

An Investigation on Green Supply Chain Management in the Construction Sector within Maharashtra

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Abstract - Aim of doing this project stems from the belief that there is an urgent need to introduce environmental thinking into supply chain management. The supply chain consists of those motions associated with manufacturing from raw material obtainment to final product delivery. Under the scenery of globalization, Green supply chain management (GSCM) is identified as direct and effective mechanism to address environmental problems along the global value chain, But there are many drivers as well as barriers' which affects directly and indirectly in the implementation of this in an organization. GSCM not only advances environmental performance but also helps reduce cost improves efficiency and speeds up innovation. The aim of this paper is to briefly review the recent literatures on GSCM and study the drivers and challenges that the construction sector in India is experiencing for its implementation. Innovative sustainable ideas can help organizations become profitable while helping the environment and simultaneously establish long-term buyer-supplier relationships.

Key Words: Green supply chain management (GSCM), construction, significance, environmental performance, drivers and challenges

1. INTRODUCTION

Environmental management is becoming a key strategic issue for organizational performance as companies increasingly realize their environmental responsibilities. Environmental issues across the world ranging from extreme weather to scarcity of water have affected 40% of world's population for several decades. Construction has been described as a major exploiter of natural resources both physical and biological (Spence and Mulligan, 1995).

Aside from nations actively participating in reducing climate change, many consumers, shareholders and businesses are becoming more attuned to and involved in

growing green movement. With customer integrity shifting towards environmental friendly products, businesses are increasingly trying to make their supply chains greener by introducing sustainability strategies throughout their organizations and supplier relationships. "The focus on sustainability has resulted in a growing need for integrating environmentally sound choices into supply chain management research and practice. The trend towards developing green supply chain is now gaining popularity among different industries." (Reshma and Mittapalli, 2016)

GSCM integrates environmental thinking into supply chain management (SCM). SCM was born in the manufacturing industry in the 1990's with the Just In Time (JIT) delivery system implemented in Toyota (Vrijhoef and Koskela, 1999), with the main aim of reducing inventories and regulating suppliers interaction with the production line. GSCM integrates green practices such as green design, green purchasing, green manufacturing, green transportation, recycling and reverse logistics (Srivastava, 2007). These practices are combined with the three dimensions of GSCM, which are environmental performance, economic performance and operational performance.

The current study is significant to identify the various drivers and barriers faced by the Indian sector in implementing GSCM as well as to assess the significance of environmental impacts and develop a structural model.

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2. LITERATURE REVIEW

Analytical review of articles was carried out. The objective of the review was to identify the importance of GSCM, and various factors that act as barriers and drivers in implementing it.

GSCM is related with any attempt of improving the environmental performance of the purchased products/services or the suppliers that provide them (Bowen et al., 2001a). The main aims of GSCM are to identify benefits, costs and risks associated with environmental performance (Hanfield et al., 2005). Internal environmental management is the practice of developing green supply chain management as a strategic organizational imperative through commitment and support from senior and mid-level managers (Zhu et al., 2008). Environmental impacts occur across all stages of a product's life cycle, from the raw material extraction, to manufacturing, use and reuse, final recycling, or disposal, namely from cradle to grave (Zhu and Sarkis, 2006).

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 GSCM (Alkhidir&Zailani, 2009). Lack of resources is probably the most important barrier identified because the sources needed have to compete with other company's priorities (Stoesser, 1997). Finally, lack of markets for recyclable materials can become a barrier for companies trying to implement product-based strategies (Rao, 2005). In today's scenario market uncertainty is very high due to global competitiveness and customers' requirements (Yu Lin, 2007). Top-management commitment needs to understand the value, efforts and support required to implement GSCM strategies successfully (Lippmann, 1999). On the other hand, middle management commitment, knowledge and awareness towards legislation and environmental impacts are a crucial step towards the successful implementation of GSCM strategies (Bowen et al., 2001a).

Lack of appropriate organizational structures and widespread ignorance of supply chain philosophy are also barriers identified for the implementation of GSCM (Akintoye et al., 2000). For Small and medium Enterprises, lack of knowledge about environmental impacts or underestimation of the environmental impacts is usual, one reason is that legal thresholds are usually bigger (Hillary, 2000). Lack of technical knowledge and skills on SMEs are also common. In the absence of other capabilities (such as quality control, inventory control management or pollution prevention) the concepts of continual improvement, lean production practices as well as avoiding the focus on "end of pipe technology" are more difficult to understand and achieve (Darnall and Edwards, 2006).

A major barrier of GSCM seen in industries is lack of awareness of customers about the benefits of green products. Customer demands become most crucial type of external pressure. (Sunil et al, 2011). Suppliers' reluctance to

change towards GSCM is due to traditional mindset and suppliers interests being different from those of total network (Mudgalet al, 2010). Large customers can impose pressures on their suppliers with requirements of better environmental performance. Therefore, companies and enterprises need to cooperate with customers for environmental objectives (Zhu and Geng, 2002). Green purchasing and eco-design focus on the inbound or early stages of a product's supply chain. Investment recovery is considered as a critical aspect for GSCM practices of United States and European (Zsidish and Hendrick, 1998). At the same time, companies have found that implementing green supply chain management results in not only environmental benefits, but can also enhance quality of product, raise productivity, and reduce of risk of supply chain interruption or damage to reputation (Lippmann, 1999).

From above analysis the sharpest factors preventing implementation of GSCM can be concluded as lack of resources, short term planning and lack of markets for recyclable materials, cost and efforts involved, top management commitment, lack of education and lack of support.

3. AIM AND OBJECTIVES

- (1) To study the benefits of implementing the concept of GSCM
- (2) Overcome/Eliminate the obstacles identified by the companies for implementing the concept.

"Studies show that large number of companies realizes the importance of GSCM, but very few of them actually engage into such practices"(Reshma and Mittapalli, 2016).

The objectives of research are aimed to identify factors such as:

- Perceptions on the significance of environmental impacts.
- Identification of barriers and main drivers to implement GSCM practices
- To develop structural model using interpretive structural modelling techniques.

A. Scope of study

The study is carried out in Pune city in the state of Maharashtra and involves the contractors & suppliers point of view.

4. METHODOLOGY

1. Literature Collection: Study of research papers and journals
2. Assimilation of factors (various factors acting as barriers and drivers to implement GSCM).

3. Data Collection: Design of Questions based on research papers reviewed.
4. Conduct questionnaire survey and analyse the results (comparison between contractors and suppliers).
5. Prepare a hypothetical model using Interpretive Structural Modelling technique (Model shows relationship among barriers)
6. Suggest suitable solutions to eliminate or reduce intensity of barriers.

5. GREEN SUPPLY CHAIN MANAGEMENT

The terms green supply chain (GSC) and sustainable supply chains (SSC) have been used interchangeably in literature. Sustainability is about satisfying the needs of the present while guaranteeing future generations the ability to satisfy their own needs. Ninlawan et al. (2010) describe green supply chain management (GSCM) as management effort to eliminate or minimize waste, emissions, energy, hazards, and chemicals along supply chain. The definition of GSCM is still not clear, because the combination of corporate environmental management and supply chain management is a relatively new area of study and practice (Zhu and Sarkis, 2004).



Fig -1 Green supply chain

Green Supply Chain Management (GSCM) is defined as "the process of using environmentally friendly inputs and transforming these inputs into outputs that can be reclaimed and re-used at the end of their lifecycle thus creating a sustainable supply chain."

GSCM focuses on [1] reduction of cost and maximize economic benefits [2] Inclusion of environmental performance [3] low carbon and environment protection. In GSCM product flow is circular and reversible and all products must be managed throughout the entire life cycle and beyond that waste finds a second life or becomes raw material available for new production or other purposes (Reshma and Mittapalli, 2016).

6. DATA ANALYSIS AND RESULTS

This chapter reports the analysis of the questionnaire floated to the companies. Table 1 indicates the various groups responding. Out of a total of 70 questionnaires sent, 17 responded to the questionnaire. In this case, it represents the participation. Rate of response from supplier is very less.

Table -1: Response rate from various groups

Group	Questionnaires sent	Respondents	Response rate (%)
contractors	40	13	33
suppliers	40	5	12.5

6.1 Perceptions on the significance of environmental impacts.

Contractor: Chart 1 shows the point of view of contractors on the significance of environmental impacts of their respective company. The highest score was obtained for waste generation i.e. 75% of the respondents accepted the fact that waste generation should be given significance.

Supplier: Approximately same responses were obtained from the supplier's point of view too. Maximum score was obtained for waste generation and deposits to land.

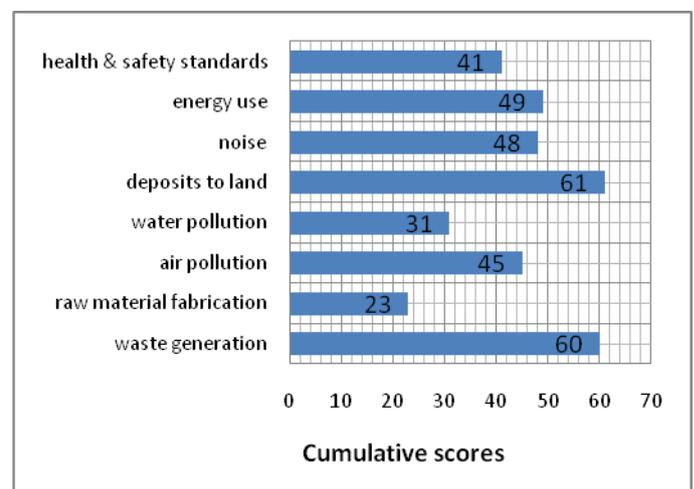


Chart -1: Perceptions on the significance of environmental impacts

6.2 Main barriers in adopting GSCM

Contractor: The various barriers identified in implementing GSCM in construction sector are given in fig 6.3. From the figure it can be concluded that various contractors feel that lack of top management commitment acts as the main barrier followed by lack of government

initiatives, high cost, suppliers reluctance to change whereas no return on investment & too complex to implement scored the lowest.

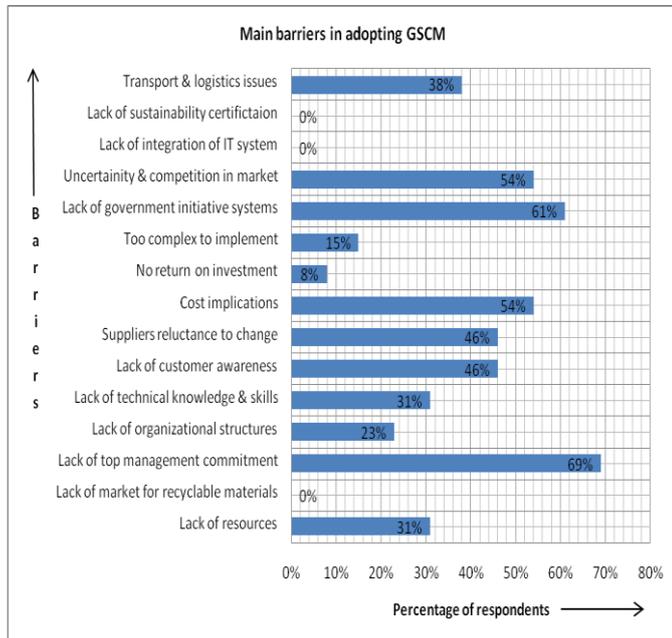


Chart -2: Main barriers in adopting GSCM (Contractors)

Supplier: Since the supplier response rate is very low, the below factors may vary. Unlike above, here the main barriers to implement GSCM are lack of government initiatives, too complex to implement and lack of resources followed by high costs and no returns.

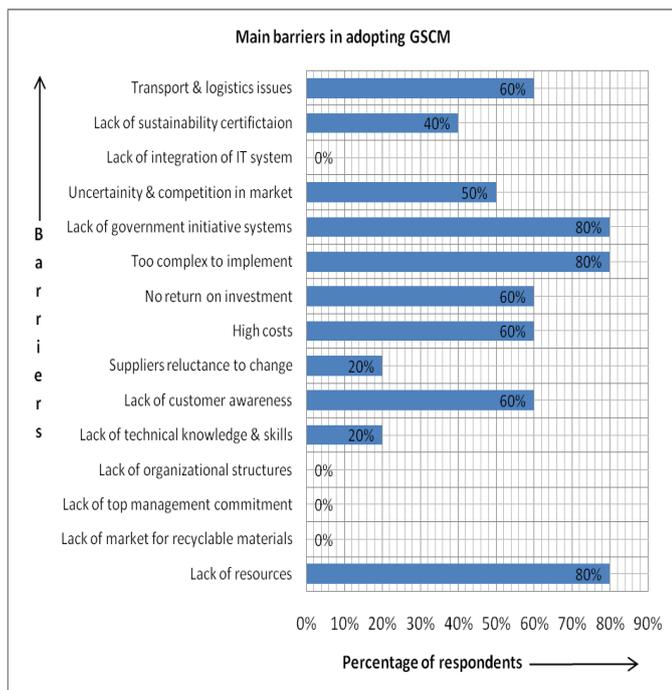


Chart -3: Main barriers in adopting GSCM (Suppliers)

6.3 Main drivers to implement GSCM

Contractor: According to fig 6.4 shown below, it can be summarized that if GSCM is implemented, the maximum benefits it will provide to an organization is improve brand image, long term benefit for sustainable development and contribute to environment protection.

Supplier: Fig 6.5 summarizes that differentiate from competitors, certification of suppliers EMS and improvement in brand image are the positive points if implemented.

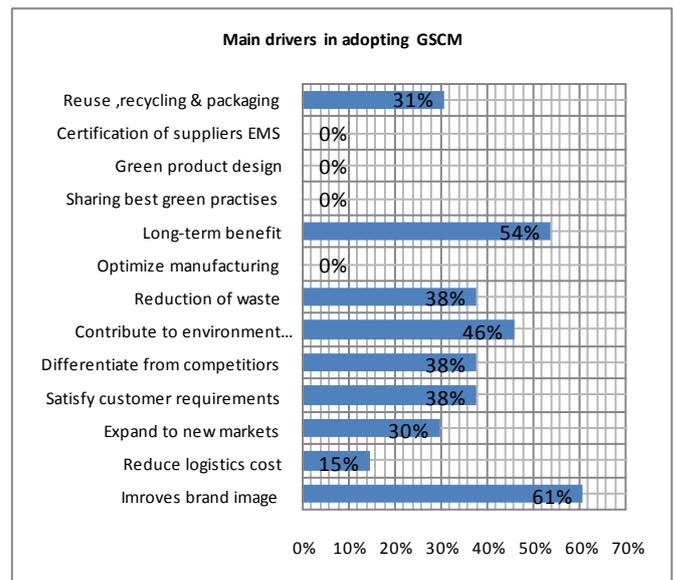


Chart -4: Main drivers in adopting GSCM (Contractors)

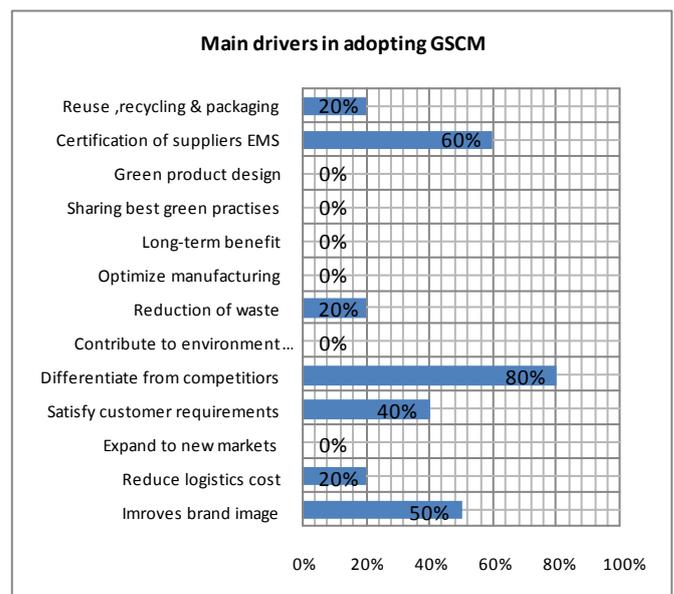


Chart -5: Main drivers in adopting GSCM (Suppliers)

6.4. Suggestions to eliminate or reduce intensity of barriers

1. Indian government should announce extra benefits to the organization following green practices.
2. Government to take initiatives to make green practices compulsory.
3. Government should keep aside certain amount of fund only to implement green practices.
4. Well aware and good quality of human resources to be hired.
5. Regular training programs to create awareness about green which will encourage organizations to help adopt.
6. Special ad-campaigns & welfare programs to promote awareness among customers.
7. Promoting green practices will help expand markets.

6.5 Interpretive structural modelling technique (ISM)

Interpretive structural modeling (ISM) is applied to barriers to implement GSCM in Indian construction industry. It is a method used to identify relationship among specific items which define a problem.

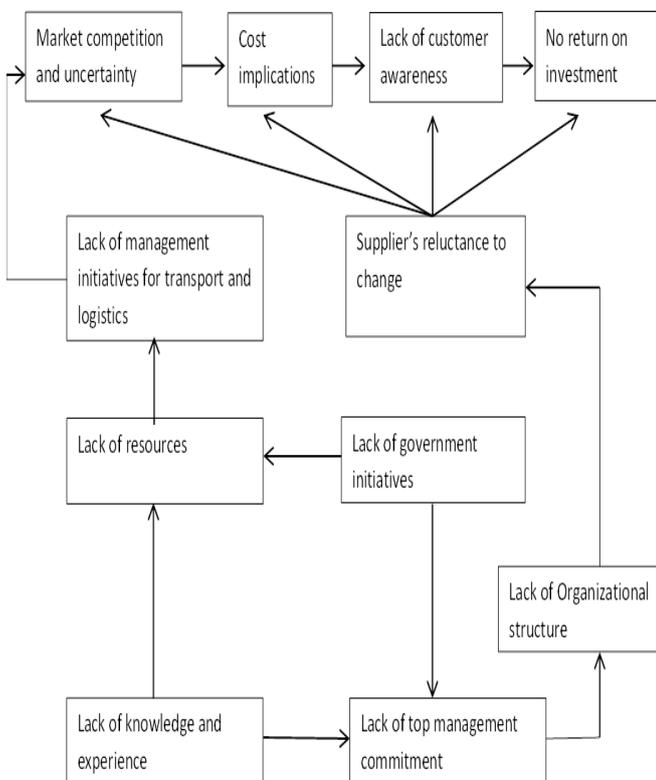


Fig 2 ISM model for barriers

By using this model organizations will get clear understanding of the barriers and will help to prioritize better and manage their resources in an efficient and effective way.

7. CONCLUSIONS

The above study gives a vision on the importance of green supply chain management and identifies the various drivers and challenges in implementing GSCM practices in construction industries. "In terms of barriers the most significant were lack of resources and short term planning, followed by problems on access to information and expertise, together with lack of government pressure.

Few measures have been suggested that will eliminate or help reduce the intensity of the barriers in Indian construction sector. As well, the structural model developed will help to understand interdependence of barriers..

Keeping these factors aside there are some positive factors like cost benefit, image improvement, reduction of environmental risks, reduction of waste that can help implement GSCM practices in the construction industry" (Reshma and Mittapalli, 2016).

8. RECOMMENDATIONS FOR FUTURE WORK

There is an urgent need to introduce green supply chain management in various sectors. More research is to be done on green supply chain management in the construction industry. It would be worth to exploring in more detail the suppliers, specifically their attitudes and resources to implement GSCM practices. In terms of the construction supply chain efficiency and environmental performance, it would be interesting in the future to investigate if GSCM in the construction industry is generating benefits to the companies involved.

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