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# Barriers analysis for green supply chain management implementation in Indian industries using analytic hierarchy process



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## ABSTRACT

Manufacturing industries started adopting the green concept in their supply chain management recently to focus on environmental issues. But, industries still struggle to identify barriers hindering green supply chain management implementation. This work focuses on identifying barriers to the implementation of a green supply chain management (Green SCM) based on procurement effectiveness. A total of 47 barriers were identified, both through detailed literature and discussion with industrial experts and through a questionnaire-based survey from various industrial sectors. Essential barriers/priorities are identified through recourse to analytic hierarchy process. Finally, a sensitivity analysis investigates priority ranking stability.

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## 1. Introduction

Supply chain management plays a vital role in the improvement and implementation of a firm's competitive advantage. Literature offers many studies and related evidence revealing the benefits of environmental initiatives for businesses (Mudgal et al., 2009, 2010; Sarkis et al., 2011; Perron, 2005; Shipeng, 2011; Kannan et al., 2008; Carter and Rogers, 2008; Hsu and Hu, 2008). The identification of benefits for environmental initiatives and performance by businesses is important for dissemination of such initiatives in Small and Medium Enterprises (SMEs) and large enterprises (Perron, 2005). Jung (2011) defined Green supply chain (GSC) as one of the "main efforts aiming to integrate environmental parameters (or requirements) with supply chain management systems." Most supply chain management innovations in the 20th century aimed to reduce waste for economic rather than environmental reasons, and it was not until the turn of the 21st century that the term *green*, with reference to protecting the environment, gained widespread use and recognition (Zhang et al., 2009). Recent studies mention that in the next couple of decades, most manufacturers will face environmental issues in Asia (Zhu et al., 2005; Shipeng., 2011; Jui and Ming-Lang Tseng, 2011; Diabat and Govindan, 2011; Zhu et al., 2012). Most Indian industries will have to develop supply chains from an environmental sustainability point of view by modifying traditional SCM to GSCM through initiation of green procurement strategies (Mudgal et al.,

2010). Procurement/purchasing decisions will affect green supply chains through the purchase of materials which are either recyclable/reusable or have already been recycled (Sarkis, 2003; Chien and Shih, 2007). During adoption of GSCM in traditional SCM, some hurdles can be anticipated due to the expected transition. These hurdles are called barriers and industries must equip themselves to remove them. However, it will be impossible to eradicate all barriers simultaneously. Hence, industries should identify those barriers which have essentially to be removed in the initial stages of GSCM adoption. This paper has, as its goal, the identification of such essential barriers so that they might be eradicated during GSCM implementation in industries through the Analytical Hierarchy Process (AHP). This study was undertaken in various industries in South India. The results might also impact environmental adoption ensuring easier eradication of essential barriers. It can also be extended to all industries in India. The resulting discussions and conclusions are achieved from an extensive survey, site visits, and interviews.

## 2. Literature review

This section discusses in detail literature related to the GSCM concept and barriers related to its implementation.

### 2.1. GSCM

GSCM, a cross-disciplinary field, has been growing in recent years with increasing interest from both academia and industry (Sarkis et al., 2011). Environmental issues like local, regional, and

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global implications of air emissions, solid waste disposal, and natural resource usage have to be monitored and managed during these growth phases (Zhu et al., 2007). Increasing environmental consciousness and commitment of businesses, governments, groups and individuals have all inspired development of procurement and purchasing policies that incorporate environmental requirements, thereby proving their collective bargaining and buying power (Massoud et al., 2010; Kannan et al., 2010). GSCM is a tremendous concept to instill environmental thinking in traditional Supply Chain Management (Zhu et al., 2012). GSCM cuts across varied boundaries (business activities integrating sourcing, making, and delivery processes) of supply chain management (Min and Kim, 2012). Environmental or green purchasing or procurement can be referred to as the integration of environmental considerations into purchasing policies, programs and actions to reduce waste and to help achieve a GSCM (Russel, 1998; Varnäs et al., 2009).

GSCM considers emphasizing environmental issues in supply chain management, in both upstream and downstream business enterprises (Shipeng., 2011). Zhu et al. (2012) argued that “GSCM is still relatively novel (innovative) for most organizations in many industries (Lin and Ho, 2008) and countries (Seuring and Müller, 2008; Seuring et al., 2008)”.

## 2.2. GSCM implementation: barriers

Research on GSCM usually focuses on aspects such as green purchasing, internal environmental operations management, or green logistics, as against taking an integrative, whole supply chain approach. Many authors suggest that green supply chain research should move from subjective studies towards an experimental and theory grounded approach (Gavaghan et al., 1998; Beamon, 1999; Carter and Carter, 1998; Zsidisin and Siferd, 2001). Barriers to GSCM implementation in SMEs are different from those of larger enterprises in many ways including: generation of less environmental data; fewer resources (less environmental expertise/experience, technical, financial, time), environmental performance being driven by personal views of business owners; no common access points and differences in organizational structure (Environment Canada, 2003).

Recent years have witnessed a growing interest in examining special challenges that hinder SMEs from taking up GSCM (Wooi and Zailani, 2010). Many studies confirm that adoption of GSCM in SMEs is unhurried (Mudgal et al., 2010; Sarkis et al., 2011; Perron, 2005; Shipeng., 2011; Kannan et al., 2008). Carter and Rogers (2008) mention that organizations fail to adopt environmental initiatives due to internal factors including sunk costs, improper communication structures, internal politics, and institutional norms. Hillary (2004) has classified internal and external barriers to implementation of environmental initiatives in SMEs. Kogg (2003) pointed out that lack of influence is an important barrier to implementing GSCM practices in industries. Similarly, Luken and Stares (2005) found significant road blocks among small and medium enterprise suppliers to provide green material. Then, Porter and Kramer (2006) mentioned that sometimes green products customers might switch over to other normal products, resulting in a negative motivation for new firms to engage in GSCM practices. Later, in 2009 Thun and Muller investigated the status quo of GSCM implementation in the German automotive industry from a practitioner's point of view. They also analyzed other perspectives including time of implementation, driving forces, relevance of intended goals, their specific realization and adoption of eco-programs with suppliers/customers, and also internal and external barriers. In addition, Zhu et al. (2010) pointed out that lack of external cooperation and diffusion are proven obstacles to GSCM's operational performance. Even with so

many barriers against GSCM implementation, recent years have witnessed large changes in Indian SME's. Taking this further, Indian SME's have started manufacturing/ supplying products to multinational companies (MNC) (Diabat and Govindan, 2011).

## 2.3. Research gap

It is evident from literature that both academicians and practitioners are fully aware and are interested in analyzing barriers to GSCM adoption (Zhu and Sarkis, 2006; Walker et al., 2008; Diabat and Govindan, 2011). Min and Kim (2012) reviewed 519 articles on GSCM published between 1995 and December 31, 2010. Of these 519 articles, only a few were from developing countries, and specifically from an Indian context. Some Indian GSCM studies are summarized here. Mudgal et al. (2010) investigated and ranked barriers against GSCM adoption based on an exhaustive questionnaire from more than 100 industries in different sectors by using interpretative structural modeling (ISM). However, increasing an issue's or a problem's variables number makes ISM methodology more complex, so only a limited number of variables in the development of ISM model are considered. Another consideration is that ISM does not provide quantification for each factor's influence on greening supply chains (Mudgal et al., 2010). Luthra et al. (2011) analyzed important barriers to GSCM adoption from an Indian perspective and identified contextual relationships among 11 barriers helped by ISM. Toke et al. (2012) ranked interactions and evaluated critical success factors for GSCM adoption in the Indian manufacturing sector through an analytical hierarchy approach. Mathiyazhagan et al., (2013) analyzed the relationship between 26 barriers and identified the most influential in GSCM adoption in the automobile industry aided by ISM in the Indian perspective. Similarly, Muduli et al. (2013) analyzed factors and sub-factors for GSCM adoption in the Indian mining industry helped by graph theoretic and matrix approach (GTMA).

Diabat and Govindan (2011) analyzed drivers for GSCM implementation in the Indian perspective through a case study involving a manufacturing firm in south India. To date, only a few research studies have attempted to analyze barriers to GSCM implementation from an Indian industry perspective (Luthra et al., 2011; Mudgal et al., 2010). Most studies dealt with a limited number of barriers. In addition, researchers have not undertaken the analysis with different industrial perspectives from the Indian context. These research gaps helped to determine why this problem was chosen. Clearly, there is little work on the analysis and identification of important barriers to GSCM implementation in an Indian scenario.

There is also no work on the identification of essential barriers which need to be removed for GSCM adoption. Similar studies were conducted on industries in China and Malaysia (Wooi and Zailani, 2010; Zhu et al., 2007), but different industries have different opinions about GSCM adoption (Zhu and Sarkis, 2006). Furthermore, different countries will obviously have varied opinions about the pressures or barriers against GSCM implementation; every country has its own environmental policies and environmental regulations (Mathiyazhagan et al., In press). Regulations and policies vary depending on the people, culture, and the politics of that country. Similarly, Indian industries also have different opinions about barriers against GSCM adoption (Luthra et al., 2011; Diabat and Govindan, 2011; Mudgal et al., 2010). Mudgal et al. (2010) and Mathiyazhagan et al. (In press) found that various automotive industries had differing judgments about barriers to GSCM adoption. Hence, it is clear that globally, not all industries share similar opinions, so this study is essential. A literature gap exists in the identification of essential barriers against GSCM implementation. This paper addresses this gap through a two-phased research approach which includes Phase

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