Chapter 2
An Integrated AHP–QFD–Based Compromise Ranking Model for Sustainable Supplier Selection

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ABSTRACT

Sustainability in industrial organizations has become a predominant concept in the 21st century due to environmental regulations, economic importance, and social obligations. In this context, sustainable supplier selection plays an epochal role for taking strategic business decisions. So, a systematic approach is required to deal with the sustainable factors. By integrating the three pillars of sustainability, namely economic, environmental, and social factors, this chapter presents an integrated model for supplier selection from a sustainability perspective. The proposed framework combines analytic hierarchy process (AHP) and quality function deployment (QFD) methods to deal with the sustainable criteria. Finally, suppliers are ranked using VIse Kriterijumska Optimizacija kompromisno Resenja (VIKOR) method. The proposed framework is used to analyze a case study of a dairy company, but it can also be implemented for sustainable supplier selection in any industries. The study brings an artefact for managers to effectively analyze suppliers with the integrated decision-making model.

INTRODUCTION

The management of social and environmental issues and the necessity to address them in parallel with the economic factors represents nowadays a top priority for managers and decision makers (DMs) in many sectors such as manufacturing, business development, tourism and agriculture (Amindoust et al. 2012). Such a synthesis of economic, environmental and social development is generally referred to as sustainable development or sustainability (Gauthier 2005; Dai and Blackhurst 2012). Sustainability in a supply chain management (SCM) applies to all relevant SC aspects: product design, material purchasing, manufacturing processes, final product delivery and reusing/ recycling design (Sarkis 2006; Srivastava 2007; Lin and Ho 2011). Managers' objective in sustainable SCM (SSCM) is the improvement of the economic condition of their organization focusing on what is needed not only to survive but also to prosper both in the near and the distant future. SSCM requires the managers to undertake social and environmental responsibility that can improve the economic performance (Carter and Liane Easton 2011; Sancha et al. 2015). In addition, supply chain managers must be aware of the environmental concerns and social aspects which are affected, by the choices they make in terms of supplier selection and supplier development, modal and carrier selection, vehicle routing, location and packaging. To select a network of sustainable suppliers is fundamental when designing new development and marketing strategies and more flexible models for the long-term policies of the organization (Dotoli and Falagario 2012; Pitchipoo et al. 2013), while it is essential when only limited resources are available (Carter and Liane Easton 2011). Therefore, one of the main questions in SSCM is to configure and implement an effective supplier selection process (Bayrak et al. 2007; Punniyamoorthy et al. 2011). Sustainable supplier selection problems (SSSPs) can be explained as classical supplier selection problems (SSPs) incorporating environmental and social factors to evaluate and rank the suppliers' performance in order for the managers to choose the optimal suppliers (Genovese et al. 2010). The problem is then to define a method flexible enough to allow for an overall evaluation as comprehensive and objective as possible of all the available suppliers. In this way, it is essential to run a systematic analysis of the interdependencies existing among the customer requirements (CRs) and the way they influence the technical requirements (TRs). However, from the theoretical background and managerial attitude this kind of analysis remains overlooked as a research gap that affects decision-making and long-run development planning.

Over the years, there has been an increasing attention in the number of studies combining several techniques for assessing suppliers' performance (Labib 2011; Zhang et al. 2012). Many contributions to sustainable supplier selection (SSS) have been obtained by employing multi-criteria decision-making (MCDM) tools (see, among others, Bottani and Rizzi 2008; Chen and Wang 2009; Awasthi et al. 2010; Amindoust et al. 2012). However, developing decision-making approaches to SSS through integrated methods can be very substantial since the single methods involve specific functions that provide stable solutions only if suitably combined together. Thus, the fuzzy decision approaches applied in the literature on green supplier selection mostly consist of fuzzy-integrated single model approaches (Govindan et al. 2015). In order to provide a meaningful and practical solution to SSSPs, this chapter proposes an integration of different MCDM tools, namely, analytic hierarchy process (AHP), quality function deployment (QFD), VIse Kriterijumska Optimizacija kompromisno Resenja (VIKOR) methods. Supplier selection problem is subordinated to both determining the degree of importance (weight) of the selection criteria and evaluating the suppliers with respect to these criteria (Ordoobadi 2009; Amindoust et al. 2012). In this study, these goals are achieved through an integrated MCDM model. The sustainable factors/criteria are defined based on the available literature. The main factors are interpreted as CRs and used to identify

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