



## Identifying the critical factors of green supply chain management: Environmental benefits in Pakistan



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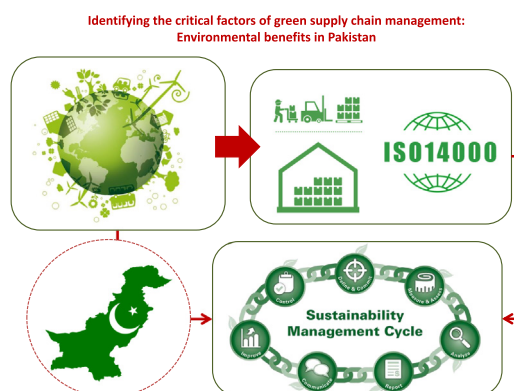
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### HIGHLIGHTS

- Developed a DEMATEL model based on ISO 14000 regarding GSCM.
- Provided empirical evidence on relationship between GSCM and performance practices.
- Analysis of GSCM practices in the industrial sector of Pakistan.
- Reduction the destructive effect of pollution on the environment.
- Guidelines to managers and decision makers about their approach towards GSCM.

### GRAPHICAL ABSTRACT



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### ABSTRACT

Pakistan is a developing country characterized by a growing industrialization, which is the major cause of environmental pollution in the country. To control the significant increase in pollution a green incentive has started, aiming to moderate the adverse effects of environmental pollution. Thus, Green Supply Chain Management (GSCM) plays an important role in influencing the total environment impact of any organizations. This study considers ten Pakistani industries that have implemented GSCM practices. The Decision-Making Trial and Evaluation Laboratory technique (DEMATEL) is used to find influential factors in selecting GSCM criteria. The results show that organizational involvement is the most important dimension useful to implement GSCM practices. In addition, commitment from senior managers, ISO 14000 certification of suppliers and recycle of waste heat are considered significant factors. The paper also signifies the casual relationship among the dimensions and the factors in the form of diagrams. The main management implication of the paper is to help decision makers to focus on the critical dimensions/factors in order to implement the GSCM practices more effectively in Pakistan.

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### 1. Introduction

Due to the increase in environmental pressures and desire for economic wellbeing, Green Supply Chain Management has emerged as an

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important strategy that can contribute to sustainability performance enhancement (Ruiz-Benitez et al., 2017). In fact, the concept of GSCM is to integrate environmental thinking into supply chain management (Srivastava, 2007; Cooper et al., 1997). In Pakistan GSCM is still in its developing stages since it not been a long time that industries are implementing these practices (Government of Pakistan, 2015). With the increase of the environmental constraints it becomes essential for a company to carry out the GSCM practices efficiently and to improve its environmental image (Sheu et al., 2005; Sheu et al., 2005; Hansmann and Kroger, 2001).

In fact, through advantage of GSCM practice, companies can select from a wide variety of suppliers and to eliminate the environmental impacts of supply chain activities. Thus, new opportunities that help against the competition and also in including new values into the business must be explored (Hansmann and Kroger, 2001).

But, as stated by Grim (Grimm et al., 2014) in reality the implementation of GSCM practices has numerous difficulties. It would be relevant investigate effectively practices to address suppliers' environmental performance according to the specific need of each national and regional context. Unfortunately, research on this issue is relatively immature. For the above reasons, this research aims to investigate the industrial scenario in Pakistan. According to literature review and companies surveys three main dimensions: 1) *organizational involvement*; 2) *supplier selection*; and *eco-design* are identified that contribute towards the GSCM practices (Tseng et al., 2009). The dimensions are further divided into their respective factors: 1) *commitment from senior managers*; 2) *commitment from mid-level managers*; 3) *improvement by cross-functional corporations*; 4) *ISO 14001 certification*; 5) *environmental quality management*; 6) *cooperation with suppliers*, 7) *audit of suppliers*, 8) *ISO 14000 certification*; 9) *environmental friendly second-tier suppliers*, 10) *reduced material/energy consumption*, 11) *reuse/recycle of material*; and 12) *recycle of waste heat*.

The main goal of this study is to identify, using the DEMATEL (Decision Making Trial and Evaluation Laboratory) method, the critical dimensions and factors in GSCM developing an interrelationship between the dimensions of GSCM and also among their respective factors in order to promote environmental improvement actions within ten Pakistani companies. The direct and indirect affect among criteria, and computes the causal relationship and strength among GSCM factor is analyzed. The advantage of the DEMATEL method is the capability of revealing the relationship between these factors which influence other factors. Data were collected to identify to find key factor criteria to improve performance and provides a novel approach of decision-making information in GSCM implementation.

The rest of the study is organized as follows: Section 3 analyses literature review on this topic; in Section 5 the methodological approach is described; Section 7 describes the analysis and the case study; Section 2 discusses the main results obtained; and finally in Section 6 certain conclusions are drawn and potential issues and opportunities in the realm of GSCM are identified.

## 2. Literature review: approaches and critical factors of GSCM

Supply Chain Management (SCM) is considered as an important concept in managerial strategies (Chopra and Meindl, 2001). Li and Wang (2007) define supply chain management as the integration of internal organizational decisions with external factors. While, according to Gilbert (2001), Green Supply Chain Management (GSCM) implements all SCM practices taking in consideration their impact on the environment. Naini et al. (2011) clarify that the adoption of GSCM practices helps organizations to reduce the environmental risks and optimize material and energy consumption. However, several authors have recognized various critical factors of GSCM, briefly defined below (Mumtaz et al., 2018).

In 1996, Lamming and Hampson (1996) analyze the use of some good practices such as lifecycle management analysis (LCA), waste

management and product stewardship etc.; they associated the use of these tools with SCM practices in order to establish an environmental friendly policy with suppliers and to assist in improvement. Unlike, Lamming and Hampson, Lippmann (Lippmann, 1999) suggests various activities and steps that an organization could adopt to enhance their environmental performance (such as written GSCM policies, supplier meetings, senior-level leadership, cross-functional cooperation, evaluation of suppliers and having supportive relations with both customers and suppliers). Similarly, Fai Pun (2006) identifies three groups of good practices: policy, product/process and performance evaluation. His results indicate that top management support is the most important factor contributing towards the achieving environmental friendly operations. While, Bowe et al. (2001) identify three kinds of green supply chain 1) *greening process*, that considers relationships with suppliers and recycling; 2) *product-based green supply* that includes treatment of the waste products; and 3) *advanced green supply* that includes implementing activities such as assessment of consumer performance, collaborative clean technology programs with suppliers, and risk sharing in the environmental standards.

Afterwards, in 2006, Hu and Hsu (2006) identify four critical dimensions in Taiwanese electronic industry, using a fuzzy analytic hierarchy approach: supplier management, product recycling, organizational involvement, and life cycle management. Another interesting study is proposed by Young and Kielkiewicz-Young (2001). Their results suggest that organizations must share sustainability related information, such as purchasing policies of the customers/suppliers, aims and objectives. In addition to this environmental standards such as ISO 14001 or EMAS must be recognized. They also propose that the suppliers' performance can be enhanced by carrying out periodic audits, and through cooperation with suppliers. In 2005, Zhu et al. (2005) assessed and defined the GSCM drivers and practices among several Chinese manufacturing organizations. Their result highlight the importance of international standards such as ISO 14001 certification. Furthermore, they conclude that environmental alertness in Chinese enterprises has improved due to external pressures such as competitive marketing environment. Zhu et al. also claim that support from top and mid-level managers was considered an important factor in implementing GSCM practices effectively. In 2008, Lee and Klassen (2008) conduct a survey considering small and medium sized organizations and comparing the effect of buyers' behavior on the environmental competences of suppliers. They conclude that factors such as "environmental championing," "external means", "GSCM" and "development of internal environmental management capabilities" can contribute to the environmental development. More recently, Toke et al. (2012) propose a study to identify the critical factors of GSCM in the Indian automotive industry. They divide GSCM practices into fifteen factors further divided into 113 subfactors. The aim of their study is to rank the crucial factors of GSCM. Their results suggest that support from top management is the most important factor for the success of GSCM. In 2013, Muduli et al. (2013) propose the use of interpretive structural modeling (ISM) to study various behavioral factors that effected GSCM in the mining industry of India. Their results support the outcome suggested by Toke et al. Their results also prove that top management support is the fundamental motivating factor for the success of GSCM. The results of Luthra et al. (2015) varied from Toke et al. (2012), Muduli et al. (2013), and Luthra et al. (2015) develop a set of factors called "critical success factors (CSF)" for successful execution of GSCM. They used ISM to rank these success factors. Their findings show that "Scarcity of Natural Resources" is the most vital CSF.

In summary, the literature analysis has been showed that GSCM is widely recognized. But, its implementation has faced various obstacles. In detail, the literature analysis has pointed out that an evaluation of the cause-effect interrelationships among critical factors of GSCM can play a critical role in influencing implementation of good practices. To address this need, as analyzed by some authors (Dou et al., 2015) several tools have been used to systemically to evaluate green supply chain management issues such as the Analytical Hierarchy Process (AHP), the

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