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Developing a hybrid multi-criteria model for selection of outsourcing providers

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ABSTRACT

Outsourcing is a good strategy for firms that need to reduce operating costs and improve competitiveness, but it remains important for firms to scientifically select the appropriate outsourcing providers. Some efforts have been made regarding outsourcing problems, but these efforts incorrectly assumed that the criteria in the decision process are independent, which is not true in the real world. In this paper, we propose a new hybrid multiple criteria decision-making (MCDM) model, which addresses the dependent relationships among criteria with the aid of the Decision-Making Trial and Evaluation Laboratory (DEMATEL) method to build a relations-structure among criteria. The Analytical Network Process (ANP) is used to determine the relative weights of each criterion with dependence and feedback. The VIKOR method (*VlseKriterijumska Optimizacija I Kompromisno Resenje* in Serbian, meaning Multi-criteria Optimization and Compromise Solution) is then used to prioritize the alternatives. The proposed model can help practitioners improve their decision process, especially when criteria are numerous and inter-related. Throughout our study, we use data from a Taiwanese airline to demonstrate this method.

1. Introduction

Outsourcing can be simply defined as devising a contract with an external organization to take primary responsibility of providing business processes (Yang, Kim, Nam, & Min, 2007). Business outsourcing has become an ever-increasing trend in today's highly competitive markets. Firms can either embark on internal off-shoring (by setting up their own centers or subsidiaries in foreign countries while maintaining full ownership and control) or external off-shoring (by handing over business functions to independent foreign providers). Interest is growing among strategy and international business scholars to better understand how outsourcing can be used as a strategic device, or sometimes as a strategy itself, in order to create value (Kedia & Mukherjee, 2009). But the concept of outsourcing is not new. External service providers in areas such as facilities operations, finance, accounting, logistics, legal services, marketing, and customer care have existed for a long time. However, elements such as new technologies, delivery models, globalization, and a more demanding end-user continue to provide impetus for outsourcing activities (Yang et al., 2007). The result – firms' increased efficiencies and abilities to focus on core competencies – has produced real profits and increased customer satisfaction. Nevertheless, ineffective outsourcing activities, derived from improper strategies or methods, will lead to a loss of core competencies and capabilities, exposure to unexpected risk, and business failures (Wang & Yang, 2007). Therefore, a scientific decision process for choosing outsourcing providers is very important to increasing the success rate of outsourcing.

Early researchers most commonly illustrated outsourcing decisions by using transaction cost theory. However, in recent years, strategy aspects such as core competency, risk analysis, and organizational flexibility have been growing in importance. As a result, this trend has led researchers and industries to become more interested in the multi-criteria decision model for outsourcing. The goal of the multiple criteria decision-making (MCDM) method is to aid decision-makers in integrating objective measurements with value judgments which are not based on individual opinions, but rather on collective group ideas (Belton & Stewart, 2002). Some researchers (Wang & Yang, 2007; Yang et al., 2007) have applied the MCDM method to different outsourcing issues. But their work assumed the criteria were independent, and used AHP (analytic hierarchical process) to construct a model of the outsourcing problems. In the real world, criteria are seldom independent and always have a degree of interactive relationships, sometimes with dependence and feedback effects (Tsai & Chou, 2009; Tzeng, Chiang, & Li, 2007).

In this paper, we shall use the DEMATEL method to construct the interrelationship between criteria, and will also use the ANP method (which releases the restriction of the hierarchical structure) to determine the weights of criteria. We will then use the VIKOR method to prioritize the alternatives. Therefore, the objective of this paper is to offer a quantitative decision model that can help practitioners set priorities and reap the most benefits from outsourcing. We use data from a Taiwanese airline to demonstrate this model. This genetic model can be easily extended to other

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industries, helping other types of firms to maximize their outsourcing benefits.

The rest of this paper is structured as follows. Section 2 summarizes some important previous research regarding outsourcing and describes problem characteristics. Section 3 reviews the basic concepts of the DEMATEL, ANP, and VIKOR. Section 4 illustrates an empirical example used to validate our model. The results and discussions of this empirical study are presented in Section 5. Section 6 contains the conclusions and final remarks.

2. A brief review in outsourcing

Outsourcing occurs when one company hands over a part of their existing internal activity to another company via contract (McCarthy & Anagroustou, 2004). The purpose of outsourcing is to create value from outside, rather than within, the company. Outsourcing has become an important business approach, and competitive advantages are often gained as products or services are produced more efficiently by outside suppliers (Yang et al., 2007). Outsourcing could be used by and for a company to strengthen its position in today's competitive markets.

The main reasons for outsourcing usually include cost savings, a focus on core competency, and flexibility in management. Although cost savings are still a very important consideration, Hamel and Prahalad (1994) argue that companies which measure competitiveness solely in terms of price are actually contributing to the erosion of their core competence. Their main idea is that only products and services, which are regarded as core competencies, should be produced internally. Outsourcing non-core activities also increases flexibility through better use of international resources; it enables quick responsiveness to customer needs and decreases financial risk by reducing capital investments (Ellram, Tate, & Billington, 2008). However, management needs to carefully consider the related shortcomings of outsourcing along with its benefits. The generally recognized disadvantages include: information security, loss of management control, morale problems, and labor union issues. Furthermore, many companies have found that outsourcing activities have introduced unexpected complexities, added costs and friction to the value chain, and required more senior management attention and deeper management skills than initially anticipated (Howell, 1999).

The majority (around 70%) of the US industry appears to have had negative experiences with outsourcing (Verma, 2005). This is a result of a lack of comprehensive evaluations, which can be used to come up with the best candidates for outsourcing. With this acknowledgement, there have been a number of studies determining the most effective manner of selecting outsourcing providers. Hsu and Hsu (2008) presented an entropy-combined technique for order preference by similarity to ideal solution (TOPSIS) based decision-making method for medical information system outsourcing. Sarder, Rogers, and Prater (2006) conducted outsourcing SWOT analyses for some US industries. They concluded that there was no correct answer to choosing the best outsourcing strategies and that many criteria/factors should be considered in the process. Lee and Kim (2005) analyzed the structural relationship among the determinants of an outsourcing partnership and identified the relationship between partnership-related variables and outsourcing success. They identified six key factors of a successful partnership in areas of outsourcing, working partnerships in marketing, and strategic alliances in management. Their proposed six inter-relative key factors are: shared knowledge, organizational linkage, mutual dependency, benefits, commitment, and predisposition. Some other researchers (Wang & Yang, 2007; Yang et al., 2007) have used different MCDM models to investigate information systems outsourcing. However, these studies did not consider the inter-relationship between criteria. Jharkharia and Shankar (2007) applied the ANP method to help firms select logistics service providers but did not clarify how to generate the relationship between criteria. Our new approach, a hybrid model combining the DEMATEL, ANP, and VIKOR methods, accounts for the more complex relationships among relative criteria/factors and feedback effects, and can be utilized as an outsourcing decision model for the airline industry (and may also be easily extended to other industries in the real world).

3. Proposed model: a novel hybrid model of DEMATEL, ANP, and VIKOR

In this section, we introduce the concepts of the DEMATEL (to establish the relations-structure model in evaluation problem), ANP (to determine criteria weights with dependence and feedback) and VIKOR (to prioritize alternatives) models.

3.1. Clarifying the interrelation between criteria

In a complex system, all system criteria are either directly or indirectly mutually related. Therefore, in such intricate systems, it is very difficult for a decision-maker to obtain a specific objective/aspect if he/she wants to avoid interference from the rest of the system. While the vision of a totally interdependent system leads to passive positions, the vision of a clearer hierarchical structure leads to linear activism, which neglects dependence and feedback and may also engineer many new problems in the process of solving others (Tzeng et al., 2007).

The DEMATEL approach, used for researching and solving complicated and intertwined problems, was successfully applied in many areas, such as marketing strategies, e-learning evaluations, control systems, safety problems, and cause analyses (Chiu, Chen, & Tzeng, 2006; Tamura, Nagata, & Akazawa, 2002; Tseng, 2009; Tzeng et al., 2007). DEMATEL was developed with the belief that the pioneering and appropriate use of scientific research methods could improve understandings of the specific *problematique* (the cluster of intertwined problems) and help identify workable solutions through a network structure. This methodology, according to the concrete characteristics of objective affairs, can confirm the interdependence among the variables/criteria and restrict the relations that reflect characteristics with essential system and development trends. The end product of the DEMATEL process is a visual representation that a respondent can use to organize his or her own actions in the world (Liou, Tzeng, & Chang, 2007).

The DEMATEL method can be summarized in the following steps:

Step 1: calculate the initial average matrix by scores. Respondents were asked to indicate the direct effect that they believe each element i exerts on each element j of others, as indicated by a_{ij}, according to an integer scale (scores) ranging from 0 to 4, representing: "no influence (0);" "low influence (1);" "medium influence (2);" "high influence (3);" and "very high influence (4)." From any group of direct respondent matrices, we derive an average matrix $\boldsymbol{A}$. In this case, each element of this average matrix will be the mean of the same elements in the different direct matrices of the respondents.

Step 2: calculate the initial influence matrix. The initial influence matrix $\boldsymbol{D}$ ($\boldsymbol{D} = [d_{ij}]_{n\times n}$) can be obtained by normalizing the average matrix $\boldsymbol{A}$ as shown by degree (i.e., shown by membership and $0 \leqslant d_{ij} < 1$; also called a "fuzzy cognitive matrix"), in which all principal diagonal elements are equal to zero. Based on matrix $\boldsymbol{D}$, the initial effect that an element exerts and receives from another is shown. The map portrays a contextual relation among the elements of a system, in which a numeral represents the strength of influence (affected degree). For example, as shown in Fig. 1, an