth of the product to till it reaches its customer . But if the firm has to move towards green supply chain management there are some issues need due consideration which falls outside the purview of supply chain activities , demanding a more holistic approach is required in not only making the supply chain sustainable but also achieves social and economic sustainability to all the stakeholders in the supply chain.

## **1.2 Purpose of the study**

The purpose of the study is to provide with a overall view of the existing barriers that the leather industry of Bangladesh is facing to implement green supply chain practices using interpretive structural model to visualize the barriers into a proper framework which will help to identify the root cause.

## **1.3 Research Questions:**

The study aims to answer questions related to the practice of green supply chain management in context of leather industry of Bangladesh .

The key questions are to follow :

1. To what extent green supply chain are being practiced in the leather industry?
2. What are the barriers to implement green supply chain ?
3. Can there be a hierarchy of barriers imposing most negative power to least one using interpretive structural modeling method ?
4. Determine the drive power and dependence power of the barriers and categorize them.

#### **1.4 Rationale of the study:**

Green supply chain management (GSCM) has gained increasing attention within both academia and industry. Traditional supply chain includes only those activities which are associated with manufacturing while new extended supply chain includes environmental management. According to Ali Daibat , green supply chain management has emerged as an important organizational philosophy to reduce environmental risks. Francesco Testa has analyzed the database of 4000 manufacturing facilities in seven OECD countries and found that green supply chain management is strongly complementary with other advanced management practices and supportive to better environmental practices.

On the basis of factor analysis Kuo-Chung Shang has identified six dimensions of green supply chain management which are green manufacturing and packaging, environmental participation, green marketing, green suppliers, green stock, and green ecodesign. Toshi H. Arimura has mentioned that ISO 14001 promotes green supply chain management practices in Japanese industries and government programs with voluntary environmental management systems indirectly promote green supply chain management.

### **1.5 Research methodology :**

The research will be based on both qualitative and quantitative methods to obtain the objectives of the study. First person interviews will be conducted with the mid level and senior level managers of proposed organization numbered 10 to 12 personnel. As the study aims to find out the barriers, a semi structured questionnaire will be used as the standard and will compare the effectiveness of green supply chain before and after implementation. Outputs of the organization needs to be compared and will be providing some recommendation which might help to reduce the casualties.

### **1.6 Organization of the thesis:**

This study is organized as follows. The first chapter has outlined the problem, purpose of the study, research questions, methodology, and organization of the thesis. In the second chapter, the relevant literature related to GSCM, GSCM practices, supply chain performance measurement, and GSCM performance measurement is reviewed. The third chapter outlines the research framework, measurement models, This chapter also describes how the data is collected and presents the characteristics of the sample. In the fourth chapter, hypotheses are tested empirically and the result is presented. In the fifth chapter limitation of the study is stated . In the sixth and seventh chapter a overall summary and references are stated .

## **Chapter 2 : Literature review**

## 2.1 Definition of Supply Chain :

According to AIMS UK “supply chain is a global network used to deliver products and services from raw materials to end customers through an engineered flow of information , physical distribution and cash . Flow of products and services usually goes from raw material manufacuterers , intermediate products and manufacturers , end product manufacturers , wholesalers and distributors and retailers.”

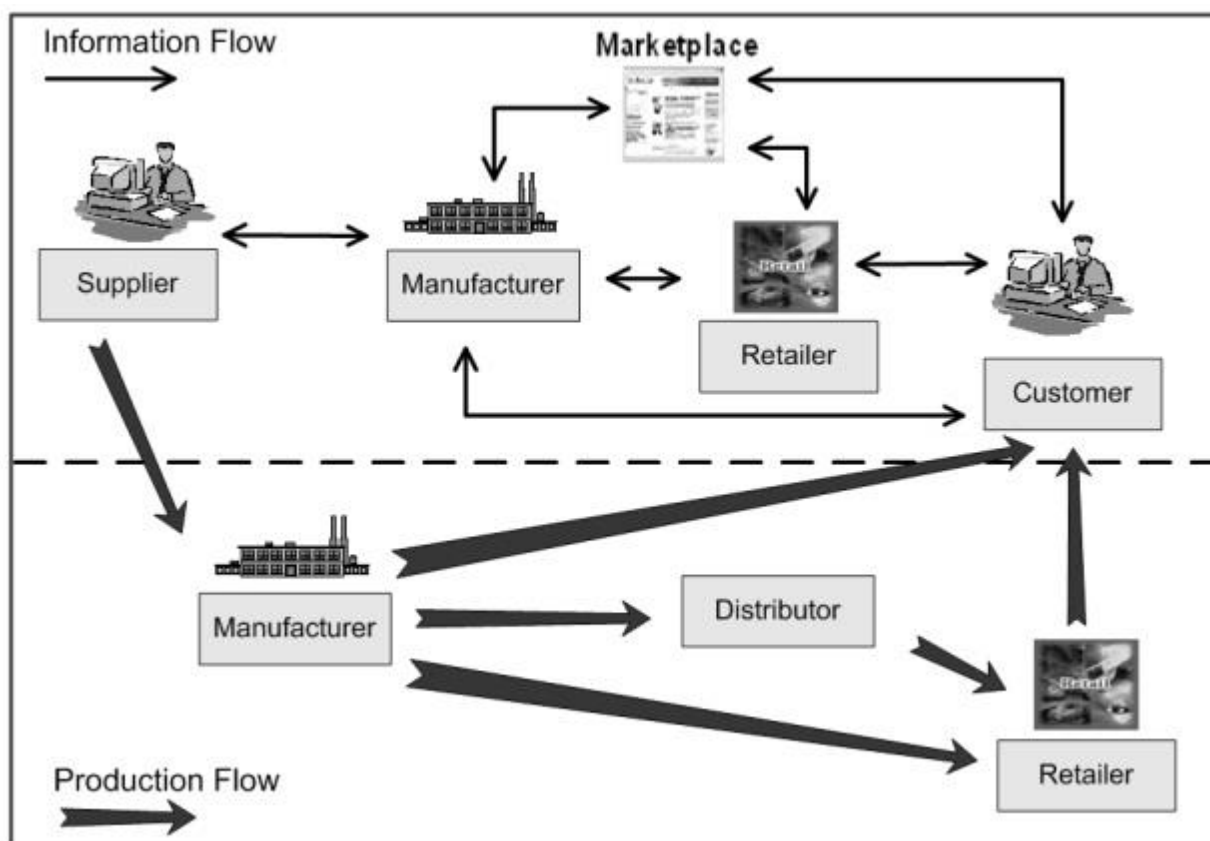


Figure 1: Basic Supply chain design

### 2.1.1 Definition of supply chain management :

Renowned Supply chain specialist Dr. Harvi Miller proposed that supply chain management is a set of approaches utilized to efficiently integrate suppliers , manufacturers , warehouses and stores,so that mechandise is produced and distributed at the right quantities , to the right locations , and at the right time , in order to minimize system wide costs while satysfying service level requirements .

According to the supply chain council , managing supply and demand , sourcing raw materials and parts ,manufacturing and assembly, warehousing and inventory tracking , order entry and order management , distribution across all channels and delivery to the customer.

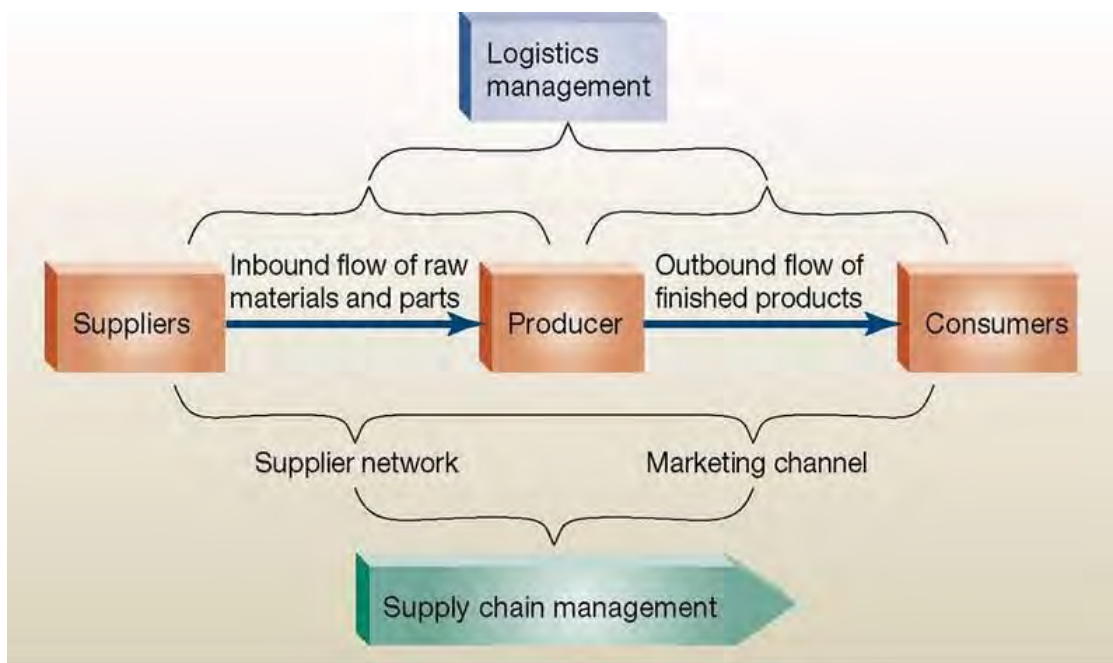


Fig 2 : Basic Supply chain management

### 2.1.2 Importance of supply chain management for the manufacturing industries:



From the blog of one of the greatest supply chain guru Dr. David Ingram it is mentioned that supply chain management is a systematic approach to managing the distribution of goods from producers of raw materials, through manufacturers and eventually down to end users. Supply chain management affects manufacturing companies in a variety of ways, including the availability of inputs needed for production processes, costs and profitability of manufactured items, company infrastructure and ways in which companies interact with their suppliers and customers. Understanding the ways that supply chain management affects manufacturers from both a daily operational perspective and a strategic viewpoint is important for all managers and entrepreneurs in the industry.

In theory, a supply chain seeks to match demand with supply and do so with the minimal inventory. Various aspects of optimizing the supply chain include liaising with suppliers to eliminate bottlenecks; sourcing strategically to strike a balance between lowest material cost and transportation, implementing JIT (Just In Time) techniques to optimize manufacturing flow; maintaining the right mix and location of factories and warehouses to serve customer markets, and using location/allocation, vehicle routing analysis, dynamic programming and, of course, traditional logistics optimization to maximize the efficiency of the distribution side.



Figure 3: Important activities determined by the supply chain

As supply chain management is coined as a philosophy with no “one correct answer”, the following points are the main importance why this philosophy needs to be implemented in the organization.

### **2.1.3 Drivers of the supply chain management:**

From the book of “Supply chain management : Strategic , Planning and Operation “ by well reputed supply chain guru Sunil Chopra, it has been found that as the use of supply chain strategies to gain market share and competitive edge is on the upswing, the spending and activities in this area have also augmented to a great extent. In today’s dynamic business world, various technologies and process upgrades used at the forward-thinking companies accentuate the applicability of supply chain management as a crucial element of overall business strategy.

It is also pointing towards the fact that increasing customer value is everyone’s business rather than only management’s.

From the observation of the trends in key industries in the world- the FMCG, high tech and industrial manufacturing industries, six key trends – demand planning, globalization, increased competition, and price pressures; outsourcing; shortened and more complex product life cycle management (or PLM); closer integration and collaboration with suppliers-have been very evident as driving the management of supply chain in today’s enterprises.

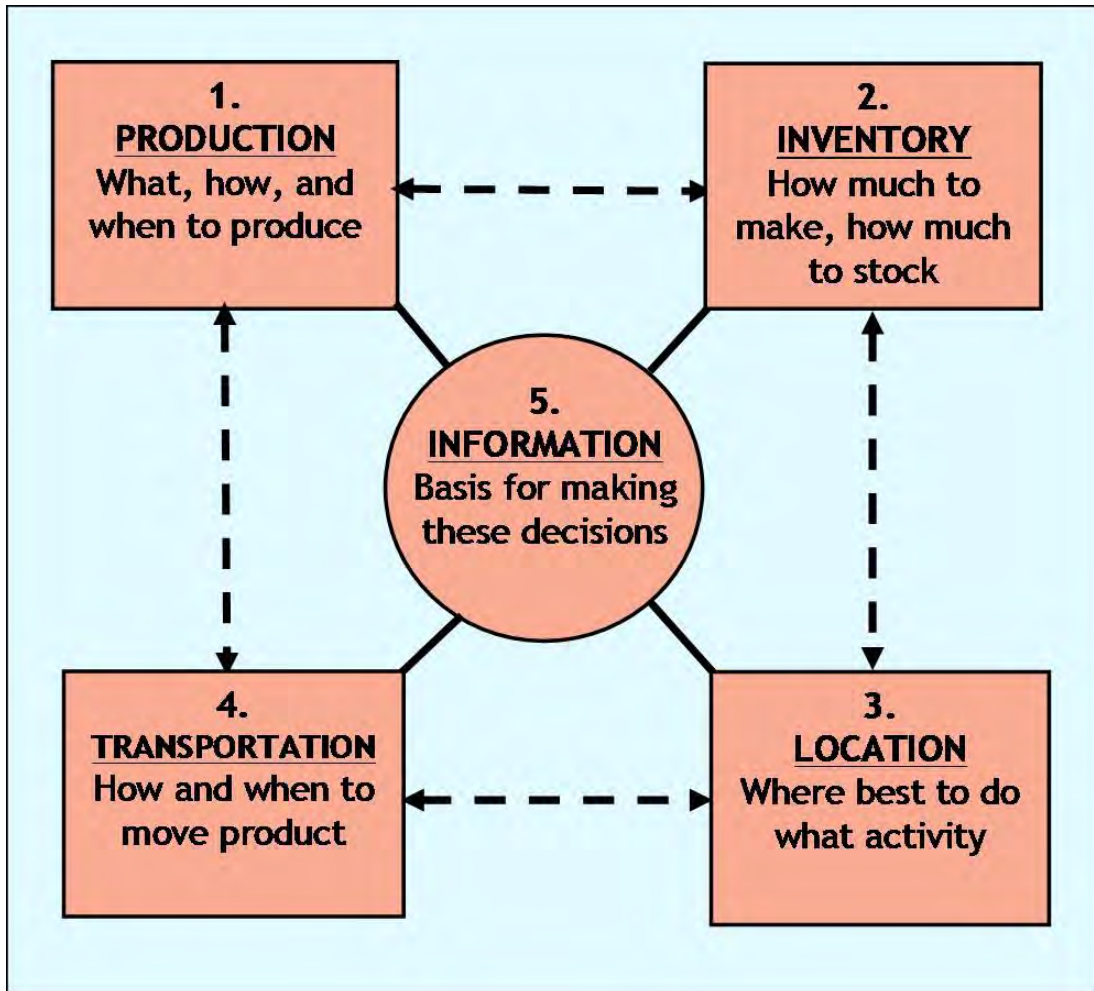


Figure 4 : Drivers of supply chain management

## 2.2 Green Supply Chain Management:

Green supply chain management (GSCM) involves traditional supply chain management practices integrating environmental criteria or concerns into organizational purchasing decision and long term relationships with suppliers (Gilbert, 2000). A green supply chains aims at confining the wastes within the industrial system in order to conserve energy and prevent the dissipation of dangerous materials into the environment (Torres, Nones, Morques, & Evgenio, 2004). It recognizes the disproportionate environmental impact of supply chain processes within

an organization. It recognizes the disproportionate environmental impact of supply chain processes within an organization. GSCM is the summing up of green purchasing, green manufacturing, green packing, green distribution and marketing. GSCM is to eliminate or minimize waste in the form of energy, emission, hazardous, chemical and solid waste (Olugu, Wong, & Shaharoun, 2010). Concepts and models related to environmental issues have been suggested by different researchers. Some of them have been described. Interpretive structural modeling (ISM) methodology was utilized to understand the mutual influences among the barriers so that those driving barriers, which can aggravate few more barriers and those independent barriers, which are mostly influenced by driving barriers are identified (Ravi & Shankar, 2005) GSCM practices adopted by the electrical and electronic industry in Taiwan were investigated, which was dominated by original equipment manufacturing and original designing and manufacturing. The data was analyzed by using statistical package and the structural equation modeling (Chien & Shih, 2007). Factors influencing to adopt green innovations for logistics service providers were described. The data generated from the questionnaire survey on logistics companies in Taiwan were used for modeling (Yu Lin & Hui Ho, 2008). A proactive GSCM approach was suggested for improving environmental performance of processes and products in accordance with the requirements of environment regulations. This study examined the consistency approaches for factor analysis that determines the adoption and implementation of GSCM (Hsu & Hu, 2008).



Figure : 5 Green Supply chain management

### 2.2.1 Green supply chain management vs. Conventional Supply chain management :

GSCM and Conventional SCM differ in various ways. GSCM takes considerations to ecology as well as economy as an objective, while Conventional SCM is usually concentrated on economy as a single objective. GSCM are green, integrated and ecologically optimized, while Conventional SCM does not take into consideration human toxicological effects (Beamon, 1999; Gilbert, 2000; Ho Johnny, Shalishali, Maurice, Tseng, & Ang, 2009). Conventional SCM concentrates more on controlling the final product; no matter harmful its effects are to the environment during production and distribution. Ecological requirements are key criteria for products and productions and at the same time the company must assure its economic sustainability by staying competitive and profitable (Ho Johnny, Shalishali, Maurice, Tseng, & Ang, 2009)

Serial No.	Characteristics	Green Supply chain management	Conventional Supply chain Management	Researchers
1.	Objectives	Ecological and economic	Economic	Beamon ( 1999)
2.	Ecological optimization	High Ecological impacts	Integrated approach low ecological impacts	Gilbert 2000
3.	Supplier selection criteria	Eco logical Aspects long term relationship	Price switching suppliers quickly Short term relationship	Ho Johnny et al.
4.	Cost Pressure	High	Low	Beamon ( 1999)
5	Flexibility	Low	High	Beamon (1999)
6.	Speed	Low	High	Ho Johnny at el (2000)

Table 1 : Difference between conventional supply chain and green supply chain

### 2.2.2 Green Supply Chain Management Practices:

“Sustainable Development” is the key concept as discussed in 1992 Earth Summit in Rio, in this, governments and other international organizations decided to take useful measures to protect environment for long term economic development.

Today's highlighted agenda is to raise environmentally responsible consumption and production to recover environmental quality, reduce poverty and bring about economic growth, with resultant improvements in health, working conditions, and sustainability .

As shown in Table , GSCM practices are divided into four major dimensions:

Internal environmental management, external environmental management, investment recovery, and eco design (Zhu and Sarkis, 2004).

Dimensions of GSCM practices	Attributes
1. Internal environmental management	<ul style="list-style-type: none"> <li>a. Commitment of GSCM my senior managers</li> <li>b. Support for GSCM for mid level managers</li> <li>c. Cross functional cooperation for environmental improvements</li> <li>d. Total quality environmental management</li> <li>e. Environmental compliance and auditing programs ISO 14001 certification</li> <li>g. Environmental management systems</li> </ul>
2. External GSM practices	<ul style="list-style-type: none"> <li>a. Providing design specification to suppliers that include environmental requirements for purchased item</li> <li>b. Cooperation with suppliers for environmental objectives</li> <li>c. Environmental audit for suppliers internal management</li> <li>d. Suppliers ISO14000 certification</li> <li>e. Second tier supplier environmentally friendly practice evaluation</li> <li>f. Cooperation with customer for eco-design</li> </ul>

	<ul style="list-style-type: none"> <li>g. Cooperation with customers for cleaner production</li> <li>h. Cooperation with customers for green packaging</li> </ul>
3. Investment recovery	<ul style="list-style-type: none"> <li>a. Investment recovery ( sale ) of excess inventories / materials</li> <li>b. Sale of scrap and used material</li> <li>c. Sale of excess capital equipment</li> </ul>
4. Eco Design	<ul style="list-style-type: none"> <li>a. Design of products for reduced consumption of material/ energy</li> <li>b. Design of products for reuse , recycle , recovery of material component parts</li> <li>c. Design of products to avoid of reduce use of hazardous products and their manufacturing process</li> </ul>

Table 2: Green supply chain management practices

Competitive advantage and value advantage of green Supply chain management: (Source : Emmet & Sood – Green Supply Chains : An Action Manifesto.)

Despite ample evidence to the contrary, there persists a myth that going green costs additional expense. Some of the factors responsible for persistence of this myth are inertia, the lack of a systematic approach and an unwillingness to engage in sustained and changed thinking that is necessary to create a green supply chain.

However, the most fundamental benefit of Green Supply Chains is a positive long term net impact on the financial performance of the organization. This has been proven by both analysis and empirical evidence.



Green Supply Chains sponsor the effective utilization of all of the available productive resources of organizations. By incorporating Green Supply Chain Management thinking through their entire business decision making process, organizations may now purchase green input resources that will flow through environmental friendly production process to produce the desired green outputs.

At the core of Green Supply Chain Management is the principle of reducing waste by increasing efficiencies. Effective management of resources and suppliers, can reduce production costs, promote recycling and also, the reuse of raw materials. Also, the production of hazardous substances can be reduced, thereby preventing organizations from being fined as a result of violating environmental regulations.

Consequently, the relevant operational costs are reduced whilst; the efficiency of using resources is improved. Organizations that produce products which are technologically advanced and environment friendly will find this will enhance the brand image and brand reputation in customers' mind.

It helps an organization to position itself and its products as environmentally friendly in the customers' perception. Besides attracting new profitable customers for organizations, it will give competitive edge over the competitors in the market place. It will also strengthen the brand image and reputation in market place.

### **2.2.3 Reverse Logistics:**

While conventional logistics optimizes the flow of goods from producer to consumer, reverse logistics manages the processes for inverting that flow to deal with returned parts, materials and products from the consumer back to the producer. Most often, this includes warranty recovery, value recovery, repair, redistribution, product recalls, used parts and replacement materials for refurbishment, service or product contract returns, and end-of-life recycling.

With the purpose of optimizing supply chain efficiency and asset recovery rates, applying a reverse logistics system has increasingly become a tool that positively impacts profitability as well as assisting an organization in meeting sustainability goals. With the growth of sustainability, more companies have adopted the use of recycled materials in production and have developed procedures for the responsible disposal of products that cannot be recycled or reused. For instance, a growing number of cell phone manufacturers have established procedures in place for consumers who wish to return an older model and ensure that the device is refurbished or recycled rather than dumped into the local landfill.

Thus, reverse logistics management has developed into a discipline that produces cost reductions, adds efficiencies and improves the consumer experience. Producers have discovered value within returned assets and the benefits of streamlining repair, return and product reallocation processes.

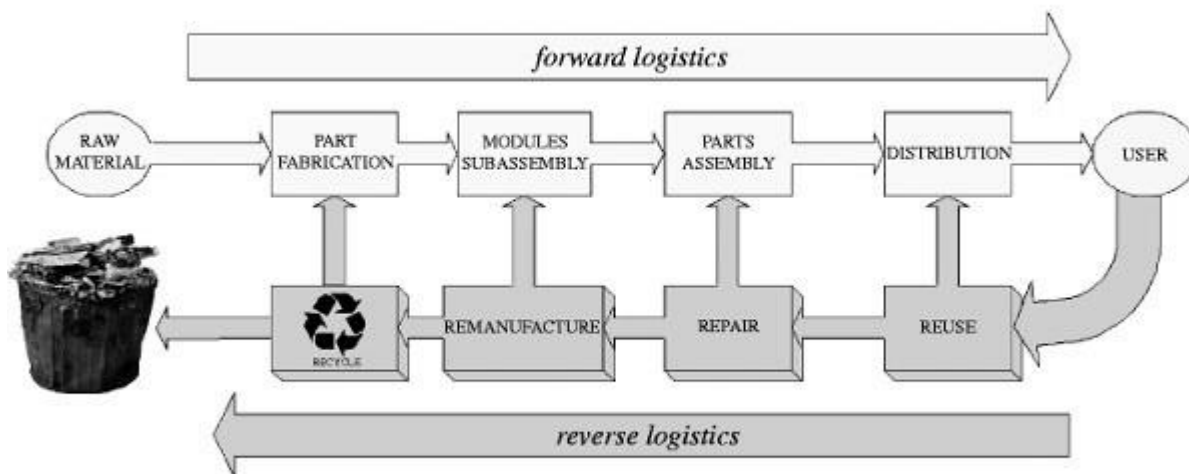


Figure : 6 : Reverse Logistics

### **2.3 Overview of the leather industry of Bangladesh: (Past and Present):**

Increasing interest of buyers has opened up an opportunity for footwear and leather industries of Bangladesh. The production of leather-made items has been increasing in the country. The sector has the potential for becoming the second largest foreign currency earner after ready-made garments. Industry analysts believe that Bangladesh's over one billion footwear industry has the potential to grow to a 15-billion dollar vibrant industry within a decade. According to EPB data, the leather industry has crossed the record \$1-billion mark in 2012-13. Bangladesh earned \$ 1.29 billion from exports of leather, leather goods and footwear in 2013-14 fiscal. The export target for 2014-15 has been set with an increase by 4.2 per cent. This rate of growth needs to be progressively accelerated to attain the target of \$5 billion in 2020. Country's leather industry is facing a number of problems.

## Chapter 3 Research and Methodology

### 3.1 Barriers to Implement Green Supply chain management in the manufacturing (Leather Industry) of Bangladesh.

In the growing environmental concern, like all other countries, Bangladesh leather industries are willing to co-opt with green supply chain management policies. Being a third world country where every step within a supply chain is prone to high level of exploitation, practice of green supply chain management is one of the toughest challenge to deal with. The major concern to obtain the practice of green supply chain management is affiliated mostly with cost, as increase of cost is a negative sign towards the customer. It should be kept in the mind that in context of Bangladesh, there is the lowest level of customer interest about the practice of green supply chain management.

As per the discussion with the respondents, 10 most important barriers / variables were identified which the top level managers of the leather manufacturing companies of Bangladesh believes to hinder the implementation of Green supply chain management. Those are discussed below.

#### 3.1.1 Cost Implication:

For centuries, cost has been used as the prime performance measure. Usually, high cost is a big pressure in implementing green supply chain management as compared to traditional supply chain management. The initial investment requirement by green supply chain policies such as green design, green manufacturing, green distribution, green packaging etc are really expensive.

Engaging in environmental management involves two types of cost, direct cost and transaction cost. Both types of costs are likely to constitute significant barrier to implement green supply chain management (Alkhidir & Zailani, 2009). Obtaining more technology, hiring good quality employees, motivating and training them towards GSCM will require more primary

investment . There fore cost implication is a major barrier in implementing green supply chain management in the organization.

### **3.1.2 Poor organizational Culture in adopting GSCM:**

Informal linkages and improved communication help the organizations to adopt Green's practices (Yu Lin & Hui Ho, 2008). Training and education are the prime requirements for achieving successful implementation of GSCM in any organization . Management may encourage employees to learn green information. Organizations may provide rewards for green employees. Employees may be helped when they face green problems and may be provided support to learn green information ( Chopra, 2008).

### **3.1.3 Lack of top management Commitment in adopting GSCM :**

Top level management plays the most important role to achieve strategic success. Top management is also responsible for environmental practices such as eco friendly supply chain management. Aside the strategic solutions , the top level management has the significant ability to influence, support actual formation and implementation of green initiatives across the organization . There fore , lack of top level management commitment can be a strong barrier to implement green supply chain management in the organization .

### **3.1.4 Lack of government support to adopt GSCM:**

Government regulation can encourage or discourage the adoption of innovation, as Government sets the environmental regulations for industry (Scupola, 2003). Time consuming regulatory requirements, fees or levies may discourage smaller firms. Tax structures that distort incentives can discourage industry to implement GSCM. Government institutions are considered as barriers to development in the environmental management in the sense that institutional process for

implementing GSCM are going on but very limited institutional support is given for new ideas to implement GSCM. The tendency of government to encourage old practices is major barrier (AlKhidir & Zailani, 2009). For the above mentioned reasons , lack of government support can work as a significant barrier to implement green supply chain management in the context of the manufacturing ( leather ) industries of Bangladesh.

### **3.1.5 Lack of proper knowledge about GSCM :**

In context of Bangladesh , adopting new traits was always a struggle . Here , in a particular organization , the concept of green supply chain management is still unfamiliar to more or less all level of management. Simply changing a route can reduce carbon emission , can save a handsome amount of money . But this innovations is hard to appear in the right minds , because of the lack of knowledge about green supply chain management . Till date , the leather industry is following the rules by only pen and paper . Because of the absence of sufficient knowledge about green supply chain , the adoption process is still being delayed as a result the industry is gradually falling back . As per the above mentioned discussion , lack of proper knowledge about GSCM can be coined as a barrier to implement green supply chain .

### **3.1.6 : Lack of technical expertise :**

IT systems support collaborative supply chain processes and enhance supply chain performance (Rogers et al., 1998). An efficient information and technology system is very necessary for supporting the GSCM during various stages of product life cycle. It can be very useful for product development programs encompassing the design for the environment, recovery and reuse. Efficient information systems are needed for tracking and tracing the returns of product, linking with the previous sales (Ravi & Shankar, 2005) Information support is necessary for developing linkages to achieve efficient GSCM in automobile industry. It is required to handle information's flows associated with both forward and backward flow of materials and other

resources to manage green SC efficiently (AlKhidir & Zailani, 2009). Also, IT enablement reduces lot of paper usage, which supports GSCM philosophy. So, lack of IT implementation is an important barrier to achieve efficient GSCM.

### **3.1.7 : Lack of awareness of customer about GSCM :**

IT systems support collaborative supply chain processes and enhance supply chain performance (Rogers et al., 1998). An efficient information and technology system is very necessary for supporting the GSCM during various stages of product life cycle. It can be very useful for product development programs encompassing the design for the environment, recovery and reuse. Efficient information systems are needed for tracking and tracing the returns of product, linking with the previous sales (Ravi & Shankar, 2005) Information support is necessary for developing linkages to achieve efficient GSCM in automobile industry. It is required to handle information's flows associated with both forward and backward flow of materials and other resources to manage green SC efficiently (AlKhidir & Zailani, 2009). Also, IT enablement reduces lot of paper usage, which supports GSCM philosophy. So, lack of IT implementation is an important barrier to achieve efficient GSCM.

### **3.1.8 Political Crisis:**

Political crisis can be coined as one of the important barriers to implement green supply chain . There are many variables that hinders a decent flow of supply chain in an organization . In those variables , a huge amount of role is played by the political crisis issues. For example , strike or road block in different routes may create disruption in supply chain entities which may lead to financial loss or it might lead to reduction of brand value , etc . Due to different political incidents , different level of activities within one supply chain might be disrupted . As a result , to implement green supply chain , political crisis is a must acknowledged factor.

### **3.1.9 : Lack of proper training :**

Training and development is essential for the restructuring of an organization's supply chain. To provide with proper training to the employees in understanding green supply chain management, there should be enough knowledgeable trainer who can play the role to lead from the front . Due to inexperience regarding the subject matter , most of the companies are avoiding such training which might at least trigger some of the employees to come forward and introduce green supply chain management. So lack of proper training on green supply chain management can be denoted as an important barrier to implement the culture of green supply chain management in the manufacturing industries of Bangladesh.

### **3.1.10 : Cost of disposal of hazardous products :**

Innovative green practices are associated with the explicitness of green practices, accumulation of green related knowledge, organizational encouragement and quality of human resources (Yu Lin & Hui Ho, 2008). Innovative green practices involves hazardous solid waste disposal, energy conservation, reusing and recycling of materials. Innovative green practices promote innovative design, new market opportunities and makes their quality better than others. However, due to market competition and cost implications, organizations try to save cost. Implementing GSCM practices initially involves high investment. Financial constraints also lead to resistance to implementing green practices (Ravi & Shankar, 2005).From the above discussion we come to a conclusion that cost of disposal of hazardous products can be a crucial element for implementing green supply chain management in the context of manufacturing industries of Bangladesh.

## **3.2 Interpretive Structural modeling ( ISM)**

Interpretive Structural Modeling was first proposed by J. Warfield in 1973 to analyze the complex socioeconomic systems. ISM is a computer-assisted learning process that enables individuals or groups to develop a map of the complex relationships between the many elements



involved in a complex situation. Its basic idea is to use expert's practical experience and knowledge to decompose a complicated system into several sub-systems (elements) and construct a multilevel structural model. ISM is often used to provide fundamental understanding of complex situations, as well as to put together a course of action for solving a problem. Anantatmula and Kanungo (2005), Warfield (1976).

### **3.2.1 Significance of ISM :**

ISM explores the dynamic influence of different elements which brings into consideration of a system of directly and indirectly related elements. It has three dimensions by each letters. Dimension interpretive (I) is based on the judgment of a group of experts in that respective field. A group of expert decisions are collected and decides whether and how the variables are interrelated. Then, (S) is structural, since on the basis of the relationship, an overall structure is extracted from the complex set of variables. Dimension (M) the modelling which portrays the specific relationships of the variables and overall structure of the system under consideration. In other words, in ISM, I (interpretive) stand for the outcome of judgment, S (structural) stands for the extraction of outcome of a set of variables and M (model) stands for the graphical representation of the specific relationship and overall structure. The analysis is conducted as a step-by-step procedure. (Bolonas et al. (2005), Raj T et al, 2007). Steps are given in a block diagram in a ISM is shown below :

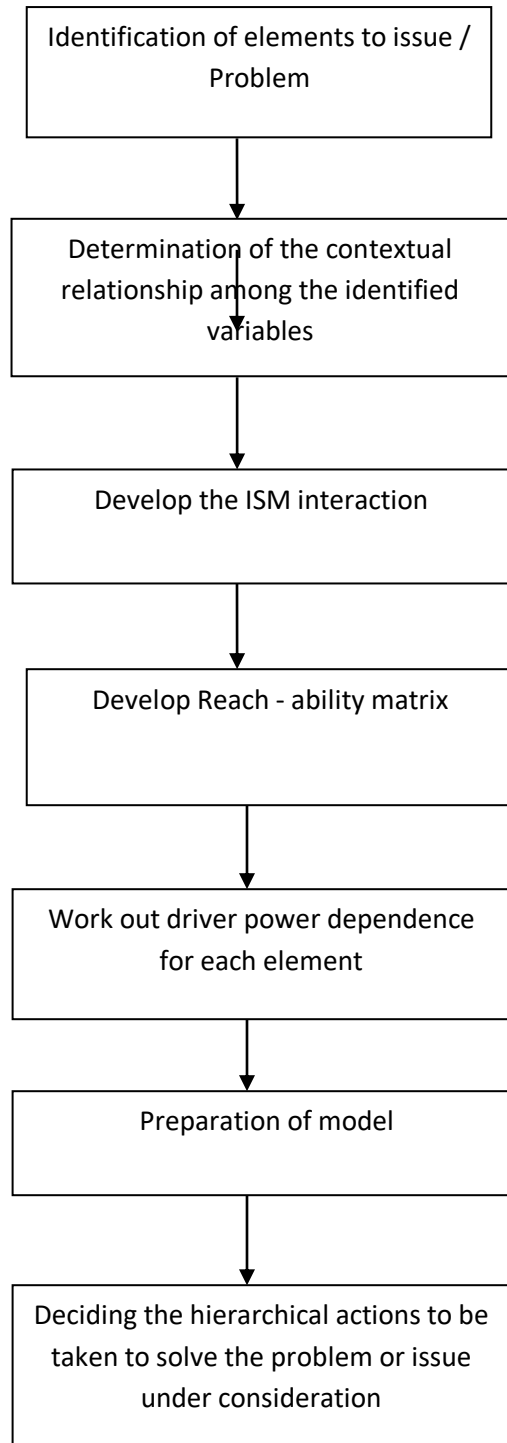


Fig : 8 Flow chart of decision making through interpretive structural modeling

### 3.3 Data Collection :

For this particular research , primary data collection has been done through one to one interview sessions . Randomly 10 senior level managers of 3 renowned leather goods manufacturing companies were asked identify different barriers that imposes threats to implement green supply chain management in respect to their particular organization. From their given answers, I selected the top 10 threats which had the highest scores given by the managers .

The questionnaire was as followed :

Questionnaire for the research on Barriers to implement green supply chain in the manufacturing ( leather ) industries of Bangladesh through interpretive structural modeling : A case study

Name :

Organization :

Age :

Designation :

1. Does your organization practice green supply chain management ? Yes. No.
2. Tick the following which your organization follows :
  - Green manufacturing
  - Green marketing
  - Reverse logistics
  - Green purchasing

3. Barriers that you face in your organization :

- 
- 
- 
- 
- 

4. Identified Barriers ( Background Research ) ( Give numbers in a scale of 1 = Lowest to 5= Highest )

- Cost implication
- Lack of IT application
- Poor organizational culture in adopting GSCM
- Lack of top management commitment in adopting GSCM
- Resistance to advance tech adoption
- Lack of govt support to adopt GSCM
- Lack of knowledge about green practice
- Lack of technical expertise
- Market competition
- Less awareness of customer about GSCM

- Fear of failure
- Non availability of bank loan to encourage green product
- Lack of training
- Lack of sustainability certification
- Cost of disposal of hazardous product
- Lack of awareness about reverse logistic adoption
- Lack of corporate social responsibilities.

From the responses provided by the managers, the top 10 major barriers were identified. After receiving the answers , Interpretive structural modeling procedures will be followed to figure out the root cause of barriers to implement green supply chain management and a structural and hierarchical model will be derived . The analysis is shown in the next chapter , Data analysis.

#### 3.4 : Difficulties in collecting the survey data :

After conducting test survey and revising the questionnaire, it was sent to the top level management related to supply chain management in different organizations through email and face book links. Emails and face book messages were sent to at least 20 professionals on October 2016. However, a total 10 responses were received in the whole month of October 2016. It was anticipated that there is less concern about green supply chain management in the Bangladesh context.

## Chapter 4: Data Analysis

### 4.1 Practice of Green supply chain management in the leather manufacturing industries of Bangladesh.

There has been an extensive research on SCM and GSCM in developed and BRICS Countries like Brazil, China and India. However, little research in this topic area has been done on developing countries like Bangladesh. Thus, this study aims to fill this gap, and should contribute to extend the theoretical body of knowledge in GSCM.

#### 4.1.1 Finding out the percentage of organizations which practices Green Supply chain management :

The first question, the 10 respondents were asked was about if they practice green supply chain management in their organization .

Serial	Practice of green Supply chain management in their particular organization? Yes / No
1	Yes
2	Yes
3	Yes
4	Yes
5	Yes
6	Yes
7	Yes
8	Yes
9	Yes
10	Yes

Table : 3 Practice of green supply chain management

From the above mentioned responses , it has been found that 100 percent of the organization of the leather manufacturing industries of Bangladesh practices green supply chain management.

#### 4.1.2 Finding out to what extent do the organization practices green supply chain policies:

The following question was asked about the extents to which the top level managers believe that they follow green supply chain policies.

Serial	Green manufacturing	Green marketing	Reverse logistics	Green purchasing
1	Yes	No	No	Yes
2	No	Yes	No	Yes
3	Yes	Yes	No	No
4	Yes	Yes	No	No
5	Yes	No	No	Yes
6	Yes	No	No	Yes
7	Yes	Yes	No	No
8	No	Yes	No	Yes
9	Yes	Yes	No	No
10	Yes	No	No	Yes

Table 4 Extent of practice of green supply chain management

From the response provided by the managers, it has been found that , the percentage of practice of different phenomenon of green supply chain are as follows :

Green manufacturing: 80 %

Green Marketing: 60 %

Reverse Logistics: 0 %

Green Purchasing : 60 %

#### **4.2 Implementation of “Interpretive Structural Modeling :**

From the discussion with the 10 respondents of 3 different leather manufacturing companies , the barriers were identified . In this section the total calculation is being described sequentially.

##### **4.2.1 Finding out the Structural Self interaction Matrix:**

The interview was a one to one conversation with the individual respondents . they were asked to establish relationship with the to be mentioned variables and I tried to interpret as per the logic provided by the respondents.

- A , If “i” is predictor of “j”
- B , If “j” is predictor of ‘I’
- C, If ‘i’ and ‘j’ predicts each other
- D, If no predict each other



### Structural Self-Interaction Matrix (SSIM)

Barriers	10	9	8	7	6	5	4	3	2
1. Cost Implication	A	A	A	D	B	B	B	A	A
2. Poor organizational Culture in adopting GSCM	A	B	A	D	B	A	A	A	
3. Lack of top management Commitment	A	A	B	A	A	A	A		
4. Lack of Govt. Support	A	A	B	A	A	B			
5. Lack of Proper Knowledge on GSCM	A	A	D	A	A				
6. Lack of technical expertise	A	A	D	A					
7. Lack of Customer awareness.	D	D	D						
8. Political Crisis	A	D							
9. Lack of Proper Training	D								
10. Cost of disposal of hazardous product									

Table: 5 Structural Self interest matrix

#### 4.2.2 Finding out the Initial Reach-ability matrix:

Initial reach ability matrix is a transformed version of structural self interaction matrix. Here the whole response is converted into binary unit so that a quantitative relationship can be measured.

- A, If 'I' is predictor of 'j', then (i,j) is 1 and (j,i) is 0
- B , If 'j' is predictor of 'I' then (j,i) is 1 and (I,j) is 0
- C , If 'I' and 'j' predicts each other then (i,j) is 1 and (j,i) is 1
- D, if no predict each other then (i,j) is 0 and (j,i) is 0

#### Initial Reach ability matrix :

Barriers	1	2	3	4	5	6	7	8	9	10
1. cost implication	1	1	1	1	1	0	0	1	1	1
2. Poor organizational Culture in adopting GSCM	1	1	1	0	1	1	0	0	1	1
3. Lack of top management Commitment	1	1	1	1	1	1	0	0	1	1
4. Lack of Govt. Support	1	1	1	1	0	1	0	1	1	1
5. Lack of Proper Knowledge on GSCM	1	1	1	0	1	1	0	0	1	1
6.Lack of technical expertise	0	1		1	1	1	0	0	1	1
7.Lack of Customer awareness.	0	0	0	0	0	0	1	0	0	0
8. Political Crisis	1	1	1	1	0	0	0	1	0	1
9Lack of Proper Training	0	1	1	1	1	1	0	0	1	0
10.Cost of disposal of hazardous product	1	1	1	1	1	1	0	1	1	1

Table : 6 Initial Reachability matrix

### 4.2.3 Final Reach ability matrix with dependence and driver power

Barriers	1	2	3	4	5	6	7	8	9	10	Driver Power
1. Cost implication	1	1	1	1	1	0	0	1	1	1	8
2. Poor organizational Culture in adopting GSCM	1	1	1	0	1	1	0	0	1	1	7
3. Lack of top management Commitment	1	1	1	1	1	1	0	0	1	1	8
4. Lack of Govt. Support	1	1	1	1	0	1	0	1	1	1	8
5. Lack of Proper Knowledge on GSCM	1	1	1	0	1	1	0	0	1	1	7
6. Lack of technical expertise	0	1	1	1	1	1	0	0	1	1	7
7. Lack of Customer awareness.	0	0	0	0	0	0	1	0	0	0	1

8. Political Crisis	1	1	1	1	0	0	0	1	0	1	6
9Lack of Proper Training	0	1	1	1	1	1	0	0	1	0	6
10.Cost of disposal of hazardous product	1	1	1	1	1	1	0	1	1	1	9
Dependence Power	7	9	9	7	7	7	1	4	8	8	67

Table : 7 Driver and Dependence power derivation

#### 4.2.4 Finding out the Reachability set :

From the final reach ability matrix , for each factor reachability set is derived. The reachability set consists of the factor itself and the other factors that it may impact.

### Reach ability set :

Variables	Set
1. Cost implication	1,2,3,4,5,8,9,10
2. Poor organizational Culture in adopting GSCM	1,2,3,5,6,9,10
3. Lack of top management Commitment	1,2,3,4,5,6,9,10
4. Lack of Govt. Support	1,2,3,4,6,8,9,10
5. Lack of Proper Knowledge on GSCM	1,2,3,5,6,9,10
6.Lack of technical expertise	3,4,5,6,9,10
7. Lack of Customer awareness.	7
8. Political Crisis	1,2,3,4,8,10
9.Lack of Proper Training	2,3,4,5,6,9
10.Cost of disposal of hazardous product	1,2,3,4,5,6,8,9,10

Table 8 : Reachability set

### 4.2.5 Finding out the antecedent Set :

From the final reachiibly matrix, antecedent set s are also derived . Antecedent Set consists of the factor itself and other factors that may impact it.

Antecedent Set :

Variables	Set
1. Cost implication	1,3,4,8,10
2. Poor organizational Culture in adopting GSCM	2,3,5,9
3. Lack of top management Commitment	2,3,4,5

4. Lack of Govt. Support	4,8
5. Lack of Proper Knowledge on GSCM	2,5,6,9
6.Lack of technical expertise	5,6,9
7. Lack of Customer awareness.	7
8. Political Crisis	4,8
9.Lack of Proper Training	2,3,5,
10.Cost of disposal of hazardous product	1,2,,4,5,6,8,9,10

Table : 9 Antecedent Set

#### 4.2.6 Distribution of the Identified variables/ Barriers in to the “Clustering Factors”:

Clustering factors work are the key factors that drives the system in various categories . Based on their drive power and dependence power the factors can be classified into four categories. They are :

- Autonomous factors: These factors have weak drive power and weak dependence power. They are relatively disconnected from the system, with which they have few links, which may be very strong.
- Linkage factors: These factors have strong drive power as well as strong dependence power. These factors are unstable in the fact that any action on these factors will have an effect on others and also a feedback effect on themselves.
- Dependent factors: These factors have weak drive power but strong dependence power.

- Independent factors: These factors have strong drive power but weak dependence power. A factor with a very strong drive power, called the 'key factor' falls into the category of independent or linkage factors

Distribution of the barriers according to their drive power and dependence power :

Variables	Drive Power	Dependence Power	Clustering Factor	Rank
1. Cost implication	8 (Strong)	7 (weak)	Independent Factor	Level 6
2. Poor organizational Culture in adopting GSCM	7 (weak)	8 (Strong)	Dependent Factor	Level 5
3. Lack of top management Commitment	8 (strong)	9 (strong)	Linkage Factor	Level 7
4. Lack of Govt. Support	8 (strong)	7 (Weak)	Independent Factor	Level 6
5. Lack of Proper Knowledge on GSCM	7 (Weak)	7 (Weak)	Autonomous Factor	Level 4
6. Lack of technical expertise	6 (weak)	7 (Weak)	Autonomous Factor	Level 3

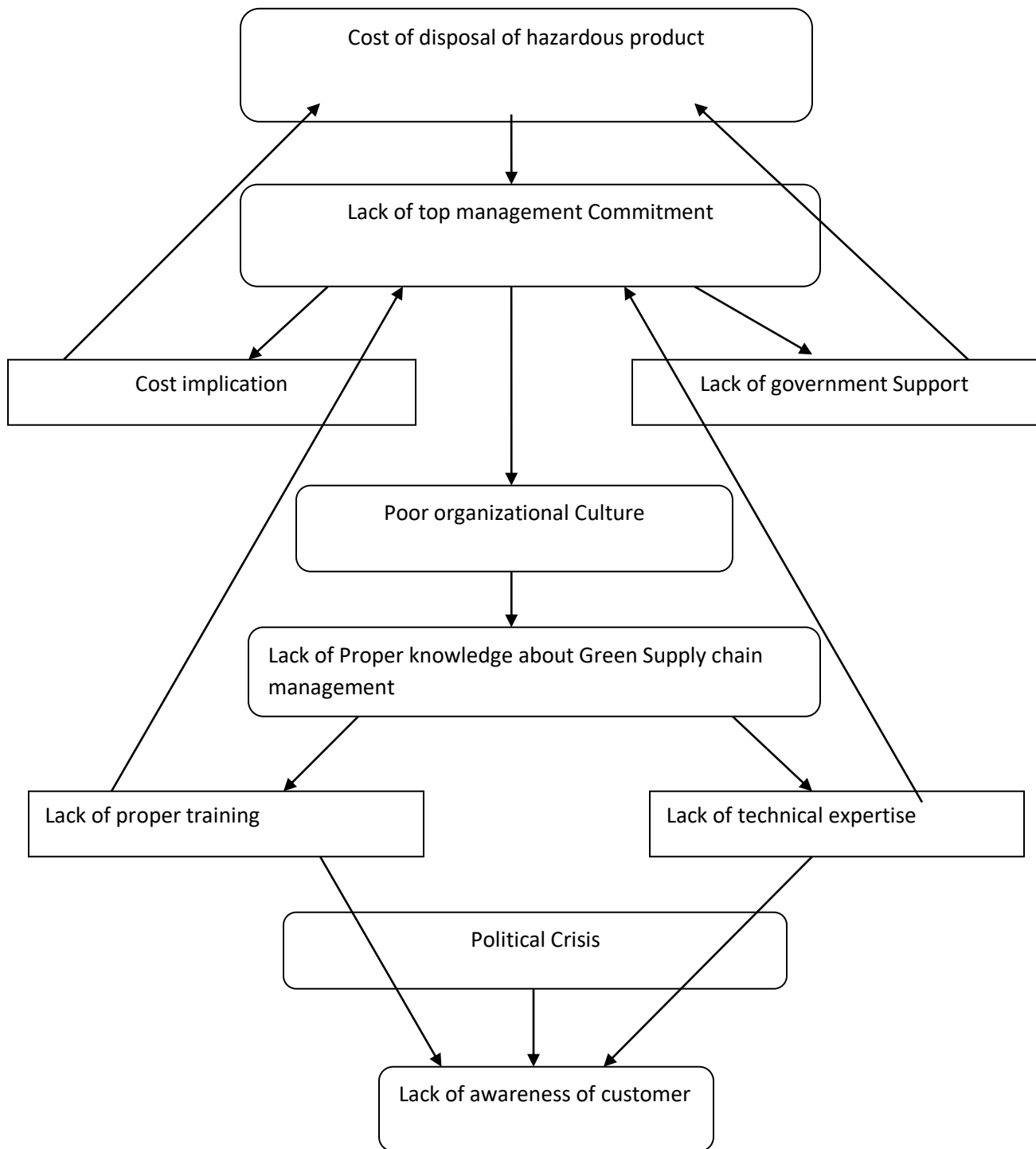
7. Lack of Customer awareness.	1 (weak)	1 ( Weak)	Autonomous Factor	Level 1
8. Political Crisis	6 (Weak)	4 (Weak)	Autonomous Factor	Level 2
9.Lack of Proper Training	6 (Weak)	7 (Weak)	Autonomous Factor	Level 3
10.Cost of disposal of hazardous product	9 (Strong)	8 (Strong)	Linkage Factor	Level 8

Table 9 Cluster and strength distribution of the barriers

#### **4.3 Derivation of the Structural model of the barriers that hinders the implementation of green supply chain management.**

As from the previous discussion, we finally got the ranks of the barriers identified by the respondents . The ranking was done with the help of the drive power and dependence power . Now according to the findings , a sequential / hierarchical model is being build up where the top most barrier has the most impact and the bottom most barrier has the least impact.





## Chapter 5: Findings

After the data analysis , the questions that were asked and raised in the objective section of the study has been answered . Though the answers do not prove a hundred percent accuracy, but in context of the study and the responses given by the top level managers, it has a lot of significance. A brief summary as well as the answers of the objective question are given below.

Answer to the objective question no. 1:

It was asked in the introduction of the study to identify the extent in which green supply chain are being practices in the leather industry of Bangladesh.

It has been found from the responses that all the 10 top level managers have their own policies of practicing green supply chain management. Though, not all dimensions are being practiced significantly but the managers ensure that at least 2 out of the 4 dimensions of green supply chain management are practiced.



Figure 9 : Practice of green supply chain management

The graphical representation shows that 80 percent of the respondents practice green manufacturing in their respected organization. But, none of them has the proper concern on reverse logistics.

Answer to the objective question no. 2

It was asked to find out the most prominent barriers to implement green supply chain management in the Bangladesh leather industry context. A table of summarized barriers is shown below:

Barriers	Summarized impact
Cost Implication	High cost is a big pressure in implementing green supply chain management as compared to traditional supply chain management . The initial investment requirement by green supply chain policies such as green design , green manufacturing , green distribution , green packaging etc are really expensive.
Poor organizational Culture in adopting GSCM	Management may encourage employees to learn green information. Organizations may provide rewards for green employees. Employees may be helped when they face green problems and may be provided support to learn green information
Lack of top management Commitment in adopting GSCM	Top level management plays the most important role to achieve strategic success. Top management is also responsible for environmental practices such as eco friendly supply chain management. Aside the strategic solutions , the top level management has the

	significant ability to influence, support actual formation and implementation of green initiatives across the organization
Lack of government support to adopt GSCM:	Time consuming regulatory requirements, fees or levies may discourage smaller firms. Tax structures that distort incentives can discourage industry to implement GSCM. Government institutions are considered as barriers to development in the environmental management in the sense that institutional process for implementing GSCM are going on but very limited institutional support is given for new ideas to implement GSCM
Lack of proper knowledge about GSCM	In a particular organization , the concept of green supply chain management is still unfamiliar to more or less all level of management. Simply changing a route can reduce carbon emission , can save a handsome amount of money
Lack of technical expertise :	An efficient information and technology system is very necessary for supporting the GSCM during various stages of product life cycle. It can be very useful for product development programs encompassing the design for the environment, recovery and reuse. Efficient information systems are needed for tracking and tracing the returns of product, linking with the previous sales
Lack of awareness of customer about GSCM :	Information support is necessary for developing linkages to achieve efficient GSCM in automobile industry. It is required to handle

	information's flows associated with both forward and backward flow of materials and other resources to manage green SC efficiently
Political Crisis	Political crisis can be coined as one of the important barriers to implement green supply chain . There are many variables that hinders a decent flow of supply chain in an organization . In those variables , a huge amount of role is played by the political crisis issues
Lack of proper training	Training and development is essential for the restructuring of an organization's supply chain. To provide with proper training to the employees in understanding green supply chain management, there should be enough knowledgeable trainer who can play the role to lead from the front
Cost of disposal of hazardous products	Innovative green practices involves hazardous solid waste disposal, energy conservation, reusing and recycling of materials. Innovative green practices promote innovative design, new market opportunities and makes their quality better than others.

Table 10 : Barriers to implement green supply chain management in the manufacturing (leather industries) of Bangladesh.

Answer to the objective question no. 3 and 4:

It was asked to determine the drive power and dependence power of the barriers which was found to have the most impact in hindering the implementation of the Green supply chain management in the leather industry sector of Bangladesh .

A graphical explanation regarding the most powerful barriers to least powerful barrier in terms of their dependence and drive power are shown below.

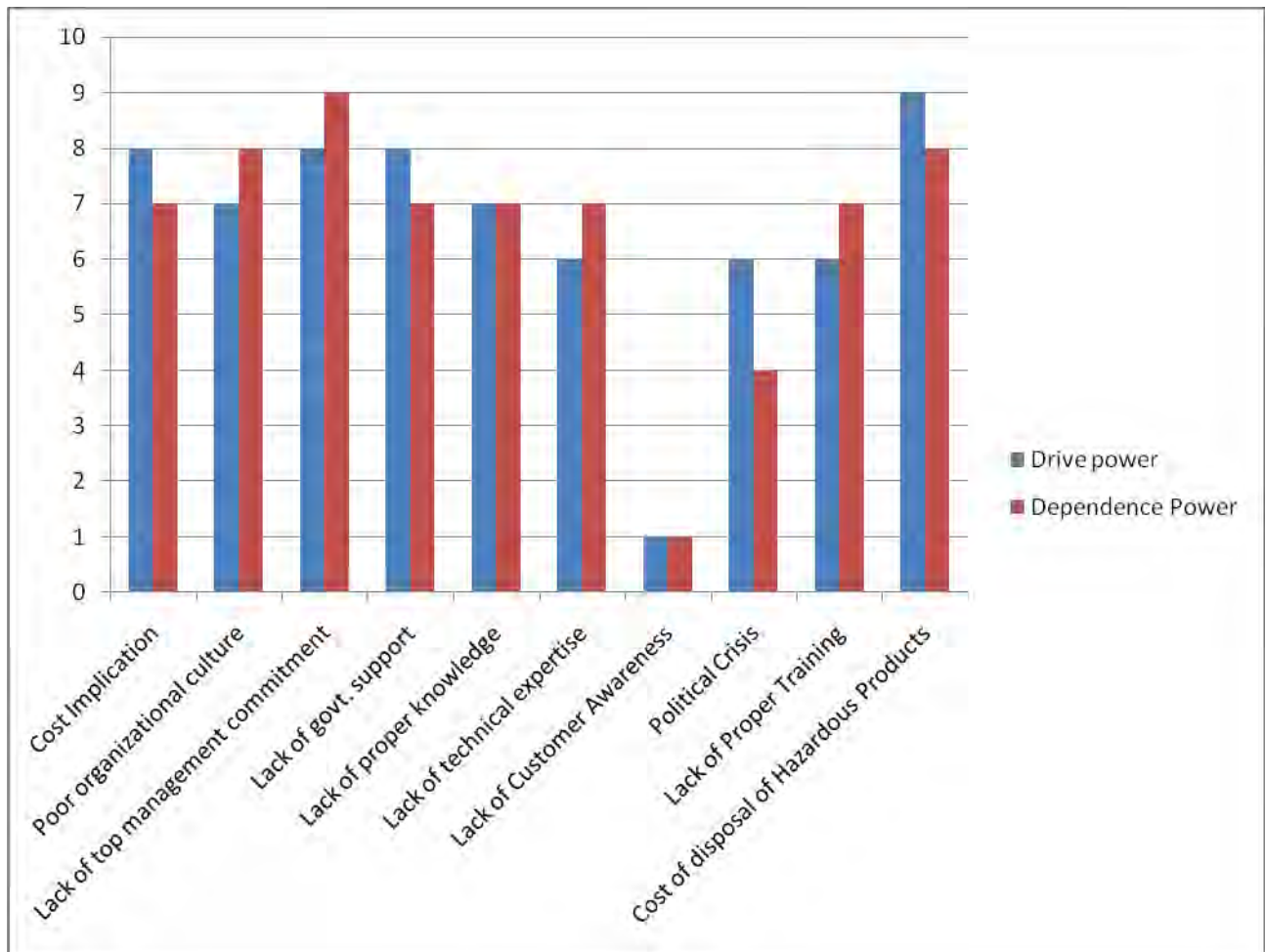


Figure 10 : Driver power and dependence power of barriers to implement green supply chain management

Here it has been found that cost of disposal of hazardous products and lack of top level commitment has the highest drive and dependence power on implementing green supply chain management in the manufacturing ( leather ) industry context of Bangladesh .

## Chapter 6: Limitation of the studies

- **Small sample size:** The sample size for the survey was only 10. This may be too small to represent the population. The population size of number procurement/supply chain profession is also unknown.
- **Lack of Experience:** The researcher did not conduct a similar study like this one before and it was a very unique experience.
- **Few expert interviews:** Only three expert interviews were conducted which was probably small for drawing conclusive findings.
- **Dependency on primary data sources:** The researcher did not find similar kind of study being conducted in the context of Bangladesh.
- **Quick response from the respondents:** Few respondents completed the survey within very short time. According to the test surveys, proper completion of the survey should take around 15 minutes. Some of the respondents even took more than 30 minutes to respond. However, few respondents took very short time to respond to the questions which might not result in thoughtful response.
- **Lack of interest from the professionals to participate in the survey:** Many professionals were requested to participate in the survey but only handful of professionals participated. Many professional provided responses only after multiple follow-ups and reminders.
- **Lack of time and resources:** It takes lots of time and resources to conduct a quality research following structured research methodology. In such a short span of time, it was not possible to conduct a full scale conclusive research.



- **Exploratory nature of the research:** The research was not a formal conclusive research. As a result, statistical tools were not used exclusively in this research. This decreased the validity of the research. However, the researcher tried to triangulate the primary data (survey and expert interview), secondary data (literature reviews) and case study findings to come up with valid reasoning for each of the research objectives.

## Chapter 7: Conclusion

Green supply Chain Management (GSCM) has been identified as an approach for improving performance of the processes and products according to the requirements of environmental regulations. Ten barriers to implement GSCM in the manufacturing industries (Leather) have been identified in context of Bangladesh Interpretive Structural Modeling (ISM) methodology has been used for finding contextual relationships among various barriers to implement GSCM in Bangladesh Manufacturing ( Leather) industry. A Model has been developed from ISM methodology.

Cost implication and lack of govt support are identified as independent variable. Poor Organizational Culture has been identified as independent variable. Lack of top level management and cost of disposal of waste has been identified as linkage factor. Lack of proper knowledge about GSCM , lack of technical expertise , lack of customer awareness , political crisis and lack of proper training has been coined as the autonomous factor.

Cost of disposal of hazardous product and lack of top level management has been identified as the two major factor that hinders the implementation of green supply chain practice in the context of Bangladesh Manufacturing ( leather) industries. Removing the barriers with proper solution can enhance the adoptability of green supply chain.

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Moreover, in the international arena, Bangladesh does not have the membership of the International Footwear Conference.

Bangladesh needs to become a member of this association like other competitors in global leather industry including China and India in order to have a voice on the global plane. The government of Bangladesh should provide adequate policy and financial support to those who deserve.

The cost of land and capital are high in Bangladesh in comparison with China, the world's largest footwear manufacturer with a 60 per cent share of global shoe production. We have low labour cost. But we have to attract foreign investment in this sector. To do so we have to ensure stable political situation, good law and order and low cost of doing business. Local leather goods manufacturers are seeing bright prospects because of a policy change in China. That country shows a drop in leather footwear production recently.

The EU, USA and Japan are becoming worried over future supply from China as their own domestic markets are expanding quickly. Already, the western importers are desperately looking for new sourcing destinations and Bangladesh is in the spotlight now. Bangladesh exports leather products mainly to Italy, New Zealand, Poland, the UK, Belgium, France, Germany, the US, Canada and Spain. Also, Japan, India, Nepal, Australia and some other countries are emerging as potential importers of Bangladeshi leather goods.

Bangladesh now occupies only 0.5 per cent share in the global leather and leather goods market worth about \$215 billion. So, huge opportunity is waiting for us.

According to a recent HSBC analysis, Bangladesh is one among the three countries to which China-based factories are planning to relocate, as the manufacturing of low-cost products is increasingly becoming pricier in the world's second largest economy. Bangladesh needs a time befitting strategy, skilful and technically capable workforce to emerge as a strong player in the global leather industry.

*The End*