



An integrated fuzzy TOPSIS and MCGP approach to supplier selection in supply chain management

Chin-Nung Liao^{a,b,*}, Hsing-Pei Kao^{b,1}

^a Department of Business Administration, China University of Science and Technology, No. 245, Sec. 3, Academia Rd., Nankang, Taipei 115, Taiwan, ROC

^b Graduate Institute of Industrial Management, National Central University, No. 300, Jhongda Rd., Jhongli City, Taoyuan County 320, Taiwan, ROC

ARTICLE INFO

Keywords:

Fuzzy numbers
Supply chain management
Supplier selection
Multiple criteria decision making (MCDM)
Techniques for order preference by similarity to ideal solution (TOPSIS)
Multi-choice goal programming (MCGP)

ABSTRACT

Supplier selection is an important issue in supply chain management. In recent years, determining the best supplier in the supply chain has become a key strategic consideration. However, these decisions usually involve several objectives or criteria, and it is often necessary to compromise among possibly conflicting factors. Thus, the multiple criteria decision making (MCDM) becomes a useful approach to solve this kind of problem. Considering both tangible and intangible criteria, this study proposes integrated fuzzy techniques for order preference by similarity to ideal solution (TOPSIS) and multi-choice goal programming (MCGP) approach to solve the supplier selection problem. The advantage of this method is that it allows decision makers to set multiple aspiration levels for supplier selection problems. The integrated model is illustrated by an example in a watch firm.

© 2011 Published by Elsevier Ltd.

1. Introduction

Supplier selection is an important issue in supply chain management. Typically, manufacturer spends more than 60% of its total sales on purchased items, such as raw materials, parts, and components (Krajewsl & Ritzman, 1996). In addition, manufacturer purchases of goods and services constitute up to 70% of product cost (Ghodsypour & O'Brien, 1998). Therefore, the selection of suppliers is an area of tremendous importance and should be considered a strategic issue in the effective management of a supply chain. Supplier selection and its related tasks are positioned at the front end in the supply chain process (see Fig. 1).

During the 1990s, many manufacturers sought to develop strategic alliances with suppliers in order to upgrade their management preference and competitiveness (Kumar, Vrat, & Shankar, 2006; Shin, Collier, & Wilson, 2000). While coordination between a manufacturer and its suppliers is typically an important and difficult link in the channel of distribution, many methods have been adopted for supplier selection under rather simplistic perceptions of the decision making process (Chen, Lin, & Huang, 2006). However, supplier evaluation and selection are complicated by the need for decision makers (DMs) to consider various criteria.

The selection process mainly involves the evaluation of different criteria and various supplier attributes. This selection process

can essentially be considered a multiple criteria decision making (MCDM) problem, which is affected by different tangible and intangible criteria (Pi & Low, 2005). Since 1966, many criteria have been employed to evaluate and select supplier. Dickson (1966) identified 23 different criteria for supplier selection, based on which Weber, Current, and Benton (1991) suggested a number of selection criteria to measure supplier performance, such as price, delivery, quality, productive capability, location, technical capability, management organization, reputation, industry position, financial stability, performance history, and maintainability. Evans (1980) proposed that price, quality and delivery are key criteria for supplier evaluation in the industrial market. Shipley (1985) suggested that supplier selection involve three criteria, namely, quality, price and delivery lead time. Ellram (1990) suggested that in the supplier selection process, firms must to consider whether product quality, offering price, delivery time, and total service quality meet organizational demand. Tam and Tummala (2001) proposed an analytic hierarchy process (AHP) based model and adopted quality, cost, problem-solving capabilities, expertise, delivery lead time, response to customer requests, experience, and reputation in selecting telecommunications systems. Pi and Low (2005) suggested a method for supplier evaluation and selection based on quality, on-time delivery, price, and service quality.

Recently, the supplier selection process has received considerable attention in the marketing management literature. Chen et al. (2006) adopted a fuzzy decision making approach to address the supplier selection problem in the supply chain system. Five benefit criteria were considered, including the profitability of supplier, relationship closeness, technological capability, conformance

* Corresponding author. Tel.: +886 2 27821862x214; fax: +886 2 27864984.

E-mail addresses: lliao@cc.cust.edu.tw (C.-N. Liao), hpkao@mgt.ncu.edu.tw (H.-P. Kao).

¹ Tel.: +886 3 4227151x66154; fax: +886 3 4258197.

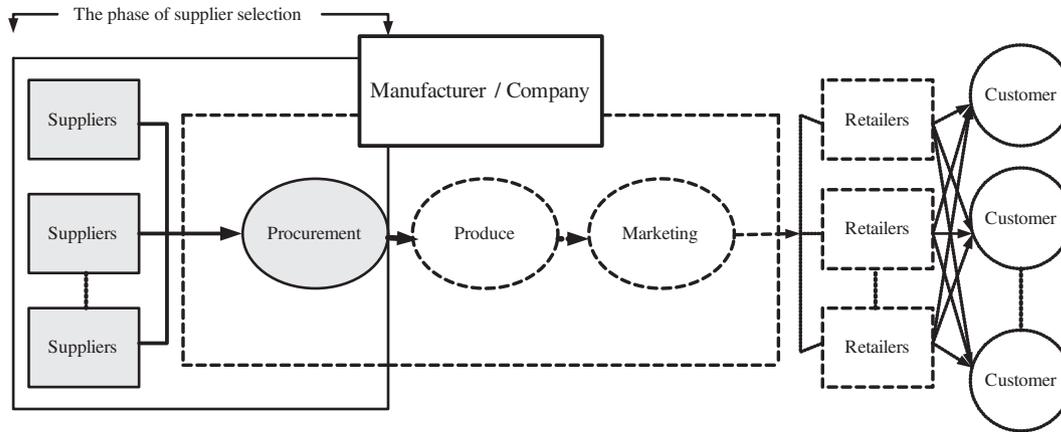


Fig. 1. The flow process of supply chain management.

quality, and conflict resolution. Lin and Chang (2008) claimed that communication, reputation, industry position, relationship closeness, customer responsiveness, and conflict-solving capabilities are important criteria in vendor selection. In addition, the role of organizational size in the supplier selection process has been addressed by Wang, Cheng, and Cheng (2009). Table 1 summarizes the criteria that have appeared in literature since 1966; most of the articles referenced above suggest that quality, price, and delivery performance are the most important supplier selection criteria.

Over the years, a number of techniques have been proposed to solve the supplier selection problem. The long list of approaches includes linear programming (LP), mathematical programming models, multiple-objective programming, statistical and probabilistic methods, data envelopment analysis (DEA), cost-based methods (CBM), case-based reasoning (CBR), neural networks (NN), AHP, analytic network process (ANP), fuzzy set theory, and tech-

niques for order preference by similarity to ideal solution (TOPSIS). Recently, the integration of different methodologies to supplier selection process has received considerable attention in the supply chain management literature. Faez, Ghodsypour, and O'Brien (2009) presented an integrated fuzzy case-based reasoning and mathematical programming method. Önüt, Kara, and Isik (2009) developed a supplier evaluation approach based on the ANP and TOPSIS methods to help a telecommunication company in vendor selection. Ha and Krishnan (2008) developed a hybrid model that including AHP, DEA and NN approaches to the supplier selection problem. Most recently, Kokangul and Susuz (2009) integrated AHP and mathematical programming to consider both non-linear integer and multiple-objective programming under certain constraints to determine the best suppliers. The integrated model uses source data provided by a manufacturing firm to address a real-world supplier selection problem.

Table 1
Supplier selection criteria literature review.

Selection criteria	1	2	3	4	5	6	7	8	9	10
Price (cost)	✓	✓	✓	✓	✓		✓			
Product quality	✓	✓	✓	✓	✓	✓	✓	✓		
On-time delivery	✓	✓	✓	✓	✓		✓			✓
Warranty and claims	✓									
After sales service	✓					✓				
Technical support/expertise						✓				
Attitude	✓									
Total service quality				✓			✓			
Training aids	✓									
Performance history	✓					✓				
Financial stability	✓				✓			✓		✓
Location	✓				✓					
Labor relations	✓									
Relationship closeness								✓	✓	
Management and organization	✓				✓					
Conflict/problem solving capability						✓		✓	✓	
Communication system	✓								✓	
Response to customer request										
Technical capability	✓				✓			✓		
Production capability	✓				✓					
Packaging capability	✓									
Operational controls	✓									
Amount of past business	✓									
Reputation and position in industry	✓				✓	✓			✓	✓
Reciprocal arrangements	✓									
Impression	✓									
Business attempt	✓									
Maintainability	✓				✓					
Size										✓

1, Dickson (1966); 2, Evans (1980); 3, Shipley (1985); 4, Ellram (1990); 5, Weber et al. (1991); 6, Tam and Tummala (2001); 7, Pi and Low (2005); 8, Chen et al. (2006); 9, Lin and Chang (2008); 10, Wang et al. (2009).

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات