Performance of green supply chain management: A systematic review and meta analysis

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Abstract

Environmental sustainability is nowadays driving firms to not only develop internal green activities, but also extend toward green supply chain management (GSCM). The extensive application of external GSCM by firms can be partially justified from perspective of transaction costs. GSCM practices are often considered to be prudent because studies suggested that such practices have a positive impact on firm performance according to the resource-based view. However, crucial questions still surround the practice-performance relationship. First, what is the overall relationship between GSCM practice and firm performance? Second, under what situations is the relationship stronger or weaker? To answer these questions, this paper focuses on quantitatively analyzing extant literature published in the field of GSCM. A random-effects meta-analysis is used to synthesize the empirical results of 54 selected literature with 245 effect sizes. Besides, subgroup analysis and meta-regression are applied to test potential moderators that may influence the strength of practice-performance relationship. We find that, internal and external GSCM practices are positively related, and they are both positively related to firm performance. Particularly, their relationship with environmental (r = 0.518) performance is the largest, followed by operational (r = 0.481) and economic (r = 0.464) performance. In addition, test of moderators discovers that industry type, ISO certification, export orientation and the cultural dimension of uncertainty avoidance all have moderating effect on the practice-performance relationship. Discussions and limitations are further addressed.

1. Introduction

These days as never before, people are much more conscious of the climate change and environmental sustainability (World development report, 2015). The constantly increasing green concerns in consumer markets as well as rapidly growing pressure from governmental regulations are now driving companies to manage their daily activities from an ecological perspective (Mutungi et al., 2014). Besides the cost, lead-time and quality, firms today need to consider the improvement of green performance as a fundamental competitive priority when doing businesses (Bloom and Morton, 1991; Azzone and Bertele, 1994). In earlier years, firms focused on the internal green measurements such as pollution control to alleviate the environmental influence of their production. Recently, external practices (e.g., green purchasing and eco-design) have started to be widely implemented because they come to realize that the environmental crisis in other firms can also bring harm to them via disruptions along the supply chain (Corbett and Klassen, 2000). Therefore, green supply chain management (GSCM) has then emerged as an important topic in both academia and practice, which requires firms to integrate environmental thinking into the whole supply chain.

Throughout the past decade, researchers have conducted a large number of relative investigations, and one of the main streams is to empirically examine the performance of GSCM, which is supposed to provide companies with constructive guidance for the adoption of specific practices (e.g., Zhu and Sarkis, 2004; Chavez et al., 2015; Govindan et al., 2015). However, the findings of prior empirical studies do not always correspond with each other, which may make practitioners confused when they intend to initiate GSCM and also prevent the further advancement of GSCM study. For instance, Rao and Holt (2005) indicated that firms adopting GSCM in Southeast Asia witness evident increases in both competitiveness and economic performance. But contrarily, Zhu et al. (2007) argued that...
little significant improvement in economic performance is found within firms adopting GSCM in China. Hence, there should now be a strong motivation for us to make a more comprehensive quantitative analysis of the prolific GSCM literature, which is able to shed light on those inconsistencies in prior empirical results by looking into potential moderators that might influence them.

Endeavors to consolidate previous empirical results of GSCM studies have also been made throughout these years. But most of them are either qualitative (e.g., Jung, 2011; Chen et al., 2013) or only based on small samples (e.g., Rao and Holt, 2005). Few of them have attempted to integrate the prior researches from a quantitative perspective. On the contrary, meta-analysis is a statistical technique designed to quantitatively synthesize research findings across a large number of studies, which has been used as an effective analysis tool in medical and clinical areas for over two decades (e.g., Lau and Chalmers, 1995; LeLorier et al., 1997; Borenstein et al., 2009; Bowater et al., 2015), and has also recently proved its efficiency in management field (e.g., Geyskens et al., 2009; Melo et al., 2009; Lu et al., 2015). The widespread use of meta-analysis attests to its growing reputation as a tool for consolidating prior knowledge and explaining mixed findings. Therefore, in our study, we abandon the traditional narrative and vote-counting methodologies, and then turn to meta-analysis, which can help us to address the two following research questions: First, what is the overall relationship between GSCM practice and firm performance? Understanding the link between GSCM and performance has valuable implications. The improvement of performance has always been a central aim for both researchers and managers (Luthra et al., 2013). If the link between GSCM and performance is strong, it may imply a need for researchers to dedicate growing attention to GSCM within their studies, and for firms to give more emphasis on developing environmental initiatives in their supply chains. However, if the link is weak, researchers and managers may regard the implementation of GSCM to be less imperative. The second key question about practice-performance relationship is as follows: under what situations is the link between GSCM and performance is stronger or weaker? Considering the broad diversity of firms seeking to improve performance through GSCM, it should be unlikely that the overall relationship between GSCM and performance remains constant for every single firm. Thus, discovering moderators that affect the strength of practice-performance relationship could also be an important issue, because it has implications for the ways how researchers construct theories about supply chains, as well as the decisions that managers make. For example, if the relationship is found to be stronger for firms with ISO certification, researchers might hope to build a theory to interpret why this difference happens and how to diminish it. In the meantime, managers may be motivated to achieve ISO certification in order to better explore the performance of their GSCM practices.

As mentioned above, we attempt to address these two research questions by using meta-analysis. Hunter and Schmidt (1990) put that this approach can combine the effects of multiple independent studies, which can lead to more robust conclusions than those presented in a single study. They further claimed that meta-analysis could correct for individual artifacts, such as sampling and measurement errors, and provide more accurate estimates of the investigated relationship than those narrative and vote-counting methods. Also, Olitzky and Benjamin (2001) added that meta-analytical tools (e.g., subgroup analysis and meta-regression) could shed light on generalizability of prior findings and determine whether different moderators impact the associations found. By synthesizing the empirical results of 54 selected literature, this paper intends to narrow the gap between what we already know and what we need to know about the relationship between GSCM and performance.

The remainder of this paper proceeds as follows. The literature review and hypotheses are developed in Section 2. And we subsequently elaborate on the criteria and procedures for shortlisting extant literature in Section 3. Moreover, a systematic review of selected literature is conducted in Section 4. In Section 5, we perform a meta-analysis to investigate the proposed hypotheses and a subgroup analysis to explore the effect of substantive moderators as well as a meta-regression to examine cultural moderators that moderate the practice-performance relationship. Findings are concluded in Section 6. And finally, we close our paper in Section 7 with the discussion of study implications and future agenda for GSCM research.

2. Literature review and hypotheses

Since the late 1980’s, when “the concepts of SCM and environmental management as strategic organizational practices to gain competitive advantage” emerged, a large variety of subtopics have been continually included into the study about GSCM (Luthra et al., 2014a; Fahimnia et al., 2015b). Basically, the research streams concentrate on two crucial issues. One relates to the relationship between GSCM practice and firm performance, whilst the other refers to the potential factors that may moderate this relationship (i.e., whether they exert positive, negative or neutral impacts on the relationship). And those two research streams are both incorporated in our theoretical framework, and are then discussed exhaustively as follows.

2.1. GSCM practices

GSCM practices are involved throughout the life cycle of green produces, from the product design to manufacturing, packaging and even after-sale service. Given the extensive scope of green practices, many literature attempt to categorize them comprehensively (e.g., Madu, 2007; Srivastava, 2007; Shang et al., 2010), among which the categorization method proposed by Zhu et al. (2008c) is the most commonly referred. They investigated the GSCM practice constructs and put forward a 21-item measurement scale for evaluating the GSCM implementations, reaching to the conclusion that green practices could be generally divided into five factors: internal environmental management (IEM), green purchasing (GP), customer cooperation (CC), investment recovery (IR) and eco-design (ED). Those five practices have been broadly studied in previous empirical researches about GSCM (e.g., Choi and Hwang, 2015; Gopal and Thakkar, 2016; Mangla et al., 2016). IEM relates to the practices from management within enterprises, such as the implementation of total quality environmental management (Ahmed, 2001) and the mid or top-level managers’ ecological commitment (Rice, 2003), while GP, CC, IR and ED are often referred as external initiatives.

More specifically, as an emergent GSCM approach, GP exerts notable influence on the upstream link of a company’s supply chain by specifying environmental requirements for its ordered products from suppliers and collaborating with them to realize its environmental targets (Zsidisin and Hendrick, 1998; Zhu et al., 2008b). Unlike GP, a close cooperation with customers affects the downstream segment of a company’s supply chain via collaborative activities such as customer education, customer support and joint ventures with the purpose to improve customers’ willingness to participate in ecological supply chain operations (Eltayeb et al., 2011). Apart from GP and CC, IR is also regarded as a key GSCM practice, which usually happens at the end of supply chain cycle (Zhu et al., 2008a). And according to Zhu and Sarkis (2004), it aims at encouraging the recycling of end-of-life products into other
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