

Chapter 13

Multi-Criteria Decision Making Models for Sustainable and Green Supply Chain Management Based on Fuzzy Approach

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ABSTRACT

Understanding different aspects of sustainability, supply chain management (SCM), and decision making policies and relating them to performance measurement have been increasingly investigated in the last decade. In contrast to traditional SCM, which typically focuses on economic and financial business performance, sustainable SCM (SSCM) is characterized by explicit integration of environmental or social objectives which extend the economic dimension. For evaluating the sustainability of SCM as well as its greenness, we have to consider many and different index and criteria. One of the best tools for assessing the SSCM and GSCM is multicriteria decision making (MCDM) techniques. Many studies have been conducted in this area. Moreover, there are many uncertainty factors which may reduce the accuracy of MCDM result. Actually, Uncertainty is always a worsening factor in any decision support models, and dilutes the planned objectives of such models. For decreasing this uncertainty, fuzzy logic has been combined with MCDM approach. In fact, the main purpose of this chapter is considering the recent studies in area of SSCM and GSCM regarding to applications of fuzzy MCDM techniques. At the end of this chapter, based on our investigations in applications of fuzzy MCDM in SSCM and GSCM and regarding to research gaps, some suggestions for future studies have been proposed.

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INTRODUCTION

In recent years sustainability in supply chain management has become an issue of increasing concern for organizations of all sizes across a range of industries and simultaneously it has become an issue of growing interest to academics (Validi et al, 2014). Sustainable supply chain network design is a complex and challenging task, as Linton et al, 2007 pointed that full consideration of sustainability in supply chains must look beyond the core supply chain to the whole product lifecycle, including recovery processes. It must take into account the key components of sustainable development including series of social, environmental, and economic objectives (Wu and Pagell, 2011). The three aspects above together are so-called triple bottom. They are compounded with the necessity to manage associated risks and to understand resulted systematic effects. Examples are to reduce corporate greenhouse gas emissions (environmental dimension), creating new employment opportunities (social dimension) while at the same time meeting financial targets such as revenue or profit (economic dimension) (Kannegiesser and Gunther, 2014; Validi et al, 2014). Actually, A sustainable supply chain is mainly concerned with the management of raw materials, parts/components, work-in-process inventories, and finished goods from the source of their supply (e.g. supplier) to the point of consumption in such a way that their adverse social, environmental, and economic impacts can be minimized (Zaarour et al, 2014). Supply chain network design (SCND) as a strategic decision, plays the main role in the performance of a supply chain. SCND contains the determination of locations, numbers and capacities of network facilities as well as the material flow through the network. The configuration of the logistics network cannot be changed in short term as its change is very costly and time-consuming. SCND is also a crucially important decision, as it constrains the subsequent tactical and operational decisions. While for many years, minimizing the total cost or maximizing the profit was the main objective of supply chains, nowadays, they are responsible for the environmental impacts of their products and operations, the health and safety of their employees and the whole society (Devika et al, 2014). Supply chains are shifting toward Sustainable Supply Chain Management (SSCM) with various motivations such as gaining public image (Fombrun, 2005), satisfying activists' requirements (Spar & La Mure, 2003), and maintaining customers for long term (Bhattacharya & Sen, 2004). Based on my research work, I found that there are many studies that consider the SSCM in many ways and aspects such as qualitative and quantitative approaches (Min & Kim, 2012) as well as empirical and numerical SSCM models. Actually many works on SSCM have been presented but the main remaining challenge is analyzing the interaction among sustainability aspects and optimizing their positive impacts on supply chain network. Another big challenge that previous studies have not consider is identification of effective criteria in supply chain network design. Moreover, despite the importance of financial aspects in SCM, few researchers have addressed the financial considerations in this area (Ramezani et al, 2014).

Sustainable supply chain is an area of research that recently attracted many of researchers of business and operations research. In order to improve the performance of sustainable supply chain, they applied different tools of operations research. One of tools that is been used to improve the capabilities of supply chain based on sustainability is multiple criteria decision making. Figure 1 indicates the application of decision making methods in supply chain management.

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