



## An ISM approach for the barrier analysis in implementing green supply chain management



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### ABSTRACT

As customers are becoming more environmental conscious and governments are making stricter environmental regulations, the industries need to reduce the environmental impact of their supply chain. Indian auto component manufacturing industries especially SMEs (Small and Medium Enterprises) are focused to cleaner production by implementing Green Supply Chain Management (GSCM) in their industries. But they are struggling to implement GSCM concept. The present research analyzes the barriers for the implementation of GSCM concept which has been divided into two phases such as identification of barriers and qualitative analysis. The study has used three different research phases: identification of barriers from the literature, interviews with various department managers and a survey of auto component manufacturing industries. The identification phase led to the selection of twenty-six barriers based on literature and in consultation with industrial experts and academicians. The Interpretive Structural Modeling (ISM) qualitative analysis was used to understand the mutual influences amongst the twenty-six barriers by survey. This study seeks to identify which barrier is acting as the most dominant one for the adoption of green supply chain management and this result is helpful for industries to make easier the adoption of green concept in their supply chain by removing the dominant barrier. It indicates that different Indian auto component manufacturing industries have differing barriers for the implementation of green supply chain management. However, in their GSCM implementation, especially for maintaining the environmental awareness, the supplier barrier is the dominant one. Finally the approach has been applied to ten auto components manufacturing industries in Tamilnadu, South India.

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## 1. Introduction

With increasing awareness of environmental protection worldwide, the green trend of conserving the Earth's resources and protecting the environment is overwhelming, thereby exerting pressure on corporations (Chien and Shih, 2007). Today, as never before people are concerned with the environment and climate change (Intergovernmental Panel on Climate Change, 2007). In the field of business and management, there is an increasing responsibility on the role of organizations in society (McWilliams and Siegel, 2000; Strandberg, 2002), and their responsibilities to minimize impacts upon the environment (Hart, 1995; Henriques and Sadosky, 1999; Walker et al., 2008). Zhu et al. (2008) pointed out that stricter government regulations and increased community and

consumer pressures have raised the need for the manufacturers to effectively integrate environmental concerns into their regular practices and onto their strategic planning agenda. Greening of the supply chain management (GSCM) is one such innovative idea that is fast gaining attention in the industries to develop their environmental performance (Rao, 2007; Srivastava, 2007). Carvalho et al. (2010), Rao and Holt (2005) and Van Hoek and Erasmus (2000) expressed "GSCM is an important organizational philosophy, (which) plays a significant role in promoting efficiency and synergy between partners, facilitating environmental performance, minimal waste, cost savings to achieve corporate profit and market-share objectives, through environmental risks and impacts reduction, while it improves the ecological efficiency of organizations and their partners". This effective implementation of GSCM in an organization plays a critical role in gaining and maintaining competitive advantage (Zhu and Sarkis, 2004). During implementation of GSCM in industries there is a need to remove obstacles (barriers). This is one of the preliminary studies to investigate

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the mutual relationship among barriers. The objective of this work is to identify the dominant barrier among the recommended barriers and investigate the imperative and mutual relationship of the twenty-six barriers for the implementation of GSCM in ten auto component manufacturing industries in Tamilnadu, South India using ISM technique through expert's judgments.

This paper is prepared as follows: A literature review presents the GSCM in SMEs and identifies the barriers for adopting GSCM in SMEs. The problem description is in the next section. The solution methodology for the study is then presented. The next section summarizes the findings of the study. Influenced barriers structures are discussed in the results and discussion section. Conclusions are drawn in the final section.

## 2. Literature review

### 2.1. Background of green supply chain management in SMEs

Min and Zhou (2002) defined a concept of supply chain management (SCM) as “evolved around a customer-focused corporate vision, which drives changes throughout a firm's internal and external linkages and then captures the synergy of inter-functional, inter-organizational integration and coordination”. With the increase in environmental concerns during the past decade, a consensus is growing that environmental pollution issues accompanying industrial development should be addressed together with supply chain management, thereby contributing to green supply chain management (Sheu et al., 2005). Small and Medium Enterprises (SMEs) play a vital role for the growth of the Indian economy by contributing 45% of the industrial output, 40% of exports, 42 million in employment and creating one million jobs every year and producing more than 8000 quality products for the Indian and international markets. Because SMEs represent a significant element of the economy, they have a considerable impact on the environment. Individually, SMEs may have limited impact on the environment, but collectively, their impact is believed to be significant (Chiu et al., 1999). Chiu et al. (1999) also found that many SMEs do not comply with the environmental regulations. Sarkis et al. (2011) point out “GSCM is consistent with the concept of environmental innovation from the EMT view, that is, manufacturers implement GSCM through hard (e.g., cleaner production equipment) and soft (e.g., increased supplier collaboration in eco-design) technological innovations.

GSCM has numerous benefits to an organization, ranging from cost reduction, to integrating suppliers in a participative decision-making process that promotes environmental innovation (Rao, 2002; Bowen et al., 2002). The implementation of GSCM can lead to reduction in the cost of materials purchase and energy consumption (Zhu and Sarkis, 2004). Fuentes-Fuentes et al. (2004) found that greening a product has a great positive impact on the financial performance of a firm referring to the cost reduction, market share growth and profit increase. Duber-Smith (2005) identified ten reasons for a SME to adopt green supply chain such as target marketing, sustainability of resources, lowered costs/increased efficiency, product differentiation and competitive advantage, competitive and supply chain pressures, adapting to regulation and reducing risk, brand reputation, return on investment, employee morale, and the ethical imperative.

Consequently, larger firms are much more likely than smaller firms to take advantage of pollution prevention opportunities (Hussey and Eagan, 2007). Epstein and Roy (2000) found that small manufacturers do not recognize that environmental enhancements can improve efficiency, reduce costs and increase profits. According to Wycherley (1999), SMEs firms have difficulty to drive their suppliers or suppliers' suppliers to involve in the green initiatives.

Driving the suppliers could be difficult because GSCM require an organization's suppliers to spend additional resources to improve their environmental performance (Arimura et al., 2011). With raising awareness of environmental protection globally, it is imperative that the Indian SMEs adopt green supply chain initiatives as a part of their business strategy to keep them alive in the market.

### 2.2. Barriers for adopting GSCM in SMEs

Literature survey has thrown light on various kinds of barriers that hinder an organization from going green. Simpson et al. (2004) found that most of the SMEs feel that they cannot gain competitive advantage by adopting good environmental practice and it was a financial cost added to the business which could not be passed on to the customers. Lee (2008) found that the government plays an important role in improving the awareness and knowhow about environmental improvement and SMEs' lack information resources or expertise to deal with the environmental issues and also attributed the firm's size to be a significant factor for a firm to practice green supply chain; a bigger size firm tends to be more willing to participate in green supply chain initiative. Also, firms with greater resources are more likely to incorporate pollution prevention innovations.

Perron (2005) summarized that there are four barrier categories that impede the adoption of green initiatives in SMEs such as attitudinal and perceptions barriers (resistance of management to change, fear of failure etc.), information related barriers (lack of awareness on environmental legislations, environmental impact of the operations in an organization), resources barriers (financial barriers and human resource barriers) and technical barriers (lack of new technologies, materials or lack of technical expertise). Hemel and Kramer (2002) found that SMEs do not perceive that greening the environment is their responsibility and mentioned that there was no clear information regarding environmental benefits in greening of their products as well as the environmental legislation and the requirements. It was also found that SMEs are not able to find alternative solution in designing their products to fulfill the design for environment requirements. All these findings of Hemel and Kramer (2002) are very much in line with that of Perron (2005). In addition to these; Wycherley (1999) mentioned that it is too costly to change the existing investments, information system and habits. According to Walker et al. (2008), there are more external barriers than internal barriers. The external barriers are regulations, poor supplier commitment and industry specific barriers, whereas the internal barriers are cost and lack of legitimacy.

Arimura et al. (2011) examined the multifaceted relationship between Japanese firms' ISO 14001 certification and GSCM practices. It was found that ISO 14001 promotes GSCM activities. On a similar line, the impact of ISO 14001 on the environmental performance in the pulp and paper industry in Quebec was found to be significant. Hence, it could be said that lack of knowledge of environmental management standards such as ISO 14001 could act as a barrier in the implementation of green supply chain (Stevens, 2002). Wooi and Zailani (2010) investigated the barriers that hinder the SMEs in Malaysia from implementing green supply chain and found that resources barrier is the key barrier that impedes the adoption of GSCM initiative and the technical barrier is expected to be the key barrier for the SMEs in the manufacturing sectors in Malaysia. A questionnaire based survey was conducted to rank these enablers and they found contextual relationships among the enablers and developed a hierarchy based model for the enablers by using ISM (Mudgal et al., 2009; Luthra et al., 2011). Luthra et al. (2011) identified the contextual relationship among the eleven barriers to implement GSCM in the automobile industry.

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