Examining Critical Success Factors for Environmental Sustainability in Supply Chain: A Case Study

by

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CERTIFICATE OF APPROVAL

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It is hereby declared that this thesis or any part of it has not been submitted elsewhere for the award of any degree or diploma.

Shafayet Ullah Sabuj

This Work is Dedicated to My Parents

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List of Abbreviations

CSF	: Critical Success Factor
ESSCM	: Environmentally Sustainable Supply Chain Management
SCM	: Supply Chain Management
TISM	: Total Interpretive Structural Modeling
MICMAC	: Cross-impact Matrix Multiplication Applied to Classification analysis
USGBC	: U.S. Green Building Council

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Abstract

Bangladesh is a country of emerging economy characterized by growing industrialization. However, huge environmental pollution takes place due to this rapid growth of industrialization. To control the significant increase of pollutants, industries need to move towards environmentally sustainable supply chain management (ESSCM) practices. This thesis aims to identify and analyze the critical success factors (CSFs) behind the successful implementation of ESSCM for the readymade garment (RMG) industry of Bangladesh. This thesis has identified fourteen CSFs to implement ESSCM through a detailed literature review. Then, these factors have been reduced to ten, which are most relevant to the Bangladeshi RMG factory according to the case study conducted in four garment manufacturing factories. After that, a structural model is suggested using the Total Interpretive Structural Modeling (TISM) technique to understand the contextual relationships among these CSFs and to determine their interdependence to implement ESSCM. Subsequently, this structural model has been validated and updated with the opinions of ten academic experts from five renowned universities. In addition, the MICMAC analysis method has been implemented to determine the importance of CSFs based on their driving power and dependence.

The findings of this study show that the implementation of ESSCM practices is greatly influenced by government policies and top management supports, which are the most dominating CSFs that act independently but influence other CSFs either directly or indirectly. Furthermore, some other factors are also considered to be significant including eco design of products, ISO 14000 certification of suppliers, pressures from consumers, and training and skill development. The findings are expected to assist industrial managers to concentrate on the CSFs to implement the ESSCM practices more effectively in the RMG industry of Bangladesh.

CHAPTER 1
INTRODUCTION

1.1 Introduction

Industrialization has always been considered as the powerhouse of poverty alleviation, economic development, and better living conditions for humans. However, the industrial revolution is now playing the worst role in climate change. Furthermore, industrial activities across the globe have made the world to experience severe environmental degradation in terms of water, air, and soil quality, ecology destruction, and loss of biodiversity (Evans, Opoku and Kofi, 2019). The manufacturing industry, including the textile and readymade garment industry (RMG), has always been responsible for large-scale energy use, which mainly comes from burning fossil fuels. To protect the planet and to ensure resource efficiency and save the resources for the future generation, the concept of the environmentally sustainable supply chain is gaining popularity globally.

(Ruiz-Benitez, López, & Real, 2018) and (Shohan et al., 2019) opined that sustainability performance enhancement can be achieved through the important strategy named green supply chain management, which helps to overcome the challenges of environmental pressures and desire for economic wellbeing.

According to a study of the Export Promotion Bureau, Bangladesh (2018), export earnings from the RMG sector of Bangladesh was USD 30.61 billion, with a growth rate of 8.76% in FY2017-18, at the same time, contribution by the country's RMG sector to national export earnings was around 83.5 percent. Nearly 4.5 million workers are directly employed in the RMG sector of Bangladesh, in which women constitute a significant portion. According to McKinsey (2011), Bangladesh is the next hot spot in apparel sourcing. The Government of Bangladesh sets out an export target of $50 billion by 2021 from the country's RMG sector. So now RMG is playing a vital role to achieve this. This Sector is mostly driven by the buyers of the developed countries.

According to Luthra et al., (2011), Mathiyazhagan et al. (2013) Mangla et al. (2014), and Asif (2019), most of the buyers from the developed countries are now more concerned not only about ethical issues but also about issues related to environment and workplace safety. To save the planet from environmental degradation as well as to ensure efficient use of resources, the concept of green industrialization and environmentally sustainable Supply chain are gaining momentum globally. It is also understood that green manufacturing and environmentally sustainable supply chain management (ESSCM) attract buyers and generate ‘price’ and ‘fiscal’ incentives. So, Bangladesh needs to transform its conventional supply chain management into an environmentally sustainable supply chain, which is more compliant from economic, social, and environmental aspects.

Though the implementation of environmentally sustainable supply chain management (ESSCM) practices has different difficulties as stated by (Grimm, Hofstetter, & Sarkis, 2014), research on this issue is relatively immature. For this reason, the aim of the research is to identify various critical success factors (CSFs) to implement ESSCM and to develop a hierarchy of CSFs to implement ESSCM towards sustainability in the supply chain of Garment industries in Bangladesh most effectively and economically.

1.2 Research Gap and Motivation

Environmental, economic, and social impacts all are considered in sustainable supply chain management and it also encourages practicing good manufacturing throughout the product lifecycle (Seuring & Müller, 2008). Economic dimensions of sustainability have been examined by many scholars. However, environmental sustainability, defined as supply chain practices to enhance the quality of the environment for the long term doesn’t receive much attention in the literature and practice especially in an emerging economy like Bangladesh. To address this issue, building a structural framework of critical success factors (CSFs) for environmental sustainability is essential for industrial managers to sustain global competition while ensuring local and international environment-related laws and compliance. Interactions among CSFs need to be evaluated for formulating a structural framework. So, the Total Interpretive Structural Modeling (TISM) approach can be applied to analyze the interactions among multiple factors. TISM, a qualitative modeling technique, is an extension of the Interpretive Structural Modeling (ISM). The application of TISM appears in several fields, including telecom service providers, the manufacturing industry (Jain & Raj, 2015), and analyzing supply chain resilience (Rajesh, 2017).

Examining CSFs for environmental sustainability is a demanding topic for industrial managers in the readymade garments industry of Bangladesh. This study considers a case of a garments factory and will examine CSFs for environmental sustainability employing the TISM methodology.

1.3 Objectives of the Present Work

The main objectives of this project work are as follows:

1. To find out various critical success factors (CSFs) of implementing an environmentally sustainable supply chain for the RMG industry in Bangladesh.
2. To find out the contextual relationships among identified CSFs.
3. To propose a structural model of CSFs using the TISM approach that helps to implement an environmentally sustainable supply chain.

1.4 Scope of the Thesis

This thesis consists of five chapters, along with a list of references and appendices. They are as follows:

Chapter 1 is entitled "INTRODUCTION", which describes the motivation and background of this research for implementing ESSCM in the Garment industry of Bangladesh. The research objectives and the outline of the methodology implied in this thesis are also described there.

Chapter 2 titled "LITERATURE REVIEW" discussed the theoretical background of SSCM. Previous studies focusing on Critical Success Factors to ESSCM have also been discussed briefly in this chapter. Later, an overview of the garments industry of Bangladesh and the status of its environmental practices have been presented in Chapter 2.

The methodology followed for conducting the thesis has been outlined in **Chapter 3**. The procedure is summarized in a flowchart. Then, the TISM methodology used for developing the frameworks of CSFs is described in this chapter. The Driving power and dependency of the factors have also been demonstrated using MICMAC analysis. At last, the validation process of the TISM model is discussed.

The next portion of this thesis deals with developing a structural framework using TISM indicating the relationships among critical Success factors of ESSCM, which is illustrated in **Chapter 4**, named "MODELING OF CRITICAL SUCCESS FACTORS USING TISM APPROACH". Hierarchical relationships among the Factors are illustrated by the MICMAC analysis. After validation of the initial structural framework, the final framework for the factors of ESSCM is constructed.

Chapter 5, termed as "CONCLUSION, MANAGERIAL IMPLICATIONS & RECOMMENDATIONS FOR FUTURE RESEARCH" briefly summarizes the work of this thesis, the findings, and the managerial implications of this research along with the recommendations for future research. References and appendix are presented at the end of the thesis.

CHAPTER 2
LITERATURE REVIEW

2.1 Environmentally Sustainable Supply Chain Management

The supply chain acts as a consolidation of different functional areas within an organization, aiming to increase product flow at each stage of the supply chain, including strategic suppliers, manufacturers, distributors, and end-users (Tan, 2001). On the other hand consideration of environmental welfare thinking into supply chain management is denoted as Environmentally Sustainable Supply Chain Management (ESSCM). It means considering environmental safety in every step of the supply chain from product design, material sourcing, and selection of manufacturing processes to deliver the final product to the customer and end-of-life management of the product (Srivastava, 2007). Industries can gain more profits and competitive advantages in the market by using this ESSCM as a strategic approach.

However, in reality, the implementation of an environmentally sustainable supply chain has many difficulties. Therefore, it is important to identify critical success factors (CSFs) and then develop a hierarchical relationship among those CSFs to implement ESSCM towards sustainability in Bangladesh Garment industries without altering the economic growth.

2.2 Critical Success Factors (CSFs)

Critical Success Factors are some areas of activities in which satisfactory results are necessary to achieve the goals for the individual, department, or organization. These are the few important areas where everything necessary to do right for the business to improve and for the managers to achieve the goal as well as necessary to get a positive outcome from the business or strategy.

In doing the literature review, a variety of critical success factors for an environmentally sustainable supply chain was identified as discussed below.

2.2.1 Government policies

According to (Kassolis, 2007), Government policies have a strong influence on the strategy development of any organization. This is especially true for the industries having environmental problems, like manufacturing. Laws and regulations are very important instruments for the proper governance of business enterprises. If the government considers environmental impact during policymaking, then organizations of course maintain those policies. So, government policy is an important factor in the successful implementation of environmentally sustainable supply chain management. Again, policies imposed by the government will also create pressure on the company to start practicing environmental practices in their operational activities. It also sometimes acts as a key factor to start the environmental practices within the firm(Kilbourne, Beckmann, & Thelen, 2002)

2.2.2 Technological capabilities

For any organization, a minimum level of technological capabilities is required to assess and improve the effectiveness of the products on the environment during the whole life cycle of the products if the organization wants to implement ESSCM practice (Pujari, Peattie, & Wright, 2004). (Kant, 2018) finds that development of technological capacities or transfer to the supplier will help organizations in achieving energy-efficient solutions to attain organizational objectives towards environmentally friendly manufacturing.

2.2.3 ISO certifications

Quality and productivity-oriented standard practice likely trigger the positive effects of the environmental score (Pujari et al., 2004). This has been stated in many studies also. Quality management principles, tools, or systems e.g. ISO 14001 and ISO 9001implementation may improve the KPI score of the company's environmental performance (Sroufe, 2003). Besides it also helps to trigger to extend those practices and standards to implement to other supply chain and third-party partners (Zhu & Sarkis, 2004)

2.2.4 Supply chain integration

It is necessary to check its suppliers' environmental factors by the company that is already performing and achieving good scores in environmental issues. Otherwise, it may create an adverse effect or situation for the parent company also. Sometimes a company performing a high level of environmental performance score may break down due to poor management of environmental issues by its suppliers. Collaboration between the company and suppliers by standardizing and maintaining environmental performance through the supply chain and internal relation will bring distinctive and collaborative cost-effective and environment-friendly waste reduction, better innovation in the product cycle and production processes. It also initiates rapid development as well as intake and uptake of environmental challenges and technologies (Simpson, Power, & Samson, 2007). Also, the success of ESSCM activities may be hampered due to the failure of supply chain integration in environmental issues. It also affects the implementation of sustainability throughout the supply chain (Sarkis, Zhu, & Lai, 2011)

2.2.5 Pressures from consumers

Any firms' most important factor is customers themselves. Therefore, all company must design their products to systems as well as their operational practices based on their customers' demands, their beliefs & values towards the company. Hence consciousness of customers often leads a company to start and impose environmental policies within the firm Also, engagement of these environmental policies is also used as advertising policies for the customers which lead them to score better environmental index number. Hence, they should invest and nurture the environmental policies & practices in the firm to obtain a better environmental index number.

2.2.6 Customer and supplier relationships

Sometimes the company cares too little about their supplier's issues as they think it's totally different from their network. It is happened due to the traditional mindsets of the company owners and their managers. They also think that suppliers' interests are totally different from the company's core philosophy. The research of (Holland & Gibbon, 1997) has found that this happens due to limited care and responsibility of the company owner as well as the managers as they think that suppliers' environmental index will impact in a negligible amount in their firm. It is also found that the relationship between firm and suppliers in environmental issues is important to enhance the sustainability performance throughout the supply chain of both company and suppliers (Carter & Rogers, 2008).

2.2.7 General awareness in the public

Maignan & Mcalister, (2003) has pointed out that, general awareness of the mass public will also impact the company's policy towards environmental factors. It also imposes greater pressure on the company to adopt environmental policies and practices due to the mass publics' common interest and awareness.

2.2.8 Eco design of products

(Zhu & Sarkis, 2004) found that, the economically viable and environmentally friendly design also helps a company to produce products cost-effectively. It also serves as a key factor to protect organizational resources.

2.2.9 Reverse logistic practices

Zhu & Sarkis, (2004); Zhu, Sarkis, & Geng, (2005) observed that, if the company can reuse the waste material, reinvent the heat transfer procedures to recycle the heat, and optimize as well as simplify the other processes of the supply chain, it will not only act as a key factor to enhance and protect the organizational resources but also will be helpful for the environment. It is always benign for the environment if the company recollects all the returned goods, used goods for reducing the waste in environments. It also accomplishes the economic benefit as well as the environmental benefit for the company. Implementation and adoption of reverse logistics practices lead to benefit to the environment and the firm too. (Raci & Shankar, 2005).

2.2.10 Alignment of company strategy with purchasing strategy

Kirchoff, Tate, & Mollenkopf, (2016) explained that, if any company considers environmental issues at the time of purchase for the company and adopts a purchasing policy following the company's overall environmental strategy then it will help them to find those suppliers who are also aware of environmental issues. So, aligning company strategy with purchasing strategy is an important factor for achieving environmental sustainability.

2.2.11 Support from top management

Any kind of environmental management success greatly relies on the top management's support and their commitments and leadership towards them (Pun, 2006). Again, any implementation of environmental success issues on any business process may even completely fail due to a lack of active support from the top management. Also, top management needs to support the idea to change radical change in mindsets and practices in GSCM. It can be further added that the top management should be accountable for determining the environmental proactiveness in the firm so that they can give support, play as a role model or act as a leader to introduce any environmental proactiveness throughout the supply chain including the suppliers (Aragón-Correa, 1998; Sharma, 2000).

2.2.12 Corporate social responsibility

If a company truly tries to improve its environmental factors, then it needs to adopt the policy to go beyond simple compliance and go for public consequences for organizational actions. It also needs to adopt the practices to bring CSR (corporate social responsibility) activity in environmental proactiveness(Sharma, 2000). CSR also helps a company to adopt voluntary strategic practices for eliminating physical waste, informing internal and external customers, confronting publicly about the environmental effects on products. Take the initiative to take corrective actions to change the current situation or condition to prevent endangerment of the natural environment. CSR policies also indicate the company's long-term view and the necessary resource allocation accordingly (Henriques & Sadorsky, 1999).

2.2.13 Use of information technology

Daugherty, Myers, & Richey, (2002) found that a company should have such MIS adaptability so that it can remain responsive to anticipate and accommodate operational changes as well as customer demands. Sometimes inefficiency of MIS may create serious problems in addressing the environmental issues of ESSCM. Hence, MIS should be established in such a way that it can integrate the ESSCM activities in different stages so that company can predict the environmental sustainability at ESSCM and take corrective actions accordingly. In order to ensure a good forecasting ability of the MIS, it is required to prevent distortion of information in sequential stages. Hence, an integrated information system is an important factor to improve environmental proactiveness in between firm and ESSCM (Chopra & Sodhi, 2004).

2.2.14 Training and skill development

During the implementation of ESSCM practices, it is required for the employees not only to inaugurate some modifications over the existing ones but also to be familiarized with the new practices and processes to apply them successfully. So, it is essential that employees should be educated about the environmental aspects of the activities of the company and be trained about the new environment-friendly processes and practices to apply them properly and effectively(Teixeira, Jabbour, De Sousa Jabbour, Latan, & De Oliveira, 2016).

2.3 Application of Total Interpretive Structural Modeling (TISM) Technique in Supply Chain

Interpretive Structural Modeling has been used along with MICMAC analysis as a prevailing tool in most of the complex situations involving modeling of critical success factors (CSFs), key variables, enablers, inhibitors, or barriers in different areas. For example, the top ten risks that are related to the supply chain of the readymade garments industry of Bangladesh were identified and a hierarchical model was developed through the ISM method. Digraph interpretations in ISM are carried out at two levels, one at the nodes and the other at the links. Nodes are interpreted by ISM through defining its elements signifying it. However, ISM has comparatively weak link interpretations. Along with that, quantitative criteria need effort and have obscurities and vagueness. ISM is modified to TISM to overcome this problem. In TISM, the causal relations and their interpretations are given by experts are represented by an interpretive matrix for detailed systematic analysis. (Dubey, Gunasekaran, Sushil, & Singh, 2015; Jayalakshmi & Pramod, 2015). That's why nowadays TISM is broadly utilized by researchers in different fields.

Eighteen (18) inhibitors of cloud computing were identified by (Amma T, Radhika, & Pramod, 2014), and then a hierarchical structure was developed to show interpretation and interdependency of linkages among these inhibitors by using TISM. Also, 10 critical factors of the construction industry were identified by (Sandbhor & Botre, 2014) that negatively impact labor productivity. Elucidating mutual relationships among those factors was done by employing TISM. Interpretation and interdependency of linkages among these factors were also shown by them. Jena et al., (2016) did research on the Smartphone manufacturing ecosystem in India where 15 critical success factors CSFs) were identified. To delineate the inter-relationship among these CSFs a five-level hierarchical model was also proposed by employing TISM.

This study considers a case of four garments factories and will examine CSFs for environmental sustainability using the TISM approach.

2.4 Overview of Readymade Garment Industry in Bangladesh

The RMG sector of Bangladesh, which has seen enormous growth over the past 30 years, becomes a key driver of the Bangladesh economy. A recent article from BKMEA (Bangladesh Knitwear Manufacturers and Exporters Association) shows that, In Ready-made Garments, Knitwear sector is a very strategic sector of RMG, which has exported knitwear products equivalent to USD 13.35 billion in FY 2015-16, accounting for 47.54% of total RMG exports of Bangladesh and creating direct employment of 1.6 million people. It has been also maintaining a domestic value addition of about 75% over the last several years. Around 81% of the overall export is earned by the RMG sector. Around 4.4 million workers are employed, 80% of them are women. By 2021 a target of 50 Billion exports has been set by the sector. With the world's several top-ranked green factories, Bangladesh, which is known as the second-largest ready-made garment exporter in the world, has taken a leading position in sustainable green industrialization. According to the U.S. Green Building Council (USGBC), Bangladesh has now 67 LEED (Leadership in Energy and Environmental Design) green factories certified by USGBC. Among these factories, 13 are LEED Platinum rated while for LEED certification more than 280 factories are registered with USGBC.

The green industry is broadly defined as those manufacturing activities that increase energy and material efficiency, and at the same time reduce waste outputs that cause loss and reduce pollution and create green jobs. The green lens of a green industry can help to reduce costs, fight against climate change, and re-think long-term business practices, and open up the doors to a myriad of opportunities. By taking on efficient use of water and energy, the process is sought to introduce on a wider scale. These adoptions have had their benefits through improving energy and water efficiency systems along with developing a recycling process that will reduce air, land, and water pollution.

The main purpose of going green is to adopt renewable energy in the production process, rigorous protections against emissions, use of environmentally responsible sources of supplies, or produce final products that are not hazardous to the environment.

2.5 Green Industry: Bangladesh Perspective

The acceptance of the green industry is increasing day by day amongst the owners of the industries as well as the buyers. Now, according to the U.S. Green Building

Council (USGBC) we are at the top compare to other countries of the present world as seven of the ten highest rated industries in the world are from Bangladesh.

Bangladesh's RMG sector, which is a $28 billion industry, has established 70 eco-friendly green buildings that are the highest in the number all over the world and through this taken its lead in green manufacturing. An efficient sustainable manager is needed to run a sustainable green industry. So, the demand for sustainable managers and maintenance procedures is increasing in our industry.

The present scenario shows that our country is going through a revolutionary change in the industry sector and sustainability is the prime issue concerning that revolution. Bangladesh started their journey on greening in 2011. The first LEED-certified project is CIPL, Saver, Dhaka. The highest rating building all over the world is Remi Holdings Ltd. at Narayanganj. However, with respect to the placement of green factories worldwide, the present status of the Bangladesh RMG industry seems to be revolutionized. There are 34 Gold, 14 Platinum, and 6 Silver rated and 1 only certified RMG factories in Bangladesh, while a total of 323 registered projects including textile and RMG firms, commercial complexes, and other industrial firms are in the LEED certification process as of June 2018. At present, the seven highest-rated green factories (i.e. platinum, 80 plus points) among the world's ten highest rated factories are in Bangladesh.

CHAPTER 3
METHODOLOGY

The purpose of this study is to identify the interrelationship of various CSFs in implementing an environmentally sustainable supply chain in the garment industry of Bangladesh. The overall approach involves discussions with senior managers/executive heads using semi-structured interviews, mainly in the broader issue of 'implementing an environmentally sustainable supply chain in Bangladesh's garment industry'. The research methodology used for this study is presented with a diagram illustrated in Figure 3.1

3.1 Identification of Critical Success Factors

To identify the critical success factors, a review of the literature was conducted. At first, 14 potential critical success factors were extracted from the literature review and listed in a questionnaire survey form which was sent to the industry experts upon their permission for selection of the most relevant critical success factors.

3.2 Development of the TISM model

Several steps were involved in developing the TISM model. All the required steps have been explained below:

Step I: Selection of the most relevant critical success factors

This is essentially the initial step of TISM. The most relevant critical success factors in this step are finalized from the list of factors identified by the literature review. It is based on the opinion of industry experts. Statistical tools have been used to evaluate expert opinion.

Step II: Contextual relationship development among CSFs

This step describes why any factor will be linked to or affected by other factors. It is of paramount importance to describe the relevant relationship among the critical success factors. Complex systems for this feature can be easily translated into TISM.

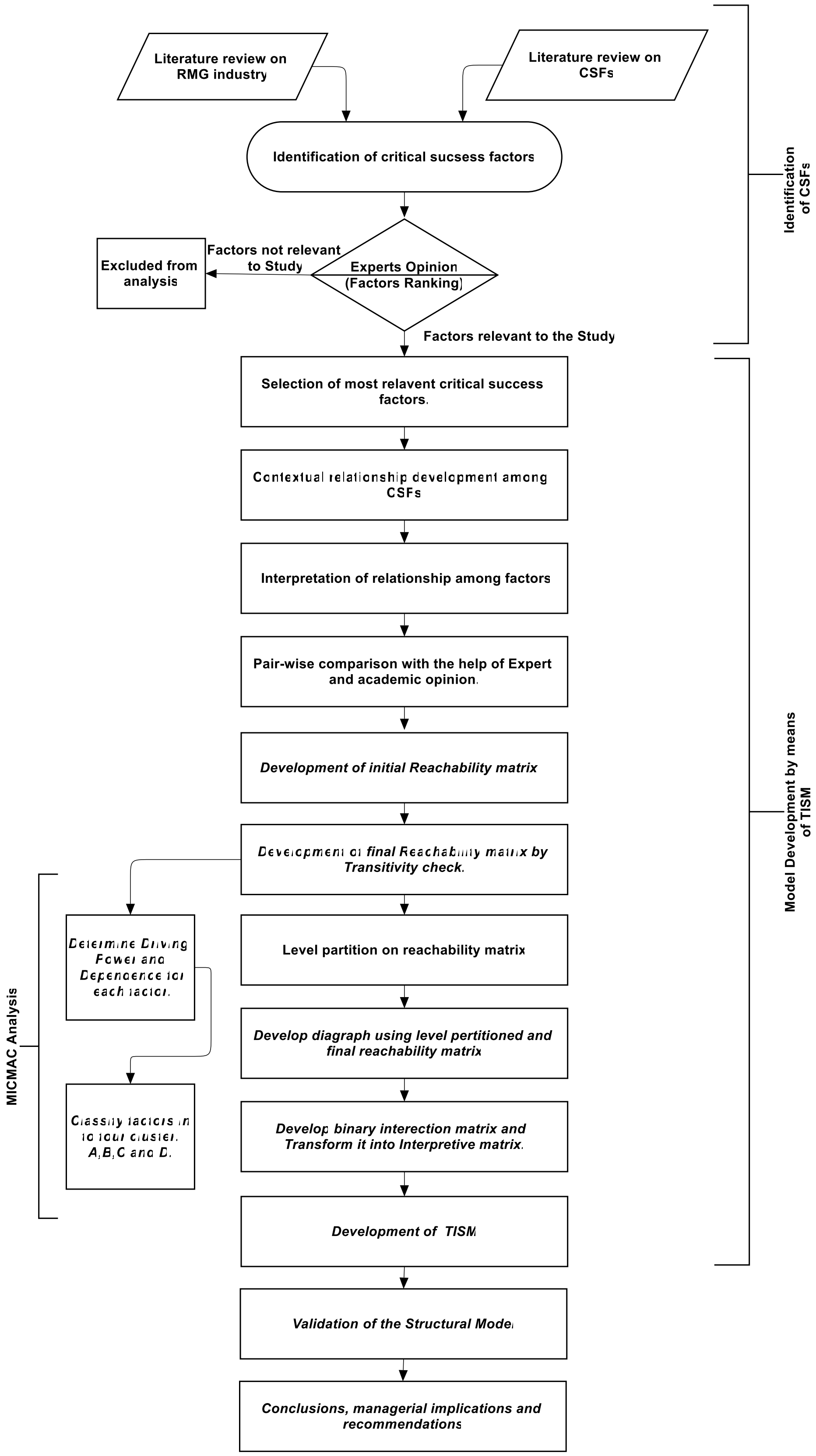

Fig. 3.1 Overall approach of the research methodology

Step III: Interpretation of relationship

This is essentially the first step towards TISM that will differ TISM from traditional ISM. Although relevant relationships can be captured by ISM but can't explain how these relationships affect each other. Thus, clarification of the relationship in TISM is achieved by specifying how one factor will influence or hamper another factor. This explanation of the relationship will help to deepen the knowledge of ESSCM implementation.

Step IV: Interpretive logic of pair-wise comparison

Each factor has to be compared individually with all other factors for achieving pair-based comparison. I-J or J-I are two possible directional links. hence, for n identified factors, n *x* (n-1) will be the total number of pair-based comparisons. Thus, the number of rows will be identified as n *x* n (n− 1). Pair-based comparison has been developed by using factors to create an "interpretive logic-knowledge base". If the expert's opinion is yes for each pair-based comparison, enter the code "Y" and if the opinion is no then enter code "N", and for code "Y", further explanation is required to provide.

Step V: Development of Initial Reachability matrix

The initial reachability matrix was developed by converting yes to 1 and no to 0 according to the data that has been collected from the pairwise comparison.

Step VI: Development of final Reachability matrix by transitivity test

In this step, the transitivity rule is applied to check the initial reachability matrix. According to this, "I" can be transitively connected with "K" while "I" is directly linked with "J" and "J" is linked with "K". Knowledgebase has been updated as "Y" for the new transitive link and inserted "transitive" in the Explanation column. If the transitive link is significant in nature, the reason behind its significance is also noted along with the "transitive" entry. Hence, the final reachability matrix developed from the initial reachability matrix by transitivity check.

Step VII: Level determination by partitioning reachability matrix

In this step, by using the final reachability matrix, the reachability set, and the antecedent set of factors are identified. The reachability set includes the factor itself and the other factor which is influenced by this factor. The antecedent set is the factor itself and those factors which have influence over this factor. Then, the intersection set is determined for all factors from the reachability set and antecedent set. In the TISM hierarchy, top-level positions will be taken by those factors whose reachability set and intersection sets are the same. The top-level factors of the hierarchy cannot reach any of the other elements upper their level. Thus, top-level factors are distinguished from other factors. The same methodology is applied to investigate the factors of the next layers. This iteration is repeated until the level of each factor is determined.

Step VIII: Develop digraph

A digraph which is also known as the directed graph for factors is constructed by arranging all the factors at their respective levels determined in step VII and showing the links indicated by the relation displayed in the final reachability matrix. Among all the transitive relations, only those are considered whose interpretations are very important according to the opinion of the experts and if the combined significance of the transitivity link was at least 50%.

Step IX: Development of Binary interaction matrix and Interpretive Matrix

By depicting all interactions to "1" on the respective cells, the final digraph is converted to a binary interaction matrix. Each cell containing 1 in the matrix will further describe the impacts of the factors. This is known as the interpretive matrix.

Step X: Total Interpretive Structural Model

By using the digraph and interpretation table, TISM has been developed for the identified critical success factors. From this TISM, the managers will be able to identify the relationship between those factors as well as prioritize the factors according to their importance.

3.3 MICMAC Analysis

MICMAC (Cross-impact Matrix Multiplication Applied to Classification analysis) generally used as a classification analysis. The main purpose of this analysis is to identify the factors which are responsible for imposing ESSCM in the industry, or which are limiting the ESSCM implementation. Initially, the driving power and the dependence powers of the factors are identified and then the factors are classified into 4 clusters like Cluster A, Cluster B, Cluster C, and Cluster D (Jena, Sidharth, Thakur, Kumar Pathak, & Pandey, 2017).

Cluster A: Autonomous factor

Factors having weak driving power and dependency are in this cluster. These are comparatively separate from the system and there is rarely any link between them which can be very powerful.

Cluster B: Dependent Factor

Factors having weak driving power, but strong dependence are in this cluster.

Cluster C: Linkage Factor

These factors have strong driving power as well as strong dependence. Factors in this cluster are unstable and any action taken on these factors will have an impact on other factors.

Cluster D: Independent Element

These factors have strong driving power but weak dependence. These are also known as key factors that are independent. The detailed calculation of the MICMAC analysis of the factors will be conducted in the following Chapter.

CHAPTER 4
MODELING OF CRITICAL SUCCESS FACTORS USING TISM APPROACH

This chapter focuses on developing the interrelation among the critical success factors of Environmental sustainability in supply chain management employing the TISM approach. Identification of relevant CSFs through literature review and then selection of most relevant CSFs by academia and industry expert's opinion is the first step towards model development. After finalizing the CSFs, we will follow other steps to develop the model using TISM. At last, the MICMAC analysis will be done to identify the driving power and the dependence of the factors.

4.1 Identification and Selection of Most Relevant Critical Success Factors

Identification of the factors is the basic step of developing the structural framework. In this present study, at first, a total of fourteen potential factors have been identified from the existing literature review. The summary of these 14 identified factors is given in Table 4.1.

Table 4.1 Fourteen Potential success Factors of ESSCM

Sl. No.	Factors	Description	References
1	Government policies	If the government considers environmental impact during policymaking, then organizations of course maintain those policies. So, government policy is an important factor towards the successful implementation of ESSCM.	(Kassolis, 2007); (B.Gardas et al., 2019)
2	Technological capabilities	Technological capacities development or transfer to the supplier will help organizations in achieving energy-efficient solutions to attain organizational objectives towards environmentally friendly manufacturing.	(Pujari, Peattie, & Wright,2004); (Kant, 2018);

Sl. No.	Factors	Description	References
3	ISO certifications	Quality management principles, tools or systems e.g. ISO 14001 and implementation of ISO 9001 may improve the KPI score of the company's environmental performance.	(Pujari et al., 2004); (Sroufe, 2003);(Zhu & Sarkis, 2004)
4	Supply chain integration	It is necessary to check its suppliers' environmental factors by the company that is already performing and achieving good scores in environmental issues. Otherwise, it may create adverse effects or situations for the parent company also.	technologies (Simpson, Power, & Samson, 2007) ;(Sarkis, Zhu, & Lai, 2011)
5	Pressures from consumers	The Consciousness of customers often leads a company to start environmental policies within the firm. Also, the engagement of these environmental policies is used as an advertising policy of the customers which leads them to improve the index number of the environment.	(Sarkis et al., 2011) (Moktadir et al., 2019); (Zhang et al., 2020).
6	Customer and supplier relationships	Relationship between firm and suppliers in environmental issues is important to enhance the sustainability performance throughout the supply chain of both company and suppliers	(Holland & Gibbon, 1997) ;(Carter & Rogers, 2008)
7	General awareness in public	General awareness of the mass public will also impact the company's policy towards environmental factors. It also imposes greater pressure on the company to adopt the environmental policies and practices	(Maignan & Mcalister, 2003)
8	Eco design of products	The economically viable and environmentally friendly design helps a company to produce products cost-effectively. It also serves as a key factor to protect organizational resources.	(Zhu & Sarkis, 2004)

Sl. No.	Factors	Description	References
9	Reverse logistic practices	It is always good for the environment if the company recollects all the returned goods and used goods for reducing waste in environments. It also accomplishes the economic benefit as well as an environmental benefit for the company.	(Zhu & Sarkis, 2004); (Zhu, Sarkis, &Geng, 2005) ;(Raci& Shankar, 2005)
10	Alignment of company strategy with purchasing strategy	If the environmental issues are addressed during purchases for the company and adoption of policies to in purchasing with the company's overall environmental strategy also helps the firm to find out the suppliers who are also committed to achieving better environmental index in their process chain also	(Aragón-Correa, 1998; Sharma, 2000);
11	Support from top management	Any kind of environmental management success is greatly relied on the top management support and their commitments and leadership towards them	(Pun, 2006); (Aragón-Correa, 1998; Sharma, 2000)
12	Corporate social responsibility	CSR also helps a company to adopt voluntary strategic practices for eliminating physical waste, informing internal and external customers, confronting publicly about the environmental effects on products. Taking the initiative to take corrective actions to change the current situation or condition to prevent endangerment of the natural environment.	(Sharma, 2000) ;(Henriques &Sadorsky, 1999).
13	Use of information Technology	Sometimes inefficiency of MIS may create a serious problem in addressing Environmental issues of SCM. Hence MIS should be established in such a way that it can integrate the ESSCM activities in different stages.	(Daugherty, Myers, & Richey, 2002) (Chopra & Sodhi, 2004).

Sl. No.	Factors	Description	References
14	Training and Skill Development	It is essential, employees are educated about environmental aspects of the company's activities and trained on the new environment-friendly practices and processes.	(Teixeira, Jabbour, De Sousa Jabbour, Latan, & De Oliveira, 2016).

After that, the potential factors are analyzed and finally, the most relevant critical success factors are selected with the help of the industry experts' opinion. To do that, the potential factors were listed in a questionnaire survey form, which was sent to the experts upon their permission. The requirements set for the expert selection process were- having extensive knowledge of ESSCM, having at least seven years of experience in industry jobs and the most important one is being involved with procurement, manufacturing, distribution, and storage of the RMG components. For effective results, the number of cases studied should be in the range of 4 to 10 (Palaniappan, 2017). In this study, we considered Six factories, 1 association, and 2 consultancy organizations. A total of 12 experts were interviewed. All the experts were provided with the questionnaire as shown in Appendix 1, which includes all the factors. All the listed factors on the questionnaire were provided with a numbering option ranging from 1 to 5, number 5 being the most relevant, and number 1 being the least. This numbering system is also called the Likert scale (Balon, Sharma, & Barua, 2016). The profile of experts is given in Appendix 2. After interviewing the experts, 10 factors were selected which were more significant according to the scoring of the experts. The factors with an average score of 3.5 or above (75 percent) were selected for further research (Rajesh, 2017).

The score and selection of the factors can be viewed in Appendix 3. Finally, the selected list of critical success factors is shown in Table 4.2.

Table 4.2 Selected list of critical success factors

Factor Code	Name of the selected most relevant critical success factors
F1	Government policies
F2	Technological capabilities
F3	ISO certifications
F4	Pressures from consumers
F5	Supply chain integration
F6	Eco design of products
F7	Reverse logistic practices
F8	Support from top management
F9	Alignment of company strategy with purchasing strategy
F10	Training and skill development

4.2 Contextual Relationship Development Among CSFs

The experts were consulted for identifying the contextual relationship among the factors. All the questions were yes or no type questions. Here, the contextual relationship identified between the success factors is "Factor A will influence or enhance Factor B".

4.3 Interpretation of the Relationship

This is the first step that gives TISM an advantage over the traditional ISM. Here, if any factor influences or enhances, any other factor; then experts not only indicate whether 'factor A will influence/enhance factor B or not, but also will explain how a factor is affecting or enhancing the other one.

4.4 Interpretive Logic of Pair-Wise Comparison

The interpretation among the factors was used to construct the database of pairwise comparison. Each factor has been compared with the other for checking how it would be enhanced, or how it will enhance the other. There are 10 factors in total and as a result, there were 10*9 or 90 rows of pair-wise comparison describing how each is being affected or enhanced. A questionnaire format has been sent to the experts and their responses have been used to develop a reachability matrix and for pair-wise comparison.

To make a decision, if a 60 % response is given 'Y', the response would be taken as 1; otherwise taken as 0 (Jain & Raj, 2015). The result of the interpretation of the contextual relationship database is listed in Appendix 4.

4.5 Development of Initial Reachability Matrix

Initial reachability matrix has been prepared from interpretive logic of pair-wise comparison by entering "1" if the relation is yes, else "0". The initial reachability matrix is illustrated in Table 4.3.

Table 4.3 Initial Reachability Matrix

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1	1	1	0	1	1	1	0	1	1	0
F2	0	1	0	0	0	0	0	0	0	0
F3	0	0	1	0	0	1	0	0	1	1
F4	0	0	0	1	1	1	0	0	1	0
F5	0	0	0	0	1	0	1	0	0	0
F6	0	1	0	0	0	1	0	0	1	1
F7	0	1	0	0	1	0	1	0	0	0
F8	0	1	1	0	1	1	1	1	1	1
F9	0	0	0	0	1	0	1	0	1	0
F10	0	1	0	0	0	0	0	1	1	1

4.6 Development of final Reachability Matrix by Transitivity Test

The initial reachability matrix is then checked for the transitivity rule to identify the indirect relationships between the factors. After the transitivity test, the factors which passed the test, their values were changed to 1 from 0 and were also given a (*) in the upper right side for easy identification. After the transitivity test, the final reachability matrix is determined which is shown in Table 4.4.

Table 4.4 Final Reachability Matrix

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	Driving
F1	1	1	1*	1	1	1	1*	1	1	1*	10
F2	0	1	0	0	0	0	0	0	0	0	1
F3	0	1*	1	0	1*	1	1*	1*	1	1	8
F4	0	1*	0	1	1	1	1*	0	1	1*	7
F5	0	1*	0	0	1	0	1	0	0	0	3
F6	0	1	0	0	1*	1	1*	1*	1	1	7
F7	0	1	0	0	1	0	1	0	0	0	3
F8	0	1	1	0	1	1	1	1	1	1	8
F9	0	1*	0	0	1	0	1	0	1	0	4
F10	0	1	1*	0	1*	1*	1*	1	1	1	8
Driven	1	10	4	2	9	6	9	5	7	6	

4.7 Level Determination by Partitioning Reachability Matrix

A total of 6 iterations was required to determine the level of factors from the final reachability matrix. All the iterations have been shown step by step in table 4.5(a). And a summary of the level matrix is given in table 4.5(b).

Table 4.5(a) Level Partition Matrix

Iteration#1

Factors	Reachability Set	Antecedent Set	Intersection Set	Level
F1	1,2,3,4,5,6,7,8,9,10	1	1	
F2	2	1,2,3,4,5,6,7,8,9,10	2	1
F3	2,3,5,6,7,8,9,10	1,3,8,10	3,8,10	
F4	2,4,5,6,7,9,10	1,4,	4	
F5	2,5,7	1,3,4,5,6,7,8,9,10	5,7	
F6	2,5,6,7,8,9,10	1,3,4,6,8,10	6,8,10	
F7	2,5,7	1,3,4,5,6,7,8,9,10	5,7	
F8	2,3,5,6,7,8,9,10	1,3,6,8,10	3,6,8,10	
F9	2,5,7,9	1,3,4,6,8,9,10	9	
F10	2,3,5,6,7,8,9,10	1,3,4,6,8,10	3,6,8,10	

Iteration#2

Factors	Reachability Set	Antecedent Set	Intersection Set	Level
F1	1,3,4,5,6,7,8,9,10	1	1	
F3	3,5,6,7,8,9,10	1,3,8,10	3,8,10	
F4	4,5,6,7,9,10	1,4	4	
F5	5,7	1,3,4,5,6,7,8,9,10	5,7	2
F6	5,6,7,8,9,10	1,3,4,6,8,10	6,8,10	
F7	5,7	1,3,4,5,6,7,8,9,10	5,7	2
F8	3,5,6,7,8,9,10	1,3,6,8,10	3,6,8,10	
F9	5,7,9	1,3,4,6,8,9,10	9	
F10	3,5,6,7,8,9,10	1,3,4,6,8,10	3,6,8,10	

Iteration#3

Factors	Reachability Set	Antecedent Set	Intersection Set	Level
F1	1,3,4,6,8,9,10	1	1	
F3	3,6,8,9,10	1,3,8,10	3,8,10	
F4	4,6,9,10	1,4,	4	
F6	6,8,9,10	1,3,4,6,8,10	6,8,10	
F8	3,6,8,9,10	1,3,6,8,10	3,6,8,10	
F9	9	1,3,4,6,8,9,10	9	3
F10	3,6,8,9,10	1,3,4,6,8,10	3,6,8,10	

Iteration#4

Factors	Reachability Set	Antecedent Set	Intersection Set	Level
F1	1,3,4,6,8,10	1	1	
F3	3,6,8,10	1,3,8,10	3,8,10	
F4	4,6,10	1,4,	4	
F6	6,8,10	1,3,4,6,8,10	6,8,10	4
F8	3,6,8,10	1,3,6,8,10	3,6,8,10	4
F10	3,6,8,10	1,3,4,6,8,10	3,6,8,10	4

Iteration#5

Factors	Reachability Set	Antecedent Set	Intersection Set	Level
F1	1,3,4	1	1	
F3	3	1,3	3	5
F4	4	1,4	4	5

Iteration#6

Factors	Reachability Set	Antecedent Set	Intersection Set	Level
F1	1	1	1	6

Table 4.5(b) Summary of Level Partition Matrix

Factor Code	Name of The Factor	Level
F2	Technological capabilities	1
F5	Supply chain integration	2
F7	Reverse logistic practices	
F9	Alignment of company strategy with purchasing strategy	3
F6	Eco design of products	4
F8	Support from top management	
F10	Training and Skill Development	
F3	ISO certifications	5
F4	Pressures from consumers	
F1	Government policies	6

4.8 Development of Digraph

Factors are graphically arranged according to the level determined by iteration and the directed links have been drawn as per the relationship shown in the final reachability matrix. Only those transitivity links are taken in the digraph whose interpretation is crucial. During the transitivity check, if experts' responses are more than 50 % then the transitivity is taken as significant transitivity (Jain & Raj, 2015). The developed diagraph is shown in Figure 4.1.

4.9 Development of Binary Interaction Matrix and Interpretive Matrix

In this stage, the final digraph is converted into a binary interaction matrix which is shown in table 4.6. The interpretation of diagraph known as interpretive matrix also has been prepared and depicted in following Table 4.7.

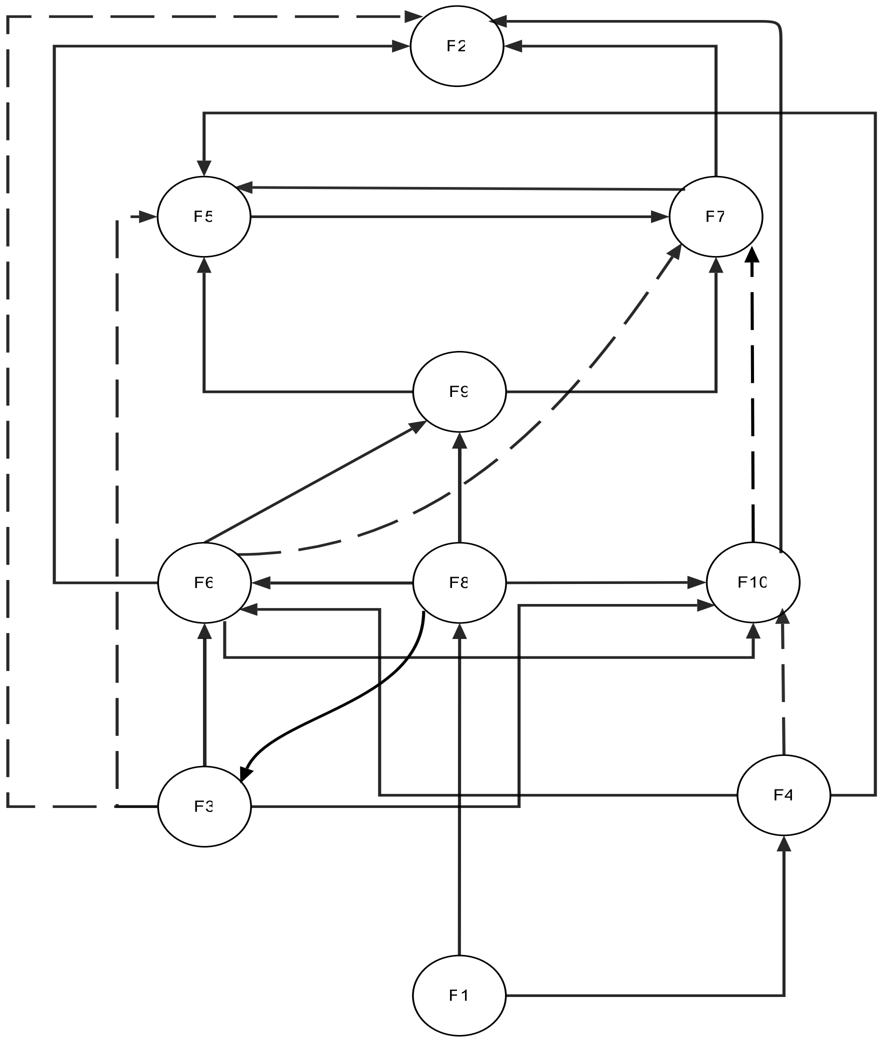

Fig. 4.1: Diagraph of Initial Framework of CSFs.

Table 4.6 Binary Interaction Matrix

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1	-	0	0	1	0	0	0	1	0	0
F2	0	-	0	0	0	0	0	0	0	0
F3	0	1*	-	0	1*	1	0	0	0	1
F4	0	0	0	-	1	1	0	0	0	1*
F5	0	0	0	0	-	0	1	0	0	0
F6	0	1	0	0	0	-	1*	0	1	1
F7	0	1	0	0	1	0	-	0	0	0
F8	0	0	1	0	0	1	0	-	1	1
F9	0	0	0	0	1	0	1	0	-	0
F10	0	1	0	0	0	0	1*	0	0	-

(* Refers to Significant Transitive Linkage)

Table 4.7 Interpretive matrix

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
F1				By restricting import or manufacturing				By creating pressure to change toward ESSCM		
F2										
F3		By Influencing to use environment friendly technology			By Influencing sourcing decisions	To get certification				Building Skilled Manpower
F4				-	To adopt new policies	By influencing in design stage				influence to become updated
F5							to integrate supply chain in adapting reverse logistics.			
F6		integrate or inaugurate new sustainable technology					By promoting 3R(Reduce, reuse and recycle)		To adapt new policy to purchase sustainable materials	To train employee for adapting new technology
F7		integrate or inaugurate new sustainable technology			To integrate sustainable policy		-			
F8			By supporting to maintain the requirements.			By encouraging design team to design more sustainable products.		-	By approving policies to purchase green items	To adapt new policy to provide opportunity for training
F9					By integration of sustainable policy		By selecting items considering 3R			
F10		Training leads to run new system more efficiently.					By promoting 3R(Reduce, reuse and recycle)			

4.10 Development of Initial Total Interpretive Structural Model

Based on the diagraph and the interpretive matrix, a TISM based model of Critical Success Factors is developed. An initial TISM based model of critical success factors is presented in Figure 4.2.

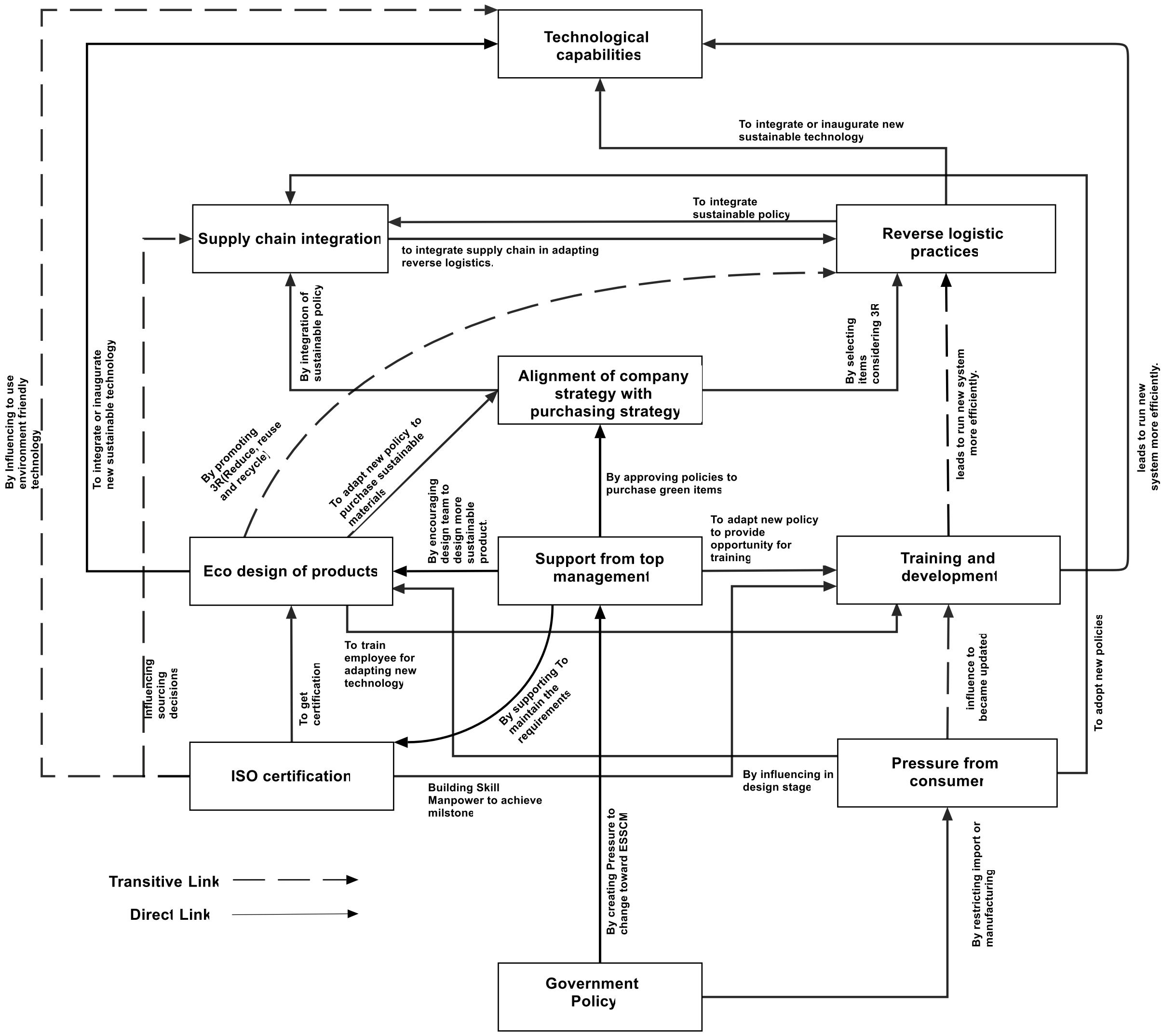

Fig. 4.2: Initial TISM based model of critical success factors.

4.11 MICMAC Analysis:

MICMAC analysis has been used to segregate the factors into 4 clusters based on their Driving power and dependence. Initially, the driving power and the dependence of the factors are identified from the final reachability matrix. Table 4.8 has presented the total driving power and the dependence of the critical success factors of ESSCM in the Garment industry of Bangladesh. The driving power of each factor has been determined by sum-up all "1" exist in the rows from the final reachability matrix. The dependence of each factor has been determined from the final reachability matrix by sum-up all "1" exist in the columns.

Table 4.8: Final reachability matrix with driving power and dependence

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	Driving Power
F1	1	1	1*	1	1	1	1*	1	1	1*	10
F2	0	1	0	0	0	0	0	0	0	0	1
F3	0	1*	1	0	1*	1	1*	1*	1	1	8
F4	0	1*	0	1	1	1	1*	0	1	1*	7
F5	0	1*	0	0	1	0	1	0	0	0	3
F6	0	1	0	0	1*	1	1*	1*	1	1	7
F7	0	1	0	0	1	0	1	0	0	0	3
F8	0	1	1	0	1	1	1	1	1	1	8
F9	0	1*	0	0	1	0	1	0	1	0	4
F10	0	1	1*	0	1*	1*	1*	1	1	1	8
Dependence	1	10	4	2	9	6	9	5	7	6	

After that, factors are plotted based on their driving power and dependence and segregated the factors into 4 clusters named Cluster A (Autonomous Factor), Cluster B (Dependent Factor), Cluster C (Linkage Factor), and Cluster D (Independent Factor

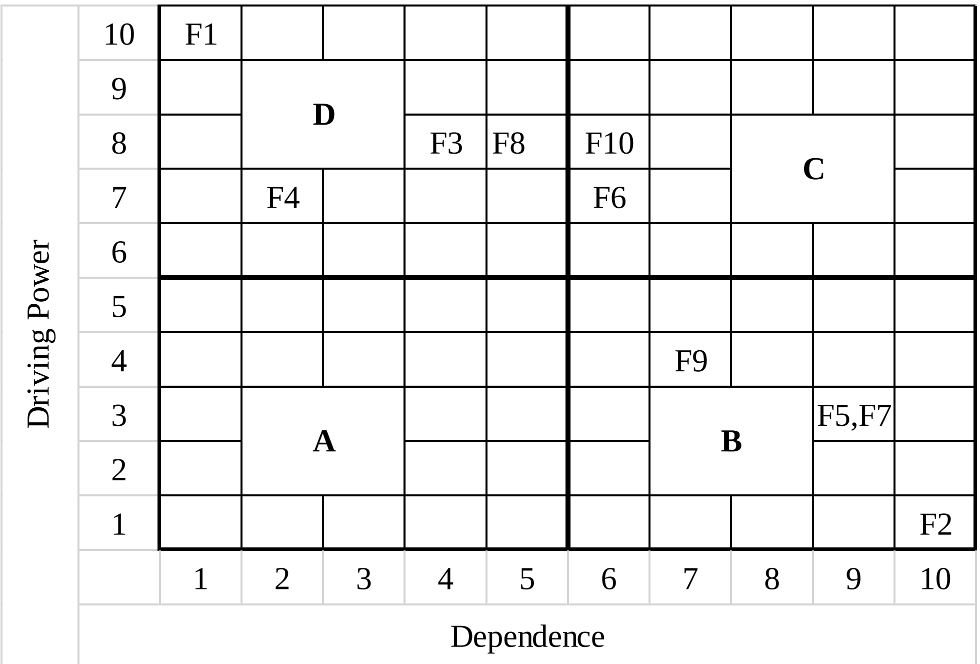

Fig. 4.3: MICMAC Analysis of the factors of ESSCM

4.11.1 Cluster A: Autonomous factor

As per plotted data in figure 4.3, there are no critical success factors that fall into this segment which is known as Autonomous Factors. That means there are no factors in the system having comparatively very weak driving power as well as dependence.

4.11.2 Cluster B: Dependent factor

Again, from figure 4.3, it can be observed that four factors named Technological capabilities(F2), Supply chain integration(F5), Reverse logistic practices(F7) and Alignment of company strategy with purchasing strategy(F9) fall in Cluster B. These factors having strong dependence over other factors but weak driving power.

4.11.3 Cluster C: Linkage factor

Factors Having strong driving power and strong dependence are plotted in this cluster. Eco-design of products (F6) and Training and Skill Development (F10) are in this cluster named as Linkage Driver.

4.11.4 Cluster D: Independent factor

Factor 1 (Government policies), Factor 3 (ISO certifications), Factor 4 (Pressures from consumers) and Factor 8 (Support from top management) have strong driving power but low dependence over other factors which are called the Independent factors. These are in Cluster D.

4.12 Validation of the Structural Model for CSFs of ESSCM

For the validation of the interpreted links of the critical success factors, Table 4.9 has been prepared. Opinion has been collected from ten experts with numbering options ranging from 1 to 5. 5 being most relevant and number 1 being the least. Then the average score was calculated. The links with an average score of three (60 percent) or above remained in the final structural model of the critical success factors to ESSCM in the Garment industry of Bangladesh.

From table 4.9, it is found that, according to the academic expert’s opinion, all the links of the initial framework except F3-F2 and F4-F10 are valid as per the selection and rejection criteria. Thus, the initial total interpretive structural model of the critical success factors of the ESSCM has been modified, and the final total interpretive structural model of the critical success factors is presented in Figure 4.4.

Table 4.9: Validation of the structural framework for factors of ESSCM

Sl. N0	Factors No.	Paired Comparison of factors	Average Score from Experts	Accept/ Reject
1	F1 -F4	Government policies will enhance or influence Pressures from consumers by restricting import or manufacturing.	3.50	Accepted
2	F1 -F8	Government policies will enhance or influence Support from top management by creating Pressure to change toward ESSCM	3.80	Accepted
3	F3 -F2	ISO certifications will enhance or influence Technological capabilities	2.70	Rejected
4	F3 -F5	ISO certifications will enhance or influence Supply chain integration by Influencing sourcing decisions	3.00	Accepted
5	F3 -F6	ISO certifications will enhance or influence Eco design of products to get certification	3.80	Accepted
6	F3 -F10	ISO certifications will enhance or influence training and skill development	3.20	Accepted
7	F4 -F5	Pressures from consumers will enhance or influence supply chain integration	3.20	Accepted
8	F4 -F6	Pressures from consumers will enhance or influence eco design of products	3.50	Accepted
9	F4 -F10	Pressures from consumers will enhance or influence training and skill development	2.70	Rejected
10	F5 -F7	Supply chain integration will enhance or influence reverse logistic practices	4.00	Accepted
11	F6 -F2	Eco design of products will enhance or influence technological capabilities	3.50	Accepted
12	F6 -F7	Eco design of products will enhance or influence reverse logistic practices	3.80	Accepted
13	F6 -F9	Eco design of products will enhance or influence the alignment of company strategy with purchasing strategy	3.30	Accepted
14	F6 -F10	Eco design of products will enhance or influence training and skill development	3.00	Accepted
15	F7 -F2	Reverse logistic practices will enhance or influence technological capabilities	3.00	Accepted
16	F7 -F5	Reverse logistic practices will enhance or influence Supply chain integration	3.20	Accepted
17	F8 -F3	Support from top management will enhance or influence ISO certifications	4.10	Accepted
18	F8 -F6	Support from top management will enhance or influence Eco design of products	3.90	Accepted
19	F8 -F9	Support from top management will enhance or influence the alignment of company strategy with purchasing strategy	3.80	Accepted

Sl. N0	Factors No.	Paired Comparison of factors	Average Score from Experts	Accept/ Reject
20	F8 -F10	Support from top management will enhance or influence training and skill development	4.40	Accepted
21	F9 -F5	Alignment of company strategy with purchasing strategy will enhance or influence supply chain integration	3.50	Accepted
22	F9 -F7	Alignment of company strategy with purchasing strategy will enhance or influence Reverse logistic practices	3.20	Accepted
23	F10 -F2	Training and skill development will enhance or influence technological capabilities	3.80	Accepted
24	F10 -F7	Training and skill development will enhance or influence reverse logistic practices	3.00	Accepted

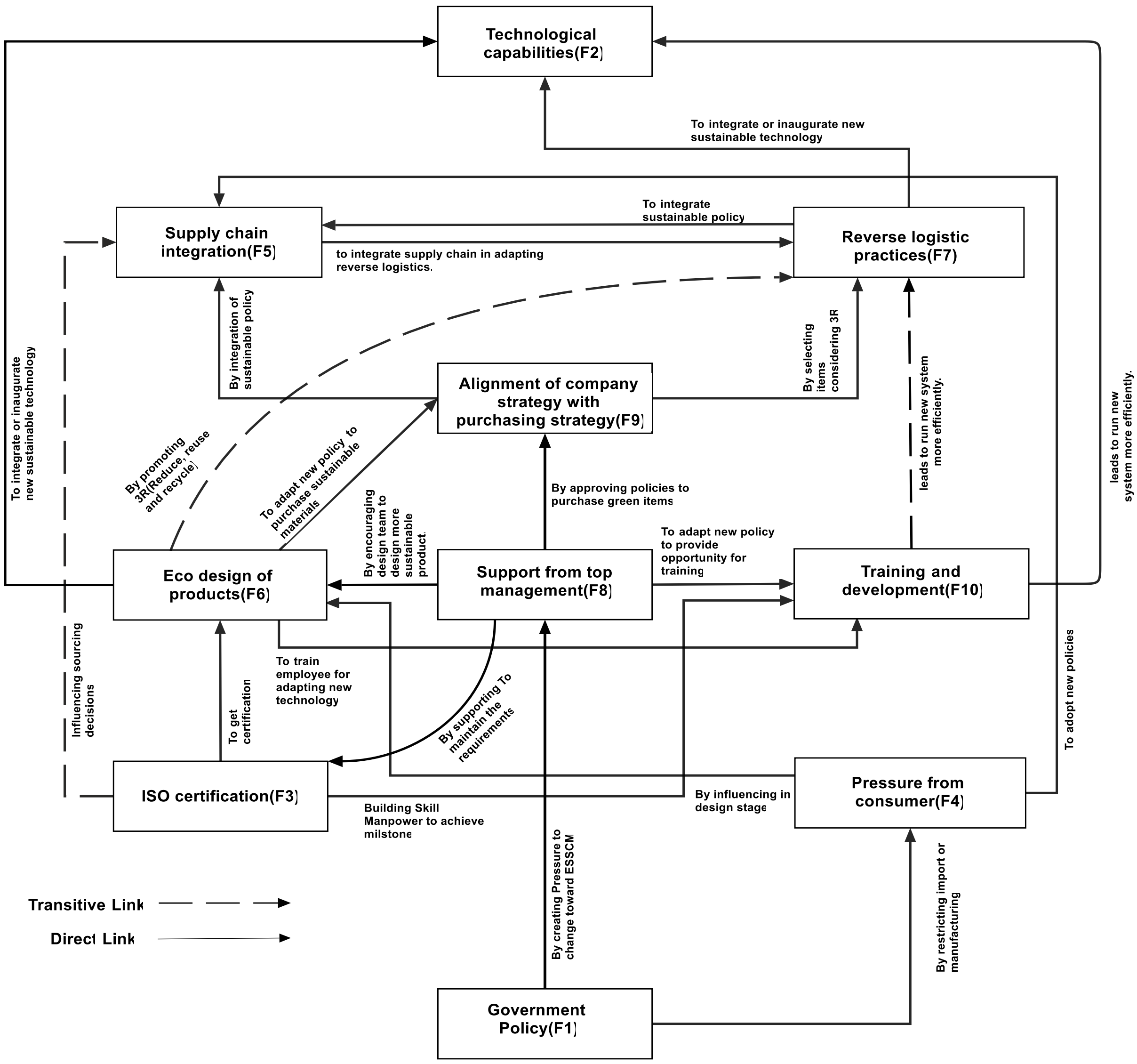

Fig. 4.4: Final TISM based model of critical success factors.

4.12 Discussion of Findings

The final model of CSFs obtained from our TISM-based analysis provides important insights by quantifying the levels of CSFs, and then prioritizing them accordingly. More specifically, we established that "Effective government policies" (F1), "ISO certification" (F3), and "Pressure from consumer" (F4) provide the basic grounding of the model. Sustainable practices in an organization will be enabled automatically if the government is stringent enough about its strategy for sustainable policymaking. To this end, the Bangladeshi government is now adopting a diverse set of regulatory instruments to foster partnerships with the industries regarding sustainability issues, which will ultimately help those industries meet the standards of ESSCM. At the same time, constant pressure from the consumer also plays a significant role in inducing organizations to embrace ESSCM. Both primary and secondary stakeholders of the RMG industry are now demanding sustainable innovations and operations throughout the organizations in question. Interestingly, our study establishes a direct linkage between government policies and consumer pressure, indicating that attaining sustainability in the supply chain will serve the requirements of government agencies along with those of mainstream customers.

Meanwhile, we found that "Technological capabilities" (F2) is the most dependent CSF in the derived model. It is directly interlinked with "Eco-design of products" (F6), "Training and development" (F10), and "Reverse logistics process" (F7). These three CSFs are interlinked, in turn, with the other CSFs either directly or through transitive links. Hence, it can be said that "Technological capabilities" (F2) is dependent on most of the other CSFs directly or indirectly. However, since it does not possess any driving capability, it has no influence on the other CSFs.

Our research also shows that intermediate factors like "Alignment of company strategy with purchasing strategy" (F9), "Supply chain integration" (F5), and "Support from top management" (F8) have an indirect linkage to the most dependent factor, "Technological capabilities" (F2). The final model indicates, too, that "Company strategy with purchasing strategy" (F9) is directly correlated with "Supply chain integration" (F5). Therefore, it is evident that the consolidation of the different constituents of a supply chain is possible if there is an alignment between the overall goal of the company and its purchasing decisions. Planning departments of firms should thus try to develop an effective purchasing plan that can achieve environmental sustainability without compromising coordination among the members of the overall network. By the same token, constituents of the network should also promote sustainable practices in their shop-floor activities, so as to facilitate environment-friendly operations throughout the organization. That said, however, without the active participation of the top management, it is difficult for an organization to attain ESSCM. Support from the top management may be considered as a strategic strength of any organization seeking to integrate sustainability into all units of the supply chain, with a view to meeting customers' demands for broader environmental improvement.

As previously noted, we used MICMAC analysis in this research to categorize and cluster the identified CSFs into four categories relative to their driving power and dependency level. The MICMAC analysis revealed that "Eco-design of products" (F6) and "Training and skill development" (F10) are unpredictable due to their high influence level and also the high levels of interdependency among them. "Effective government policies" (F1), "ISO certifications" (F3), "Support from top management" (F8), and "Pressure from consumers" (F4), however, fall into cluster D, with high influencing power but low dependence. The CSFs in this cluster can be considered as the most vital factors because they provide a basis for quantifying the contribution levels of all the other dependent factors examined in this study. We also found that cluster A doesn't contain any factors, meaning that all the factors that we did include are important, either impacting on or impacted by other factors.

4.13 Comparison of the Study Findings with Existing Literature

The final conclusions of this article depart from some of those advanced in previous studies. For example, our study finds that sustainable practices are mainly initiated via the rules and regulations of government agencies. In prior studies, however, "customer pressures" and "organizations' support" have been found to provide the foundational level of CSFs (Moktadir et al., 2019; Zhang et al., 2020). Moreover, we found "Technological capabilities" to be the least influential and most dependent CSF, whereas in previous research on the textile and electronics industries, "Environment-friendly product" has been categorized as the least influential factor (Subramaniya et al., 2017; Manjunatheshwara & Vinodh, 2017).

This variability of results can be interpreted in two ways. In the first place, the assessment of which CSFs play the most significant role in achieving ESSCM is dependent on the type of industry involved. For instance, for the electronics industry, the biggest challenge to practicing sustainability is the need to create energy-efficient products at a low cost, a requirement that can be achieved through technological innovations (Chatterjee et al., 2018). Thus, technological capabilities are often viewed as the driving factor vis-à-vis the electronics industry's efforts to bring out eco-friendly products, a finding that contrasts with the results of this study. Secondly, the demographic pattern of a country may also have an impact on the relative dependency levels of the CSFs. Population growth and distribution characteristics can shape the attitudes of a country's citizens with respect to sustainability, and these attitudes ultimately make a difference in sustainable infrastructure development (Hermawan et al., 2015). People from an overpopulated country like Bangladesh are often not aware of the importance of sustainable manufacturing practices. In these circumstances, sustainability engagement needs to be legally mandated by the government. Industry managers of the RMG industry in Bangladesh, for example, will adopt sustainable technologies based if the government requires that they design and manufacture environment-friendly products. Therefore, "Effective government policies" is discovered as the most significant influencer, whereas "Technological capabilities," rather than "Eco-friendly products," is the most influenced factor.

CHAPTER 5
CONCLUSION, MANAGERIAL IMPLICATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

The summary of the research conducted, findings, and the managerial implications are briefly presented in this chapter. Recommendations for future research are also presented.

5.1 Conclusion

Bangladesh is now entering into developing country from the LDC (least developed country). This has been achieved through rapid industrialization. Among all the sectors, the garment is played the prime mover roll. However, this rapid growth also brought huge environmental pollution. Hence, it is high time to control it. In this perspective, TISM is found one of the most effective tools to develop a structural framework to implement environmental sustainability throughout the supply chain. Hence, this thesis aimed to develop structural frameworks of critical success factors to ESSCM in the garment industry of Bangladesh. The contribution of this research is actually to find out the CSFs to ESSCM, and also evaluate the structural frameworks of CSFs to ESSCM in the garment industry. The identification of critical success factors was done from a review of relevant literature and consultation with the industry experts.

Government policies, Pressures from consumers, Technological capabilities, ISO certifications, Supply chain integration, Eco design of products, Reverse logistic practices, Support from top management, Alignment of company strategy with purchasing strategy, and Training and Skill Development were found as the significant critical success factors of ESSCM in the Garment Industries of Bangladesh.

Using the TISM qualitative tool, a structural framework of the critical success factors has been developed. It also shows that CSFs have influenced each other. The driving power and the dependence of all critical success factors were identified and subsequently categorized into four clusters with the help of MICMAC analysis.

After doing MICMAC analysis and analyzing the structural framework of critical success factors, Eco design of products (factor 6) and Training and Skill Development (factor 10) were found as unpredictable in nature because these have high driving power as well as high dependence. Factor 1 (Government policies), factor 3 (ISO certifications), Support from top management (factor 8), and Factor 4 (Pressures from consumers) are in cluster D which are vital factors having high driving power but low dependence on which management of any garment industries of Bangladesh need to focus on for the long-run benefits in the successful implementation of ESSCM. There are no factors in cluster A which means that all factors are Important and closely impacted by other factors.

5.2 Managerial Implications

This research has intended to bring out the most important critical success factors in the Garment industry for the top management so that they can achieve and sustain the environmental stationarity in the supply chain. The probability of successful implementation of ESSCM in the garment industry will be greatly increased by focusing on the resulting interrelationship between critical success factors. Total sectoral improvement can be possible by concentrating on the developed framework of CSFs in the garment industry.

Top management can get more effective information by analyzing the direct links and the transitive links between the critical success factors. Also understanding the interconnectivity among themselves as well as how their dependences, can be used in management's advantage. In the real-world there exist many numerous complex tools to extract such information from the same data which may seem very tough to understand and implement for the managerial authorities. Complex information can be interpreted simply by the constructed framework and the interpretation of the links of the TISM model, which can be anticipated by anyone with minimum effort. Top management can use this methodology for creating interrelationship of any newly identified critical success factors in the future as well as to identify the driving power and dependence of the factor in the new framework.

5.3 Recommendations for Future Research

TISM technique has been used to construct the represented framework for the critical success factors identified. To check the validity of the TISM Model some other tools such as fuzzy TISM can be used to conduct the same research. For the validation of the proposed theoretical model here, Structural Equation Modelling (SEM) technique can be used. In this research, initially, fourteen critical success factors were taken, and then it was reduced to the most crucial ten according to the industry expert's opinion. More factors may have been included in future studies for conducting this experiment. In this research, the MICMAC analysis tool has been used to identify the driving power and the dependency of the factors. Similar research work can be conducted in the future by using another analysis tool such as Fuzzy MICMAC. This research has been focused on the garment industry of Bangladesh. Similar research methodologies are also applicable to any other industry that want to identify critical success factors to implement ESSCM in that sector. Initially, data has been collected from experts of four case study factories and from some organizations that are working with green industry development. For conducting the experiment in future research, more factories and experts can be included.

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APPENDIX

Appendix 1: Questionnaire.

Designation:

Company:

Years of Experience:

Keywords: ESSCM (Environmentally Sustainable Supply Chain Management.

We are trying to identify the Critical Success factors of Environmental sustainability of supply chain management in Bangladeshi RMG factories.

[Just click on the scores and save it. Then please send it back]

S.NO	Name of potential success factors	Do you think, this factor Influence or Enhance ESSCM as critical success factors?		IF yes, how much would you score this factor as a Critical success factors of ESSCM?				
		Yes	No	1	2	3	4	5
1	Government policies							
2	Technological capabilities							
3	ISO certifications							
4	Supply chain integration							
5	Pressures from consumers							
6	Customer and supplier relationships							
7	General awareness in public							
8	Eco design of products							
9	Reverse logistic practices							
10	Alignment of company strategy with purchasing strategy							
11	Support from top management							
12	Corporate social responsibility							
13	Use of information Technology							
14	Training and Skill Development							

**** Please suggest any other factor if you think that Influence or Enhance ESSCM as critical success factors.

Appendix 2: Industry Experts

Organization Name	Location	Experts	Affiliation
A.R Jeans	Asulia	Expert 1	Sr. Manager, Operations
Plummy Fashions Ltd.	Narayangonj	Expert 2	Manager, Industrial and production Engineering.
Evitex Apparels Ltd.	Gazipur	Expert 3	GM, Operations
BD Technology Ltd	Dhaka	Expert 4	Architect, Green Industry Department.
BKMEA	Dhaka	Expert 5	Asst. Deputy Secretary, Green Industry Development cell.
BKMEA	Dhaka	Expert 6	Deputy Secretary, PIC
Bay Creation Ltd.	Vulta, Narayangonj	Expert 7	General Manager, Operations
RBC	Dhaka	Expert 8	National Consultant
AKH ECO	Dhaka	Expert 9	Manager, Operation
AKH ECO	Dhaka	Expert 10	Sr. Manager, Supply chain.
Tarasima Apparels Ltd	Manikgonj	Expert 11	GM, Quality Assurance
Tarasima Apparels Ltd	Manikgonj	Expert 12	Unit Head, Production.

Appendix 3: The score and selection of the factors:

S.NO	Expert marking / Critical Factors	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	Expert 11	Expert 12	Mean	Std. dev	Response %	Selected / Not selected as relevant Critical success factor
1	Government policies	5	5	5	5	5	5	5	5	3	5	5	4	4.8	0.622	95%	Selected
2	Technological capabilities	5	4	3	3	4	3	5	3	4	4	4	3	3.8	0.754	75%	Selected
3	ISO certifications	4	4	3	4	4	3	4	4	3	4	4	5	3.8	0.577	77%	Selected
4	Supply chain integration	4	5	3	3	5	3	3	4	5	5	3	3	3.8	0.937	77%	Selected
5	Pressures from consumers	3	5	3	4	5	3	3	4	2	5	5	3	3.8	1.055	75%	Selected
6	Customer and supplier relationships	2	4	0	1	4	0	2	1	3	4	3	4	2.3	1.557	47%	Not Selected
7	General awareness in public	2	3	3	3	3	3	3	2	1	3	3	4	2.8	0.754	55%	Not Selected
8	Eco design of products	5	4	3	3	4	3	5	3	3	4	3	5	3.8	0.866	75%	Selected
9	Reverse logistic practices	5	5	3	4	5	3	5	4	1	4	2	4	3.8	1.288	75%	Selected
10	Alignment of company strategy with purchasing strategy	5	4	4	3	4	4	5	3	4	3	3	4	3.8	0.718	77%	Selected
11	Support from top management	4	5	5	3	5	5	4	3	4	3	4		4.1	0.831	82%	Selected
12	Corporate social responsibility	2	3	1	3	1	3	3	2	3	3	4	3	2.6	0.900	52%	Not Selected
13	Use of information Technology	3	3	2	3	3	2	3	3	3	3	4	3	2.9	0.515	58%	Not Selected
14	Training and Skill Development	5	4	3	3	4	5	3	3	4	5	4	4	3.9	0.793	78%	Selected

Appendix 4: Pairwise comparison database for factors

S.NO	Factors No.	Paired Comparison of factors	Yes/No	If yes, then in what way one factor enhance or influence other.
1	F1 -F2	Government policies will enhance or influence Technological capabilities	Yes	Offer Incentive or By Legal Action.
2	F1 -F3	Government policies will enhance or influence ISO certifications	No	
3	F1 -F4	Government policies will enhance or influence Pressures from consumers	Yes	By restricting import or manufacturing
4	F1 -F5	Government policies will enhance or influence Supply chain integration	Yes	Implementing regulation
5	F1 -F6	Government policies will enhance or influence Eco design of products	Yes	Providing award and incentive.
6	F1 -F7	Government policies will enhance or influence Reverse logistic practices	No	
7	F1 -F8	Government policies will enhance or influence Support from top management	Yes	Pressure to change toward ESSCM
8	F1 -F9	Government policies will enhance or influence Alignment of company strategy with purchasing strategy	Yes	By tax rebate
9	F1 -F10	Government policies will enhance or influence Training and Skill Development	No	
10	F2 -F1	Technological capabilities will enhance or influence Government policies	No	
11	F2 -F3	Technological capabilities will enhance or influence ISO certifications	No	
12	F2 -F4	Technological capabilities will enhance or influence Pressures from consumers	No	

S.N0	Factors No.	Paired Comparison of factors	Yes/No	If yes, then in what way one factor enhance or influence other.
13	F2 -F5	Technological capabilities will enhance or influence Supply chain integration	No	
14	F2 -F6	Technological capabilities will enhance or influence Eco design of products	No	
15	F2 -F7	Technological capabilities will enhance or influence Reverse logistic practices	No	
16	F2 -F8	Technological capabilities will enhance or influence Support from top management	No	
17	F2 -F9	Technological capabilities will enhance or influence Alignment of company strategy with purchasing strategy	No	
18	F2 -F10	Technological capabilities will enhance or influence Training and Skill Development	No	
19	F3 -F1	ISO certifications will enhance or influence Government policies	No	
20	F3 -F2	ISO certifications will enhance or influence Technological capabilities	No	
21	F3 -F4	ISO certifications will enhance or influence Pressures from consumers	No	
22	F3 -F5	ISO certifications will enhance or influence Supply chain integration	No	
23	F3 -F6	ISO certifications will enhance or influence Eco design of products	Yes	To get certification
24	F3 -F7	ISO certifications will enhance or influence Reverse logistic practices	No	
25	F3 -F8	ISO certifications will enhance or influence Support from top management	No	
26	F3 -F9	ISO certifications will enhance or influence Alignment of company strategy with purchasing strategy	Yes	By promoting 3r (reduce, reuse and recycle)
27	F3 -F10	ISO certifications will enhance or influence Training and Skill Development	Yes	Building skill manpower
28	F4 -F1	Pressures from consumers will enhance or influence Government policies	No	
29	F4 -F2	Pressures from consumers will enhance or influence Technological capabilities	No	
30	F4 -F3	Pressures from consumers will enhance or influence ISO certifications	No	
31	F4 -F5	Pressures from consumers will enhance or influence Supply chain integration	Yes	To adapt new policies

Sl. N0	Factors No.	Paired Comparison of factors	Yes/No	If yes, then in what way one factor enhance or influence other.
32	F4 -F6	Pressures from consumers will enhance or influence Eco design of products	Yes	By influencing in design stage
33	F4 -F7	Pressures from consumers will enhance or influence Reverse logistic practices	No	
34	F4 -F8	Pressures from consumers will enhance or influence Support from top management	No	
35	F4 -F9	Pressures from consumers will enhance or influence Alignment of company strategy with purchasing strategy	Yes	By influencing in supplier selection
36	F4 -F10	Pressures from consumers will enhance or influence Training and Skill Development	No	
37	F5 -F1	Supply chain integration will enhance or influence Government policies	No	
38	F5 -F2	Supply chain integration will enhance or influence Technological capabilities	No	
39	F5 -F3	Supply chain integration will enhance or influence ISO certifications	No	
40	F5 -F4	Supply chain integration will enhance or influence Pressures from consumers	No	
41	F5 -F6	Supply chain integration will enhance or influence Eco design of products	No	
42	F5 -F7	Supply chain integration will enhance or influence Reverse logistic practices	Yes	To integrate supply chain in adapting reverse logistics.
43	F5 -F8	Supply chain integration will enhance or influence Support from top management	No	
44	F5 -F9	Supply chain integration will enhance or influence Alignment of company strategy with purchasing strategy	No	
45	F5 -F10	Supply chain integration will enhance or influence Training and Skill Development	No	
46	F6 -F1	Eco design of products will enhance or influence Government policies	No	
47	F6 -F2	Eco design of products will enhance or influence Technological capabilities	Yes	To integrate or inaugurate New sustainable technology
48	F6 -F3	Eco design of products will enhance or influence ISO certifications	No	
49	F6 -F4	Eco design of products will enhance or influence Pressures from consumers	No	

S.N0	Factors No.	Paired Comparison of factors	Yes/No	If yes, then in what way one factor enhance or influence other.
50	F6 -F5	Eco design of products will enhance or influence Supply chain integration	No	
51	F6 -F7	Eco design of products will enhance or influence Reverse logistic practices	No	
52	F6 -F8	Eco design of products will enhance or influence Support from top management	No	
53	F6 -F9	Eco design of products will enhance or influence Alignment of company strategy with purchasing strategy	Yes	To adapt new policy to purchase sustainable materials
54	F6 -F10	Eco design of products will enhance or influence Training and Skill Development	Yes	To train employee for adapting new technology
55	F7 -F1	Reverse logistic practices will enhance or influence Government policies	No	
56	F7 -F2	Reverse logistic practices will enhance or influence Technological capabilities	Yes	To integrate or inaugurated new sustainable technology
57	F7 -F3	Reverse logistic practices will enhance or influence ISO certifications	No	
58	F7 -F4	Reverse logistic practices will enhance or influence Pressures from consumers	No	
59	F7 -F5	Reverse logistic practices will enhance or influence Supply chain integration	Yes	To integrate sustainable policy
60	F7 -F6	Reverse logistic practices will enhance or influence Eco design of products	No	
61	F7 -F8	Reverse logistic practices will enhance or influence Support from top management	No	
62	F7 -F9	Reverse logistic practices will enhance or influence Alignment of company strategy with purchasing strategy	No	
63	F7 -F10	Reverse logistic practices will enhance or influence Training and Skill Development	No	
64	F8 -F1	Support from top management will enhance or influence Government policies	No	
65	F8 -F2	Support from top management will enhance or influence Technological capabilities	Yes	To integrate or inaugurated new sustainable technology
66	F8 -F3	Support from top management will enhance or influence ISO certifications	Yes	By supporting to maintain the requirements.

S.N0	Factors No.	Paired Comparison of factors	Yes/No	If yes, then in what way one factor enhance or influence other.
67	F8 -F4	Support from top management will enhance or influence Pressures from consumers	No	
68	F8 -F5	Support from top management will enhance or influence Supply chain integration	Yes	By integration of sustainable policy
69	F8 -F6	Support from top management will enhance or influence Eco design of products	Yes	By encouraging design team to design more sustainable product.
70	F8 -F7	Support from top management will enhance or influence Reverse logistic practices	Yes	Encouraging revers logistic practice
71	F8 -F9	Support from top management will enhance or influence Alignment of company strategy with purchasing strategy	Yes	By approving policies to purchase green items
72	F8 -F10	Support from top management will enhance or influence Training and Skill Development	Yes	To adapt new policy to provide opportunity for training
73	F9 -F1	Alignment of company strategy with purchasing strategy will enhance or influence Government policies	No	
74	F9 -F2	Alignment of company strategy with purchasing strategy will enhance or influence Technological capabilities	No	
75	F9 -F3	Alignment of company strategy with purchasing strategy will enhance or influence ISO certifications	No	
76	F9 -F4	Alignment of company strategy with purchasing strategy will enhance or influence Pressures from consumers	No	
77	F9 -F5	Alignment of company strategy with purchasing strategy will enhance or influence Supply chain integration	Yes	By integration of sustainable policy
78	F9 -F6	Alignment of company strategy with purchasing strategy will enhance or influence Eco design of products	No	
79	F9 -F7	Alignment of company strategy with purchasing strategy will enhance or influence Reverse logistic practices	Yes	By selecting items considering 3R

S.N0	Factors No.	Paired Comparison of factors	Yes/No	If yes, then in what way one factor enhance or influence other.
80	F9 -F8	Alignment of company strategy with purchasing strategy will enhance or influence Support from top management	No	
81	F9 -F10	Alignment of company strategy with purchasing strategy will enhance or influence Training and Skill Development	No	
82	F10 -F1	Training and Skill Development will enhance or influence Government policies	No	
83	F10 -F2	Training and Skill Development will enhance or influence Technological capabilities	Yes	Training leads to run new system more efficiently.
84	F10 -F3	Training and Skill Development will enhance or influence ISO certifications	No	
85	F10 -F4	Training and Skill Development will enhance or influence Pressures from consumers	No	
86	F10 -F5	Training and Skill Development will enhance or influence Supply chain integration	No	
87	F10 -F6	Training and Skill Development will enhance or influence Eco design of products	No	
88	F10 -F7	Training and Skill Development will enhance or influence Reverse logistic practices	No	
89	F10 -F8	Training and Skill Development will enhance or influence Support from top management	Yes	By creating awareness
90	F10 -F9	Training and Skill Development will enhance or influence Alignment of company strategy with purchasing strategy	yes	By creating awareness to purchase right items.

Appendix 5: Questionnaire set for the validation of Initial TISM

Sl. N0	Factors No.	Paired Comparison of factors	How much would you score between 1 to 5 (5 being the highest)
1	F1 -F4	Government policies will enhance or influence Pressures from consumers by restricting import or manufacturing.	
2	F1 -F8	Government policies will enhance or influence Support from top management by creating Pressure to change toward ESSCM	
3	F3 -F2	ISO certifications will enhance or influence Technological capabilities	
4	F3 -F5	ISO certifications will enhance or influence Supply chain integration by Influencing sourcing decisions	
5	F3 -F6	ISO certifications will enhance or influence Eco design of products to get certification	
6	F3 -F10	ISO certifications will enhance or influence Training and Skill Development	
7	F7-F5	Reverse logistic practices will enhance or influence Supply chain integration	
8	F4 -F5	Pressures from consumers will enhance or influence Supply chain integration	
9	F4 -F6	Pressures from consumers will enhance or influence Eco design of products	
10	F4 -F10	Pressures from consumers will enhance or influence Training and Skill Development	
11	F5 -F7	Supply chain integration will enhance or influence Reverse logistic practices	
12	F6 -F2	Eco design of products will enhance or influence Technological capabilities	
13	F6 -F7	Eco design of products will enhance or influence Reverse logistic practices	
14	F6 -F9	Eco design of products will enhance or influence Alignment of company strategy with purchasing strategy	
15	F6 -F10	Eco design of products will enhance or influence Training and Skill Development	
16	F7 -F2	Reverse logistic practices will enhance or influence Technological capabilities	
17	F8 -F3	Support from top management will enhance or influence ISO certifications	
18	F8 -F6	Support from top management will enhance or influence Eco design of products	
19	F8 -F9	Support from top management will enhance or influence Alignment of company strategy with purchasing strategy	

Sl. N0	Factors No.	Paired Comparison of factors	How much would you score between 1 to 5
20	F8 -F10	Support from top management will enhance or influence Training and Skill Development	
21	F9 -F5	Alignment of company strategy with purchasing strategy will enhance or influence Supply chain integration	
22	F9 -F7	Alignment of company strategy with purchasing strategy will enhance or influence Reverse logistic practices	
23	F10 -F2	Training and Skill Development will enhance or influence Technological capabilities	
24	F10 -F7	Training and Skill Development will enhance or influence Reverse logistic practices	

Appendix 6: Academic Experts

Name	Affiliation	Organization
Expert 1	Professor, Industrial & Production Engineering Department	Shahjalal University of Science and technology
Expert 2	Assistant Professor, Industrial & Production Engineering Department	Jessore University of Science and Technology
Expert 3	Professor, Industrial & Production Engineering Department	Shahjalal University of Science and technology
Expert 4	Lecturer, Leather Products Engineering	University of Dhaka.
Expert 5	Associate Professor, Industrial & Production Engineering Department	Bangladesh University of Engineering & Technology
Expert 6	Assistant Professor, Industrial & Production Engineering Department	Shahjalal University of Science and technology
Expert 7	Assistant Professor, Industrial Engineering and Management	Khulna University of Engineering & Technology
Expert 8	Assistant Professor, Industrial & Production Engineering Department	Shahjalal University of Science and technology
Expert 9	Assistant Professor, Industrial & Production Engineering Department	Jessore University of Science and Technology
Expert 10	Assistant Professor, Industrial & Production Engineering Department	Shahjalal University of Science and technology

Appendix 7: The score of Validation of the initial structural framework for the factors.

Paired Comparison of factors	EX-1	EX-2	EX-3	EX-4	EX-5	EX-6	EX-7	EX-8	EX-9	EX-10	Avg. Score from Experts
Government policies will enhance or influence Pressures from consumers by restricting import or manufacturing.	4	4	3	3	4	4	4	3	2	4	3.50
Government policies will enhance or influence Support from top management by creating Pressure to change toward ESSCM	3	5	4	5	4	3	3	3	5	3	3.80
ISO certifications will enhance or influence Technological capabilities	3	3	3	3	3	3	2	3	3	1	2.70
ISO certifications will enhance or influence Supply chain integration by Influencing sourcing decisions	4	3	3	2	3	4	4	3	3	1	3.00
ISO certifications will enhance or influence Eco design of products to get certification	4	4	5	4	2	5	5	4	4	1	3.80
ISO certifications will enhance or influence Training and Skill Development	3	3	4	4	3	4	4	3	2	2	3.20
Reverse logistic practices will enhance or influence Supply chain integration	1	3	4	3	3	4	4	3	5	2	3.20
Pressures from consumers will enhance or influence Supply chain integration	4	4	2	3	2	4	3	3	4	3	3.20
Pressures from consumers will enhance or influence Eco design of products	4	3	4	4	2	4	4	4	3	3	3.50
Pressures from consumers will enhance or influence Training and Skill Development	3	3	3	2	2	3	3	3	3	2	2.70
Supply chain integration will enhance or influence Reverse logistic practices	5	4	4	4	3	4	4	4	4	4	4.00
Eco design of products will enhance or influence Technological capabilities	4	4	2	4	4	5	2	2	4	4	3.50
Eco design of products will enhance or influence Reverse logistic practices	4	4	4	4	3	5	3	3	4	4	3.80

Paired Comparison of factors	EX-1	EX-2	EX-3	EX-4	EX-5	EX-6	EX-7	EX-8	EX-9	EX-10	Avg. Score from Experts
Eco design of products will enhance or influence Alignment of company strategy with purchasing strategy	4	4	4	3	3	4	2	3	3	3	3.30
Eco design of products will enhance or influence Training and Skill Development	2	3	3	2	3	4	2	3	4	4	3.00
Reverse logistic practices will enhance or influence Technological capabilities	4	3	2	4	2	4	1	3	3	4	3.00
Support from top management will enhance or influence ISO certifications	5	5	4	5	2	4	4	4	4	4	4.10
Support from top management will enhance or influence Eco design of products	5	5	5	4	2	5	2	3	4	4	3.90
Support from top management will enhance or influence Alignment of company strategy with purchasing strategy	5	5	4	5	2	4	3	3	3	4	3.80
Support from top management will enhance or influence Training and Skill Development	5	5	5	5	4	4	3	4	5	4	4.40
Alignment of company strategy with purchasing strategy will enhance or influence Supply chain integration	4	3	5	4	3	3	3	3	4	3	3.50
Alignment of company strategy with purchasing strategy will enhance or influence Reverse logistic practices	4	3	4	3	3	4	2	3	3	3	3.20
Training and Skill Development will enhance or influence Technological capabilities	5	5	4	3	3	3	4	4	4	3	3.80
Training and Skill Development will enhance or influence Reverse logistic practices	3	3	3	3	2	3	3	4	3	3	3.00