A novel hybrid MCDM approach for complicated supply chain management problems in construction

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Abstract

The paper tackles a hybrid multi-criteria decision-making (MCDM) model related to supply chain management, problems, and the supplier selection problem. Modern management of materials and products requires continuous evaluation of numerous complex social, ecological, and economic factors. A group decision process using Analytic Hierarchical Process (AHP) approach presented to find the criteria weights. Measurement of conflict among criteria and decision makers presented with illustration and numerical example. Firstly, eight evaluation criteria, including cost, quality, distance, and delivery, reliability, reputation, and technology level, compatibility, and development ability identified. Later, the ARAS and the Multiplicative Utility function adopted for ranking and selecting suppliers. Criteria values normalized according to Hovanov method. The ARAS method with this normalisation method named as a hybrid original model INMUARAS.

Keywords: AHP; ARAS; Multiplicative utility function; hybrid model; INMUARAS; selection; construction; supply chain.

1. Introduction

The past few decades have seen increased concern for environmental issues by companies, governments, and the public. Since the 3Rs of Reduce, Recycle and Remanufacture are the basic requirement for green supply chain activities, a closed loop management from in-plant production to off-plant forward and reverse logistics has to be...
taken care of so that environmental impact and energy usage can be minimized.

Due to global intensive competition, many companies prioritize quick and precise responses to customers’ various demands improving their supply chain management. Many strategic issues that confront business today stem from the new rules of competition, globalization down pressure on price and the customer taking control. However, such activities not generate savings or revenues, and thus are non-understandably for companies as cost centres.

Examples of strategies used to achieve the aims include:

- Use of environment-friendly materials;
- Product or process modifications to improve efficiency and reduce attendant environmental releases;
- Optimal operation of processes to minimize consumption of energy or raw materials and generation of waste, and
- Implementing exchange of waste streams between process and plants to achieve industrial symbiosis.

Thus, decisions on supplier selection are as one of the most important aspects of production planning and control. The term of supply chain management firstly used in the 1980s. A supply chain includes all activities, functions, and facilities in the flow and transformation of goods and services from the material stage to the end user. The objective of supply chain management is to maximise value in the supply chain. In addition, selecting suitable suppliers significantly reduces material purchasing cost, improves the competitiveness of businesses, increases flexibility and product quality, and helps with speeding up the process of material purchasing.

Experience from management of any complex system points toward some guidelines for the selection of strategic paths:

- Once basic principles for the ultimate goal are clear, the individual’s potential for dealing with trade-offs and for optimizing chances in multidimensional and complex situations (e.g., medical treatment) grows with experience.
- The complete investment path need not necessarily be determined up-front, only smart flexible steps followed by continuous reassessment as the “game” unfolds.
- Beyond a certain level of specificity, checklists may confuse more than help decision makers.

Supply chains comprise potential suppliers, producers, distributors, retailers, customers, etc. (Fig. 1). The repetitive nature of supplier selection process and frequently changing customer demands lead to the increase in the uncertainty and ambiguity of this decision-making process. Therefore, in order to achieve the successful operation of an ASC, an effective supply partner selection becomes an essential process that may enhance effectiveness, efficiency, quality, safety and profit. Supplier selection defined as a process for identification of an efficient combination of suppliers, producers and distributors, depending on which the right mix and quantity of products and services provided to customers.
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