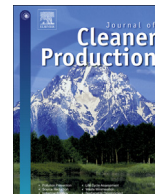




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# Suppliers' communication capability and external green integration for green and financial performance in Korean construction industry

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## ABSTRACT

Environmental policies and customer concerns about environmental pollution lead to the implementation of environmental management by companies. Beyond individual-level efforts, manufacturing firms started to integrate green activities into their supply chain management system. However, suppliers still struggled to satisfy the needs of buyers and customers related to environmental capabilities in the construction sector because of the lack of communication resulting from the hierarchical relationship between buyers and suppliers. This study empirically examined the communication capabilities for green supply chain management and the relationship among external green integration, green cost reduction, and corporate competitiveness from the suppliers' perspective. We collected data from a survey of 103 construction suppliers in Korea and employed structural equation modeling to test the hypotheses. The findings from this study indicated that suppliers with higher information sharing capabilities improved their environmental collaboration, contributed to green cost reduction, and achieved their competitive advantage. In addition, the results showed that green alignment—the degree of consistency in the evaluation of suppliers' environmental capabilities made by buyers and suppliers—had a positive influence on the suppliers' competitiveness. Thus, the managers who can understand the buyer-supplier relationship and the necessity for environmental management in supplier firms need to consider information sharing and external green integration as critical factors for the implementation of an effective green supply chain management system. In addition, this study provides scientific value by revealing the role of communication capabilities, identifying the importance of supplier perspective, and exploring green supply chain management in the context of the construction industry.

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## 1. Introduction

Environmental activities and practices are now considered to be part of supply chain management (SCM)—labeled green supply chain management (GSCM)—because there are serious environmental problems such as shortage of natural resources, pollution, climate change, and destruction of the ecosystem (Muduli et al., 2013). The purpose of implementing environmental activities is moving away from reducing waste for economic reasons to increasing social and environmental performance for sustainable development by mediating the stakeholders' concerns (Zhang et al., 2009). Prior studies reported that environmental issues would be critical for manufacturing firms in Asia over the next few decades (Diabat and Govindan, 2011; Zhu et al., 2005). Most Korean firms

strive to implement GSCM or integrated environmental management because of increasing environmental concerns and external pressure such as environmental regulations or a green growth policy. For example, Korean R&D policies focus on green growth; further, international regulations for environmental protection such as the Restriction of Hazardous Substances Directive (RoHS) and the directive on Waste Electrical and Electronic Equipment (WEEE) prompt governments and firms to establish environmental strategies and implement GSCM (Kim and Rhee, 2012).

Despite the importance of GSCM, there are several gaps in the research on GSCM. First, although several studies emphasize the importance of information sharing (IS) or material coordination as social capital for improving supply chain performance (by increasing the efficiency of resource allocation and reducing costs), studies examining the impact of social capital on green supply chain performance are scarce (Sahin and Robinson, 2005). Therefore, empirical research that examines the impact of IS on GSCM is necessary because resource allocation and costs are critical factors

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in the performance of a green supply chain. Such studies are required for the implementation of effective GSCM strategies that are not intended to merely satisfy the requirements of regulations in a passive way but are meant to achieve corporate competitiveness (CC) by increasing social capital such as IS and networking in a proactive way. Therefore, the current study explores the impact of IS as a determinant of GSCM.

Second, it is necessary to examine GSCM from the perspective of both buyers and suppliers (Kim and Rhee, 2012). Many prior researchers focused on the GSCM practices or implementations from the buyers' perspective only (Wu et al., 2012; Yang et al., 2013) because buyers (as the contractor) have more power to make decisions in the supply chain compared to the suppliers. However, suppliers also play an important role in GSCM. For instance, green suppliers produce eco-materials and implement green product design for buyers as part of green procurement (Appolloni et al., 2014). Therefore, win–win strategies involving both buyers and suppliers are necessary for sustainable and mutually beneficial GSCM (Kim and Rhee, 2012). Thus, an investigation of the impact of GSCM on suppliers' competitiveness is required. The objective of this research is to explore the impact of the suppliers' communication capabilities on GSCM and the relationship among external green integration, green performance, and financial performance in the Korean construction sector.

Many prior studies emphasized the necessity for environmental management in the construction sector because construction activities are considered to be a main contributor to environmental pollution (Shen and Tam, 2002). Integrated efforts among the members of the supply chain are necessary to overcome the environmental problems and to obtain competitive advantage in the construction sector. For instance, the Korean government implemented 'Green Supply Chain Management Business' in 2003 to encourage the environmental performance of not only buyers but also small- and medium-sized enterprise (SME) suppliers (Kim and Rhee, 2012). However, few empirical studies lend support to this policy and investigate the strategy for the effective implementation of GSCM in the construction sector. Hence, this study focuses on the GSCM strategies of the construction sector (a pollution-intensive industry) and provides the implications of the Korean environmental policy for suppliers.

The rest of this paper is divided into five parts. The theoretical background of the study and an overview of the extant literature are presented in Section 2; further, hypotheses are developed based on the literature review. The data collection, measurements, and methodologies are described in Section 3. Section 4 presents the results of this study with several tables. The discussion of the results and the conclusions drawn from the findings of this study are presented in Section 5 and Section 6, respectively.

## 2. Literature review and theoretical background

Environmental awareness has increased over the years; further, various environmental regulations have motivated managers to implement environmental strategies/activities in their organizations (Hervani et al., 2005; Zhu et al., 2005). Additionally, a large and growing body of literature on sustainable management emphasizes the convergence between SCM and environmental management (Wu et al., 2012; Yang et al., 2013). The extant literature on GSCM is reviewed in the following sub-sections.

### 2.1. Green supply chain management

Green supply chain management (GSCM) can be defined as a new type of framework for accomplishing CC by increasing environmental performance in the supply chain (Vachon and Klassen,

2008; Zhu et al., 2005). According to Hervani et al. (2005), GSCM involves environmental activities such as green purchasing, green manufacturing/material management, green distribution/marketing, and reverse logistics.

Most of the extant studies focused on the relationship between various elements of GSCM and corporate performance (Lirn et al., 2013; Yang et al., 2013). For example, Lirn et al. (2013) investigated the impact of green capabilities on firm performance in the container shipping industry. Vachon and Klassen (2008) found that environmental collaboration (EC) among buyers, suppliers, and customers influenced their performance. Some studies aimed to identify the drivers of and the barriers to GSCM (Govindan et al., 2013; Lee, 2008; Zhu and Sarkis, 2004). For instance, Govindan et al. (2013) described the barriers to the implementation of GSCM strategies in Indian manufacturing industries by using an analytic hierarchy process (AHP). Although these studies reported that GSCM has become a critical factor for the sustainability of firms, the results of these studies cannot be applied to the construction sector, which is an industry with a strong and negative environmental effect—this sector is responsible for about 40% of the world's total carbon emission (Cheng et al., 2008). Several studies applied GSCM to the construction sector to determine ways to reduce its environmental impact and increase environmental performance (Balasubramanian, 2012; Ketikidis et al., 2013; Thipparat, 2011). Thipparat (2011) evaluated GSCM practices using AHP and found that green purchasing and internal environmental management are the most important factors in GSCM. Although these studies tried to measure GSCM practices/implementation, few empirical studies examined the determinants of GSCM and the relationship among the various GSCM factors in the construction sector.

### 2.2. Information sharing

Information sharing (IS) at the firm level is a critical ability in supply chains for obtaining seamless and real-time information (Zelbst et al., 2010). In the context of a supply chain, IS refers to the ability of the supply chain members to communicate with one another in real time with shared values (Green et al., 2007; Vokurka and Lummus, 2000). Several prior studies investigated the advantages of IS in a supply chain (Green et al., 2007; Zelbst et al., 2010). Green et al. (2007) examined the impact of just-in-time information—a type of IS achieved using an enterprise resource planning (ERP) system—on organizational performance in terms of reducing waste or cost. Zelbst et al. (2010) examined the importance of radio frequency identification (RFID)-enhanced IS in improving supply chain performance.

Information sharing is required to achieve environmental improvement through GSCM without duplication of efforts and through the development of comprehensive solutions using the collective knowledge related to environmental activities (Daily and Huang, 2001). Handfield et al. (2005) reviewed how firms develop environmental supply chain strategies; they highlighted the importance of IS in sourcing decisions for the reduction of pollution. Lippmann (1999) provided the drivers of effective GSCM (such as supplier meetings and two-way information sharing) using case studies of leading firm. Although previous studies focused on IS for GSCM, they did not empirically deal with the impact that IS as a communication capability has on green collaboration and performance.

### 2.3. External green integration

External integration can be defined as the extent of working together with supply chain members to formulate inter-

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