Knowledge-Based Systems 28 (2012) 59–67

Contents lists available at SciVerse ScienceDirect

Knowledge-Based Systems

journal homepage: www.elsevier.com/locate/knosys

Developing an integrated model for the selection of strategic alliance partners in the airline industry

James J.H. Liou *

Department of Industrial Engineering and Management, National Taipei University of Technology, No. 1, Section 3, Chung-Hsiao East Road, Taipei, Taiwan

ARTICLE INFO

Article history:
Received 6 June 2011
Received in revised form 24 November 2011
Accepted 24 November 2011
Available online 3 December 2011

Keywords:
Strategic alliance
ANP
DEMATEL
Fuzzy preference programming
Airline

ABSTRACT

This study proposes a hybrid model to help airlines select suitable partners for strategic alliances. The model addresses the interdependency and feedback effects between criteria and alternatives by using the Decision-Making Trial and Evaluation Laboratory (DEMATEL) and Analytic Network Process (ANP). Decision-makers may hold diverse opinions and preferences due to incomplete information, differences in knowledge or simply inherent conflicts between various departments. This can make it difficult to judge the importance of the selection criteria. To remedy the problem we further apply Fuzzy Preference Programming (FPP) to integrate the different expert opinions. The proposed model can help practitioners improve their decision making process, especially when criteria and alternatives are numerous and interrelated. The method is demonstrated using data from a Taiwanese airline. Specific companies can easily extend this generic model to address their individual needs.

1. Introduction

Strategic alliances are increasingly being perceived as critical elements of united business networks, and as strategic weapons for competing within core markets and technologies. However, the intercultural and inter-organizational nature of strategic alliances results in enormous complexity, dynamics, and challenges in managing this cross-border, hybrid form of organization [11]. Prior studies have suggested that the choice of a particular partner is a crucial variable affecting alliance performance, since it influences the mix of skills and resources which will be available to the participating firms and thus the alliance's ability to achieve its strategic objectives [16,18,32]. These studies have typically cited the need for selecting the "suitable" or "poor" partner, particularly when a strategic alliance involves a firm's core markets or technologies. If they have a suitable strategic partner in the airline industry, airlines cannot only concentrate on running the routes that they have a comparative advantage, but may also expend output by extending the reach of their networks via the shared routes of member airlines [8]. However, a poor strategic alliance can sometimes lead to a loss in core competencies and capabilities, increased exposure to unexpected risks and even business failure, as was the case for Swissair. Financial statements show that Swissair's airline alliance policy and related investment strategies were responsible for the majority of its losses from 1997 to 2001 [24].

Although the importance of selecting the appropriate partner to fulfill the strategic goals involved in forming a strategic alliance has been recognized in the literature, there have been few empirical studies carried out that stress how to choose such a partner and how to analyze the interrelationship among said partners. Therefore, the objective of this study is to apply a developed hybrid multi-criteria decision model for selecting a suitable strategic alliance. The goal of the multiple criteria decision-making (MCDM) method is to aid decision-makers to integrate objective measurements with value judgments not based on individual opinions, but rather on collective group ideas [2]. Some have striven to apply the MCDM method to different issues [12,28,29], but have assumed the criteria to be independent, using the AHP (analytic hierarchical process) to construct a model. In the real world, partner selection criteria are seldom independent and always have a degree of interactive relationships, sometimes with dependence and feedback effects [27]. Further, partner-related selection criteria require a firm to consider whether the corporate cultures of the partners are compatible and whether trust exists between the partnered management teams. Thus, the selected partner and the focal firm should have organizational interdependence.

In addressing the above situations, the DEMATEL method is used to construct the interrelationship between criteria and alternatives, and the ANP method (which releases the restriction of the hierarchical structure) is used to determine the weights of the criteria. However, due to problems such as incomplete information and subjective uncertainty, even experts find it difficult to quantify the precise ratio of weights for the different criteria. The concept of

* Tel.: +886 2 27712171x2332; fax: +886 2 27317168.
E-mail address: jamesjhliou@gmail.com

0950-7051/$ - see front matter © 2011 Elsevier B.V. All rights reserved.
doi:10.1016/j.knosys.2011.11.019

fuzzy sets has been incorporated into AHP to deal with the problem of uncertainty, although ANP has not often been used to address this type of problem in fuzzy environments. A way to cope with uncertain judgments and to incorporate the vagueness that typifies human thinking is to express preferences as fuzzy sets or fuzzy numbers [1,30]. Therefore, three methods are incorporated in this study. First, we construct the impact-relationship map (IRM) obtained from DEMATEL which can help the user visualize the complex relationships between the criteria and the selected partners. Second, based on the results of IRM we consider the interdependence and feedback effect between criteria and partners by applying the ANP. Third, the model can avoid the convergence problem and it is more practical for actual applications than ANP because of using fuzzy preference programming. What distinguishes the present study from its predecessors is that we consider both the organizational and criterion interdependence and uncertainties of human thinking. Data from a Taiwanese airline is used to demonstrate this model. This generic model can be easily extended to other industries, to help other types of firms to maximize their benefit from strategic alliances.

2. The partner selecting criteria for strategic alliance

Previous studies [10,13] have raised the topic of strategic alliances varying according to their specific contexts, attempting to identify a universal list of criteria which firms should employ when seeking a complementary partner would be futile. However, during the process of formatting a strategic alliance, a firm must first identify appropriate criteria for strategic partner selection as well as the relative importance of each criterion since selecting a "suitable" partner is the key factors for successful strategic alliances. Luo [11] suggested the criteria can be classified into three categories related to: (i) tasks or operations; (ii) partnership or cooperation; and (iii) cash flow or capital structure. Operation-related criteria are associated with the strategic attributes of partners including marketing competence, relationship building, market position, strategic orientation and corporate image. Cooperation-related criteria include organizational leadership, organizational rank, learning ability, and human resource skills. Cash flow-related criteria generally represent profitability, liquidity, leverage and asset efficiency [11]. Geringer [7] distinguished between criteria associated with the operational skills and resources which a firm requires for its competitive success (i.e., task-related criteria) and criteria associated with the efficiency and effectiveness of partners' cooperation (i.e., partner-related criteria). The task-related criteria refer to technical knowhow, financial resources, experienced managerial personnel, and access to marketing and distribution systems. In contrast, partner-related criteria include corporate culture, the degree of favorable past association between partners, compatibility and trust between partners' management teams, and a partner's organizational size or structure. Brouthers et al. [4] defined four Cs for a firm which is considering forming a strategic alliance. They concluded that a strategic alliance should be utilized when: (i) complementary skills are offered by partners; (ii) cooperative cultures exist between the firms; (iii) firms have compatible goals; and (iv) commensurate levels of risk are involved. Strategic alliances themselves are as fraught with peril as the emerging competitive environment, and an inappropriate choice of an alliance partner could prove to be even more dangerous than operating as a single firm. On the other hand, Medcof [13] deemed that the four Cs for partner selection should be capable, compatible, committed, and control. From process consideration, Evans [6] suggested that three stages should be considered in alliance formation: analysis, formation and implementation. In the analysis stage an airline should evaluate risk sharing, economics of scale, access to assets, global competition, etc. The formation stage includes marketing agreements, joint ventures, licensing agreements, mergers and acquisitions. As in the implementation stage, airlines should assess capability, compatibility, commitment, control, and geographical fit.

Based on the prior studies and the complexity and uncertainty associated with the criteria of partner selection when forming a strategic alliance, we conclude there are no universal or exact selection criteria for strategic alliances; thus, strategic alliances mean different things to different industries. This seems to suggest that the concept of strategic alliance is context-dependent, and its evaluation should reflect the operational environment being investigated. The proposed methodology for partner selection and how to extract the evaluating criteria in the airline market are briefly described in the subsequent sections.

3. An integrated model combining DEMATEL, fuzzy preference programming and ANP

In this section, we introduce the concepts of the DEMATEL (to establish the relations-structure model in evaluation problem), fuzzy preference programming (to decide upon the pair-wise comparisons from imprecise judgment), and ANP (to determine criteria weights with dependence and feedback) methods.

3.1. Clarifying the interrelation between criteria

In a complex system, all system criteria are either directly or indirectly mutually related. 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. The DEMATEL approach, used for researching and solving complicated and intertwined problems, has been successfully applied in many areas, such as marketing strategies, e-learning evaluations, control systems, service quality, safety problems and cause analysis [5,23–27]. DEMATEL was developed with the belief that the pioneering and appropriate use of scientific research methods could improve understanding of the specific *problematique* (the cluster of intertwined problems) and help to 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.

The steps in the DEMATEL method can be summarized as follows:

Step 1: *Calculate the scores for the initial average matrix*. 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}, using an integer scale (scores) ranging from 0 to 4: "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 $\boldsymbol{D}$ ($\boldsymbol{D} = [d_{ij}]_{mxn}$) 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