



Creative Construction Conference 2017, CCC 2017, 19-22 June 2017, Primosten, Croatia

A Multi-Criteria Decision Model for Construction Material Supplier Selection

A.E. Cengiz^{a*}, O. Aytekin^b, I. Ozdemir^b, H. Kusan^b, A. Cabuk^a

^aAnadolu University, 2 Eylul Campus, 26470, Eskisehir, Turkey

^bEskisehir Osmangazi University, ESOGU Meselik Campus, 26480, Eskisehir, Turkey

Abstract

Supply chain management (SCM) is a sophisticated concept which contains all material-related activities of construction projects. In the last decade, construction supply chain management (CSCM) has become a new challenge for construction managers in order to procure right quantities of materials to construction site on time, and within the pre-defined budget. Supplier selection as a significant process in SCM is a multi-criteria decision making problem. There is a broad literature on supplier selection that examines selection of supplier evaluation criteria and multi-criteria decision making methods. Individual and integrated multi-criteria decision approaches are studied by many researchers. In this paper, supplier selection analysis for wall, cladding and roofing construction materials are researched. Whilst literature review and expert panel are employed in order to identify criteria, weights of each criterion are determined by an extensive questionnaire survey. Participants are selected from the experts in construction industry, universities and governmental institutions. Analytic Network Process (ANP) is utilized as multi-criteria decision making methodology and weights of criteria are obtained. This study is a section of an on-going doctoral research, in other words, a part of a more comprehensive model. The study is significant due to the development of a new approach on construction material supplier selection and the basis of the model that is able to provide decision support for construction project participants throughout the project life cycle.

© 2017 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the scientific committee of the Creative Construction Conference 2017

Keywords: CSCM; construction material; supplier selection; multi-criteria decision making; construction industry.

* Corresponding author. Tel.: +90-537-405-31-56
E-mail address: aemrecengiz@gmail.com

1. Introduction

In construction projects, material related activities constitute more than half of the total cost and have huge effects on project schedule. Thus a sophisticated management approaches are needed through the life cycle of construction projects. Supply Chain Management (SCM) is a featured management concept which emerged in 1980s, and found a broad scope of application on construction. Consequently, studies of SCM are now increasingly concentrating on the relationships between organizations involved rather than the traditional physical flow of materials and products [1]. Supplier selection problem has become one of the most important issues for establishing an effective supply chain system [2]. Supplier selection and evaluation is the process of finding the appropriate suppliers who are able to provide the buyer with the right quality products and/or services at the right price, in the right quantities and at the right time [3, 4]. Supplier selection is a multiple criteria decision making (MCDM) problem which involves both qualitative and quantitative criteria.

The aim of this paper is establishing a new approach on supplier selection of wall, cladding and roofing materials. Supplier selection criteria are identified based on supplier selection literature and an expert panel. An extensive questionnaire survey is implemented to professionals from construction companies, universities and governmental institutions. Results of the questionnaire survey are analyzed in SPSS software and weights of each criterion are obtained. ANP is implemented for 3 supplier alternatives with respect to 10 main criteria and 19 sub-criteria. This study is significant due to the development of a new approach on construction material supplier selection in Turkey. The study is the basis of the model that is able to provide decision support for construction project participants throughout the project life cycle.

2. Literature Review

Literature on supplier selection can be divided into two major categories; determining and weighting supplier selection criteria, and selecting the best supplier among alternatives by means of MCDM methodology. Early researches indicated that quality, delivery, price and supplier's capacity are the most significant criteria in supplier selection process [5, 6]. It is stated that technical acceptable material, gross price, discount rate, net price, progress payment, special charges, freight charges, total cost to destination, terms of payment, escalation, acceptance of project terms and conditions, promised delivery date based on award, shipping weight and expiration date of bidder's quotation are featured criteria in supplier selection [7]. In another research, 30 criteria are selected and a questionnaire survey is implemented. According to survey results, most commonly mentioned criteria are cost, quality, delivery performance, capability and culture [8]. Recent studies show that quality is the most popular criterion, followed by delivery, cost and capacity [1, 9]. Service, management, technology, research and development, finance, flexibility, reputation, relationship, risk, and safety and environment are also important criteria for supplier selection. Contrary to popular belief, price obtained the sixth rank in another paper. This means that market is moving toward competition and price is no longer the main factor [10].

MCDM methods are commonly used in order to analyze suppliers and select the optimum alternative. Extensive MCDM approaches have been proposed for supplier selection, such as the analytic hierarchy process (AHP), ANP, case-based reasoning (CBR), data envelopment analysis (DEA), fuzzy set theory, genetic algorithm (GA), mathematical programming, simple multi-attribute rating technique (SMART), and their hybrids [9]. Ma and Yang (2010) stated that supplier evaluation and selection methods are dependent on the type of material purchased [11]. A remarkable research on MCDM methods provide different multi-criteria decision making approaches in order to identify their weaknesses and strengths on comparison each other [4]. Linear weighted method, Categorical method, Fuzzy approach, and AHP are utilized in the study. It is concluded that each methodology has its own advantages and disadvantages depending on the need of the organization. In a systematic literature review, decision making methods are researched under categories of MCDM, mathematical programming and artificial intelligence. Research findings show that most frequently used technique in supplier selection is AHP, followed by linear programming, TOPSIS, ANP, DEA and multi-objective optimization [12]. While supplier evaluation factors influence each other and interdependency between criteria needed to be considered in the evaluation process, ANP is a suitable MSDM method. Sarkis and Talluri (2002) implemented ANP with respect to seven evaluating criteria to select the optimum supplier [3]. An ANP model is proposed to select the best supplier with respect to ten evaluating criteria which were

Download English Version:

<https://daneshyari.com/en/article/5026950>

Download Persian Version:

<https://daneshyari.com/article/5026950>

[Daneshyari.com](https://daneshyari.com)