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A linear regression approach to evaluate the green supply chain management impact on industrial organizational performance

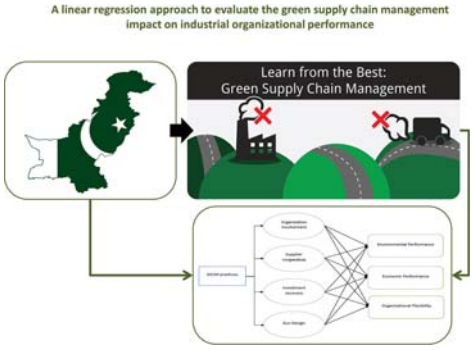
Ubaidullah Mumtaz [a], Yousaf Ali [b], Antonella Petrillo [c,*]

[a] Master in Engineering Management, Faculty of Management Sciences, Ghulam Ishaq Khan Institute of Engineering Sciences and Technology, Pakistan
[b] Department of Management Science & Humanities, Ghulam Ishaq Khan Institute of Engineering Sciences & Technology, Topi, Swabi, KPK, Pakistan
[c] University of Naples "Parthenope", Department of Engineering, Isola C4, Centro Direzionale Napoli, Italy

HIGHLIGHTS

- Developed a linear regression framework regarding GSCM and firm performance
- Provided empirical evidence on relationship between GSCM and performance practices
- Analysis of GSCM practices in the industrial sector of Pakistan
- Findings of this paper show that GSCM leads to green innovation.

GRAPHICAL ABSTRACT



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ABSTRACT

The increase in the environmental pollution is one of the most important topic in today's world. In this context, the industrial activities can pose a significant threat to the environment. To manage problems associate to industrial activities several methods, techniques and approaches have been developed. Green supply chain management (GSCM) is considered one of the most important "environmental management approach". In developing countries such as Pakistan the implementation of GSCM practices is still in its initial stages. Lack of knowledge about its effects on economic performance is the reason because of industries fear to implement these practices. The aim of this research is to perceive the effects of GSCM practices on organizational performance in Pakistan. In this research the GSCM practices considered are: *internal practices*, *external practices*, *investment recovery* and *eco-design*. While, the performance parameters considered are: *environmental pollution*, *operational cost* and *organizational flexibility*. A set of hypothesis propose the effect of each GSCM practice on the performance parameters. Factor analysis and linear regression are used to analyze the survey data of Pakistani industries, in order to authenticate these hypotheses. The findings of this research indicate a decrease in environmental pollution and operational cost with the implementation of GSCM practices, whereas organizational flexibility has not improved for Pakistani industries. These results aim to help managers regarding their decision of implementing GSCM practices in the industrial sector of Pakistan.

* Corresponding author.
E-mail addresses: yousafkhan@giki.edu.pk (Y. Ali), antonella.petrillo@uniparthenope.it (A. Petrillo).

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1. Introduction

Environmental pollution is a growing concern all around the world. The increase in greenhouse emissions has an adverse effect on the environmental integrity of the planet (Wang and Song 2017). The major cause of environmental degradation is the increase of industrialization around the world. In 2016 there has been a significant rise in pollution, Pakistan is among the worst 30 counties which are affected by air pollution. In addition Pakistan has two of its cities in the top 10 most polluted cities of the world (Vidal 2016). This is having an adverse effect on the climatic conditions of the country. On the other hand, Pakistan is a developing country and the progress of industrialization is a strategic issue for the economic growth of the country.

In this year, to balance both economic and environmental performance the managerial approach of green supply chain management (GSCM) has been developed (De Felice et al. 2013). The concept of GSCM aims to integrate environment thinking into supply chain management, as highlighted by several authors (Chang et al. 2018; Chin et al. 2015; Srivastava 2007). Industries all over the world are implementing GSCM techniques to address the problem of environmental degradation. In most of the developed counties GSCM is a well-known concept, and is being implemented with great success. In Pakistan the concept of GSCM is relatively new and its implementation is contradictory. In fact, on one side the social pressures are forcing industries to implement these practices as the environmental pollution has become a growing concern in Pakistan. But at the same time, there is a general fear concerning how these factors will affect the economic performance.

For the above reasons it is important to develop a sustainable development of the industrial sector identifying GSCM practices as pointed out by some other authors among which is worthy to note Nidumolu et al. 2009 and Markley and Davis, 2007. Addressing the environmental aspect helps in recognizing new opportunities, which leads towards competitive advantage (Choi and Hwang, 2015). Instigating policies such as recycle of waste, reuse of material, cleaner production, and waste management can help in accomplishing the environmental objectives. It has been proved that GSCM can be an important element in the improvement of general performance of an organization with an additional benefit on improving market competition (Sarkis, 2006; Chan et al. 2012). Adopting GSCM and the combination of *internal factors* (i.e. organizational support) with *external factors* (i.e. supplier support, and collaboration) is very productive for the global performance of a manufacturing organization (Cheng et al. 2008). In other words, the implementation of GSCM has both monetary and non-monetary benefits (Geffen and Rothenberg 2000; Seuring and Müller 2008).

In Pakistan, the lack of research on GSCM and its impact on the organizational performance is the reason why only a small portion of the companies is implementing these practices. Thus, the aim of this research is to evaluate the performance of an organization after implementing GSCM practices. For this purpose, in the present research, the Pakistani industries implementing GSCM have been considered in order to evaluate the influence of GSCM on the financial, and environmental performance. In detail, four dimensions have been analyzed, i.e. *organizational involvement*, *supplier cooperation*, *investment recovery*, and *eco-design*. The effect of these dimensions has been evaluated on the economic and environmental performance of the industries in Pakistan. The motivation behind the study is due to awareness that there has been an increase in metal contamination of surface soil in the industrial city of Sialkot, increase in the concentration of Cadmium (Cd), Nickel (Ni), chromium Cr), zinc (Zn) and lead (Pb) has been highlighted (Malik et al. 2010).

The rest of the paper is organized as follows: Section 2 identifies the relevant literature review; in Section 3 the hypothesis of the research are defined; Section 4 describes the materials and methods proposed; Section 5 explains data analysis; Section 6 discusses the results of the study and finally in Section 7 main benefits of the study are summarized.

2. Literature review

Industrialization plays an important role in the economic progression of a country. But it is responsible of environmental impacts. In the current industrial environment, GSCM is being considered as an important "philosophy" in order to improve profits while reducing the negative impact of industrial processes on the environment. GSCM practices are linked to the concept of "*Industrial Ecology*" (Graedel and Allenby, 2003). Industrial Ecology was defined by Lowe as "*a systematic organizing framework for the many facets of environmental management. It views the industrial world as a natural system - a part of the local ecosystems and the global biosphere. Industrial ecology offers a fundamental understanding of the value of modeling the industrial system on ecosystems to achieve sustainable environmental performance* (Lowe 1993)."

GSCM practices performed by an organization, also known as the internal practices are considered serious for the improvement of organizational performance. Managing the internal factors lead to the improvement of organization's environmental performance (Zhu et al. 2008c). External factors such as customer and suppliers involvement, are studied as factors affecting organizational performance. Developing connections with external influences such as the government, suppliers, customers and even competitors lead to superior environmental supply chain performance (Carter and Ellram 1998; Choudhary et al. 2017) In addition to the internal and external factors, the product must be designed such that the waste is reduced and can be recycled.

Various organizations are trying to implement GSCM (Ashton et al. 2017; Kirchoff et al. 2016). ISO 14001 environmental principles plays an important role in integrating GSCM into the organization's policies (Savita et al. 2016). According to several researchers (Green Jr et al. 2012; Linton et al. 2007; Preuss 2000), due to the increased environmental impacts, organizations are now focusing on the supply chain management. "*Environmental supply chain management*" as a process where products or services are produced by green processes in order to fulfill the customer demands (Seuring 2001). The implementation of GSCM can help an organization to gain competitive advantage over its competitors (Sen 2009; Barratt and Oke 2007; Handfield et al. 1997).

Numerous studies have been conducted to recognize the factors that assist or prevent the implementation of GSCM (Diabat and Govindan 2011; Nishat Faisal 2010). In 2018, Lie and Ho analyze six factors that influence the intention to adopt green innovations for logistics service providers. The determinant factors include technological, organizational and environmental dimensions (Lin and Ho 2008). While, in 2009 Bin and Jun propose a model in which various factors of a green supply chain are investigated, and their effect on all the production process are analyzed (Bin and Jun, 2009). Lee (2008) states that customer impact, government association, and green supply chain alertness are the main forces that helped in implementing GSCM practices (Lee 2008). In 2010, Hu and Hsu, identify twenty critical factors for implementing GSCM. The critical factors are grouped into four dimensions: (1) supplier management, (2) product recycling, (3) organization involvement, and (4) lifecycle management (Hu and Hsu 2010). Afterwards Shang et al. (2010) propose a Factor Analysis technique to reduce the number of critical factors to six.

A different point of view is proposed by Zhu et al., (2008b). In their study investigate GSCM practices implementation among Chinese manufacturers. After, in 2012, Zhu et al., investigate the effect of GSCM practices in China by considering ISO 14001 certification and eco-labeling. Green supply chain initiatives among certified companies in Malaysia and environmental sustainability is analyzed by Eltayeb et al. (2011). A GSCM model using a multi criteria approach based on Analytical Network Process (ANP) is proposed by Büyüközkan and Çifçi (2012). Similarly, Bhattacharya et al. (2014) use a multi criteria model based on fuzzy ANP) and balanced scorecard to measure green supply chain performance. Green Jr. et al., (2012) use a structural equation model to verify the performance of GSCM practices in US manufacturing companies, concluding that GSCM has a positive effect on economic, environmental,