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ScienceDirect

Procedia Manufacturing 8 (2017) 691 – 698

Procedia MANUFACTURING

14th Global Conference on Sustainable Manufacturing, GCSM 3-5 October 2016, Stellenbosch, South Africa

Interactions among inter-organizational measures for green supply chain management

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Abstract

Collaboration among supply chain partners is essential to enhance environmental performance during the life cycle of a product. Inter-organizational measures for green supply chain management tend to show diverse patterns because of various requirements that emerge in a complex supply chain. However, this diversity hampers the comprehensive understanding and systematic adoption of these measures. Therefore, this paper classifies various inter-organizational measures for green supply chain management into several collaboration patterns and analyzes their structural relations through an interpretive structural modeling. The results reveal the collaboration patterns that have higher driving power and dependency than other patterns and, thus, require further attentions.

Peer-review under responsibility of the organizing committee of the 14th Global Conference on Sustainable Manufacturing

Keywords: Green supply chain management, inter-organizational collaboration, interpretive structural modeling, product life cycle

1. Introduction

Improving environmental performance of product life cycle is based on closed-loop and boundary-spanning collaboration to minimize negative environmental consequences along the various stages of the supply chain [50,53]. Several studies have defined the green supply chain management (GSCM) through inter-organization collaboration. Sharfman et al. [43] introduced the term “cooperative supply-chain environmental management,” signifying activities

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Peer-review under responsibility of the organizing committee of the 14th Global Conference on Sustainable Manufacturing
doi:10.1016/j.promfg.2017.02.089

in which the focal firm and its suppliers collaborate to reduce negative environmental impacts along the product life cycle. Vachon and Klassen [53] defined "environmental collaboration" as the direct involvement of an organization with its supply chain partners in conducting joint environmental management and developing environmental solutions. The GSCM collaboration focuses not only on reducing the environmental consequences of material flows but also on improving operational process and product quality by fulfilling the demands in the supply chain [46].

The collaborative measures for GSCM tend to show diverse patterns [34,41]. Various collaboration measures can be applied for GSCM to deal with multiple requirements occurring in the complex supply chain. This behavioral diversity causes difficulties in the understanding and systematic implementation of the collaborative measures. In the field of environmental management, several researchers endeavored to identify significant collaborative GSCM measures [7,10,26,34,36,37,42,48,52,58] and classify the measures to observe possible causal relationships between the measures [2,21]. However, a holistic view in explaining how various collaborative measures influence each other and how the company-overlapping measures can be integrated for better GSCM remain lacking [41]. The conditions under which the collaborative environmental management develops have been also hardly examined [43].

This paper aims to understand the formation and interaction mechanisms of collaborative measures for GSCM. This paper identifies various collaborative measures from the literature on GSCM, traditional supply chain management (SCM), and environmental management and classifies them into 12 collaboration patterns. Basing on this classification, this study scrutinizes inter-relations between these patterns by using an Interpretive Structural Modeling (ISM) framework. A cross-impact matrix called MICMAC (Matrice d'Impacts Croises Multiplication. Appliquee a un Classement) analysis is also carried out to evaluate the driving power and dependence of the collaboration patterns.

2. Classification of inter-organizational measures for green supply chain management

This section identifies 12 collaborative measures for GSCM through a review of GSCM and SCM literature.

2.1. Information and knowledge sharing

Information and knowledge sharing is one of the most critical collaboration pattern because it can promote the understanding of the partners' goals, values, present status, and activities among others [25,30,41,45,47,49].

One-way transfer of requests and information - Manufacturers can effectively adopt GSCM by informing their supply chain partners of their requirements and compelling them to improve their status quo [8,52]. By directly asking partners about the required actions, the integration of their supply chain processes can be facilitated and their long-term relationship can be established [4]. The one-way request can also accelerate the monitoring and evaluation system for GSCM, where the requested tasks may be bound to the level of requirements that suppliers should cope with [4,26].

Interactive communication - The interactive communication covers a wide range of strategic and tactical information on business plans, operational process, performance, and best practices [46]. According to literature analysis by Seuring and Mueller [41], company-overlapping communication is regarded as one of the most crucial factors for sustainable SCM, because it can integrate other collaboration measures into a whole [46]. First, the communication activities are positively related to inter-organizational sharing of technical knowledge [6,13,21]. Second, the data derived from the communication can be utilized to evaluate the suppliers' performance [21,46,52]. Third, the increased transparency and flexibility due to the shared information enables manufacturers to easily compare their supply chain options and impose pressures on their partners' activities [52]. Finally, the communication influences trust building in inter-organizational relationships to achieve GSCM goals [6].

Provision of technical expertise - Providing technical aids can support the diffusion of information on the tacit knowledge [9,52], because each firm has different knowledge and expertise about the overall performance of the supply chain [46,56]. Ravi Shankar [37] underlined that the provision of technical training and education to chain members can contribute to process integration and the implementation of reverse logistics, in the supply chain.

2.2. Process integration

Process integration encompasses the integration of decision process [3,16,46], operations, logistics, information systems [3,28,46] and joint research and development [52]. Process integration consists of the three patterns.