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An analysis of interactions among critical success factors to implement green supply chain management towards sustainability: An Indian perspective

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ABSTRACT

Increasing environment related problems and societal issues generally emerged due to different activities of the supply chain that pushes the industries to move towards social responsible Green Supply Chain Management (GSCM) practices. To deal with this, an attempt has been made here to identify, analyze and model the Critical Success Factors (CSFs) to implement GSCM towards sustainability in industries in Indian perspective. Twenty six CSFs to implement GSCM towards sustainability are recognized by means of the literature review and in discussions with experts. A solution methodology based on the Interpretive Structural Modeling (ISM) technique is used to propose a structural model, which not only helps in understanding the contextual relationship among these CSFs, but also in determining their interdependence to implement GSCM towards sustainability. Further, the importance of CSFs has been determined based on their driving and dependence power by using MICMAC analysis. "Scarcity of Natural Resources" has been identified as most important CSF that may force industries to implement GSCM practices to ensure their business sustainability. A case example of Indian mining industry is presented to show the real-world applicability of the proposed model. This work may help practitioners, regulators and academicians to focus their efforts towards implementation of sustainable GSCM on various levels in business.

Introduction

Environmental sustainability and green considerations have an increasing popularity among scholars and business organizations practicing managers. Further, the natural environment is becoming a demanding subject to improve their ecological and economic impacts among industries (Diabat et al., 2013). Environmental problems and societal issues linked to the waste and emissions generated due to different activities of the supply chain have pushed the industries towards social responsible GSCM practices (Barve and Muduli, 2013). Indian Industries are also facing tremendous pressure from customer's environmental awareness and stricter environmental regulations to incorporate ethical and environmental considerations in all facets of traditional supply chain management (Luthra et al., 2011; Mathiyazhagan et al., 2013; Mangla et al., 2014b). Green Supply Chain Management (GSCM) is a combination of, environmental thinking and supply chain management (SCM), encompassing product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumer and end-of-life management of the product (Srivastva, 2007). The business organizations can use GSCM as a strategic approach to earn profits and competitive image in the market (Yan, 2011).

Organizations have multiple objectives like enhanced brand image, competitiveness, optimum resources utilization, better customer service, environmental and social friendly image, increased profitability and many more. To achieve these objectives, organizations employ various business strategies. GSCM may be a reasonably logically good to stabilize the ecological, financial and social gains (Mangla et al., 2014c) and has emerged as an important management strategy for business organizations to become more environmental friendly, cost effective and competitive.

With a growing emergence of globalization and international traders introduction in market poses several concerns for industries like environmental issues and supply chain sustainability (Shukla et al., 2009). In general terms, sustainable supply chain has been considered as a measure that covers loss and profit as well as

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social and ecological aspects in business (Carter and Rogers, 2008). From the definition, we may further submit that sustainability is all about reducing a business' harmful impacts on people, societies and the environment at the same time enhancing value for customers, business partners and stakeholders (Schmidt et al., 2011). Many authors reported that the GSCM plays an important role in sustainable development (Sarkis et al., 2011; Green et al., 2012; Luthra et al., 2014a; Schrettle et al., 2014).

However, one of the biggest challenges for each industry in current market is the growing need for integrating environmentally sound choices into supply chain practices. The industries in India are facing regulatory, community, stakeholders and competitive pressures to move towards GSCM (Luthra et al, 2014e) and to become sustainable. GSCM, which has already been grown-up in developed nations, but, relatively a fresh concept in a developing nation like India. In India, GSCM practices are in the early stage of adoption. The industries in India, believe that the implementation of GSCM would be very expensive (Mangla et al., 2014a), but it is the matter of knowledge on the concept and the management view point and involvement towards making the industries' supply chain more cost effective and environment friendly. Therefore, it calls for the need to identify various critical success factors (CSFs) to implement GSCM and to develop a hierarchy of CSFs to implement GSCM towards sustainability in Indian industries in most effective and economic manner.

Objectives of the research

This research has some objectives, as follows:

- To identify various critical success factors (CSFs) to implement GSCM towards sustainability from industrial viewpoints.
- To find the contextual relationships among identified CSFs.
- To suggest a hierarchy structural model of CSFs to implement GSCM towards sustainability in business.
- To confer the research managerial implications.

Various CSFs helpful in implementation of GSCM to achieve sustainability are recognized through the literature survey and expert estimations. A literature review is an integral part of any research to identify the conceptual content of the field and gives guidance towards theory development (Srivastva, 2007; Luthra et al., 2014c). Further, in order to identify the contextual interactions among identified CSFs and to suggest a hierarchy structural model for them, Interpretive Structural Modeling (ISM) methodology has been proposed as an appropriate tool, which will assist managers to know the relationships between CSFs and to determine their levels. ISM has been applied in many domains like policy analysis (Sage, 1977), management research (Sarkis et al., 2007; Mudgal et al, 2010; Haleem et al., 2012; Govindan et al., 2013; Mathiyazhagan et al., 2013; Mathiyazhagan and Haq, 2013; Mangla et al., 2014c). The methodology of ISM has a tendency to transform the undecided and inadequately expressed "systems models" into observable and distinct models (Sage, 1977). Due to these benefits, in this work, ISM methodology has been recognized as a suitable technique to indentify the contextual relationships among these identified CSFs to develop structured model of the CSFs.

To show the real-world applicability of the proposed ISM based model, a case example of Indian mining industry is offered. The fast mounting demand of minerals has got the mining industries focus on developing and developed countries. Generally mining and mineral operation is an excellent contributor to economic growth and development in each country (Sivakumar et al., 2014). From last few years, mining has become a significant key business activity in terms of, either in benefits for society and community or in providing necessary raw materials basically minerals for delivering daily usable items to the customer. Including, products related to automotive sector, computer and hardware, frameworks and structures for buildings, electrical appliances, etc. In addition, in present scenario, mining and its related activities play a crucial role in achieving any kind of technological and medical advancements (Shen et al., 2014). However, a significant negative impact of mining and its mineral extraction associated activities in terms of degradation of environment, pollution of land, water, air, soil quality, and on human health and habitation, is greatly noticed. In this context, the need arises to put this subject under investigation to ensure green trends and sustainability in business of mining industries (Barve and Muduli, 2013; Muduli et al., 2013a). Considering the highlighted significance of adoption and implementation of GSCM initiatives in mining sector, we opted to select and discuss a pragmatic example of mining industry in Indian context. The case industry is seeking to analyze the GSCM implementation CSFs, and has desire to build a structural model to understand the interactive relationships among the CSFs in adopting an effective GSCM concept to ensure sustainability in the business.

This leftover of the paper is given as: *Literature review* provides a detailed literature review of the related work and identifies the CSFs to implement GSCM towards sustainability in Indian industries. *Solution methodology* describes the solution methodology for the research. A case example of mining industry operational in India is presented, and correspondingly results are discussed (see *An illustrative case example of mining industry in Indian context*). The findings are discussed along with managerial/practical implications of research are given in *Discussions of findings*. Finally, conclusions have been drawn with the limitations of the study and the future directions for research.

Literature review

In this section, the relevant literature on GSCM and sustainability in Indian context and identification of CSFs to implement GSCM towards sustainability in Indian industries are summarized.

Green supply chain management and sustainability in Indian context

The GSCM and sustainability issues are becoming relevant in India because the most of world's manufacturing will be carried out in Asia continent within the next twenty years (Hu and Hsu, 2010) and will create a lot of opportunities in this continent, but it will also bring about considerable environmental burdens (Rao, 2002) and societal concerns (Mangla et al. (2014c). Over the years, few studies have been conducted in India by taking various perspectives/industries as follows - Mudgal et al. (2009) suggested in their research that implementation of green business practices are difficult due to the presence of many barriers. Muduli and Barve (2011) discussed the role of green issues in Indian mining industry and distinguished various challenges associated with the adoption of the green in the supply chain in mining. Luthra et al. (2011) identified barriers to fulfill GSCM practices in Indian automobile industry and proposed ISM based model. Barve and Muduli (2013) identified eleven challenges to green management practices in mining industries of India using the literature review approach and presented hierarchical model of the identified challenges using the interpretive structural modeling (ISM) technique. Mathiyazhagan et al. (2013) pointed out that customers are becoming more and more aware of environmental problems and government agencies are making strong environmental regulations to reduce environment damage. They analyzed the barriers to adopt GSCM practices in Indian auto component manufacturing firms. Mangla et al. (2013) recognized and analyzed fourteen