Agents and Factors Evaluation in IT Infrastructures Projects Using TOPSIS Method

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Abstract As international corporate activities increase and specialization develops, the prevailing competitive relationship in the IT industry is no longer the simple competition between enterprise and enterprise, but becoming the competition among strategic alliances. So the selection of alliance factors has become the most important problem for the IT enterprise in KM strategic alliance to make decisions. Factors’ performance decides the effectiveness of the KM strategic alliance and can lead to the success and failure of strategic alliance. The evaluation and selection of appropriate partner is a multi—objective and multi—layer comprehensive problem, and some evaluation factors are subjective. To evaluate the factors objectively, this paper establishes the index system of factors in KM strategic alliance according to BSC index model. In the process of evaluating and selecting factors based on TOPSIS method to standardize the evaluation result so that we can get more objective and effective evaluation result and get the final appropriate partner.

Key words: KM strategic alliance, partner, selection, evaluation, TOPSIS

INTRODUCTION

Knowledge-based assets are now widely recognized by scholars and managers as the most valuable resources of modern organizations. Knowledge management (KM) has been proven to be necessary for effective organizations and competitive strategy in the new millennium. However, rapidly changing competition, continuing technological innovation, shortening product life cycles, rising internationalization of markets and evolving customer preferences have led to greater numbers of strategic alliances and networks (Ohmae K, 1989, Winter, G. S., J. McIntosh & D. May, 2003). These dramatic and simultaneous changes forced managers of IT enterprises to realize that they may not have all the human or technological resources necessary to respond effectively. Consequently, many managers are trying to shift their strategic focus away from preempting competition to a broader view of building competitive advantage through a selective and often simultaneous reliance on both collaboration and competition (Bardett, C.A. & S. Choshal, 1992; Brass, D. J., J. Galaskiewicz, H.R. Greve & W. Tsai, 2004;Gimeno, J, 2004). Ohmae claimed that “globalization mandates alliances, makes them absolutely essential to strategy” (Ohmae K, 1989). The alliance that combines many factors has faster responding to customer's service demand and it will become an important organizational form of IT enterprises in the future. With limited resources, the KM strategic alliances will enable individual IT firms to share risks and resources, exchange knowledge, and access new markets. It is bringing great changes to IT enterprises on their services, the capital and the knowledge value and also making a great change on promoting and enhancing the partner response capability, the innovation ability, the personnel skill and the enterprise efficiency. KM strategic alliances is becoming an important part of enterprise knowledge management

Cooperative Factorship in strategic alliance refers to one kind of coordinated relationship, which is formed among the factors in the strategic alliance (Mathews J., Tyler A., Thorpe A.,1996). Factors in the KM alliance share the information, risk and benefit to achieve some specific goal and get optimal interests. The performance level of factors influences the common interests of each member in strategic alliance directly. So the core enterprise’s objective evaluation and preferential selection to factors is the most important factor for the effective operation of the whole KM strategic alliance. The selection of strategic factors is a complicated process, thus while the core enterprise selecting the appropriate factors from a lot of candidate enterprises, it must weigh various factors from different aspects and investigate candidate enterprises in an all-round way to make the optimum choice finally.

Since partner selection is crucial and complex, it is necessary for decision-makers to devise effective partner selection criteria and choose advanced evaluation method to evaluate and select appropriate factors. So we choose AHP-TOPSIS method to carry on research to evaluate and choose the cooperative partner in KM strategic alliance.

2 Research Method: AHP-TOPSIS:

AHP (analytic hierarchy process) is a method which is developed by Saaty to support MCDM (Multiple Criteria Decision-Making). The principle of AHP is (T.L. Saaty, 1980).

- Analytic indicates that the problem is broken down into its constitutive elements.
- Hierarchy indicates that a hierarchy of the constitutive elements is listed in relation to the main goal.
AHP is a widely popular technique employed to model subjective decision-making processes based on multiple attributes. Application of AHP in MCDM environments involves defining a common hierarchy of criteria, specifying pairwise comparisons by members of the group, and aggregating those pair wise comparisons for the entire group (T.L. Saaty, 1980).

Technique for order performance by similarity to ideal solution (TOPSIS), one of the known classical MCDM methods, was first developed by Hwang and Yoon for solving a MCDM problem. It bases upon the concept that the chosen alternative should have the shortest distance from the positive ideal solution (PIS) and the farthest from the negative ideal solution (NIS). In the process of TOPSIS, the performance ratings and the weights of the criteria are given as crisp values (Chen-Tung Chen, 2000).

The integrated application of AHP and TOPSIS in multi-objective and multi-layer evaluation can absorb advantages of the two methods and can get rid of the insufficiencies of each method. With the integrated application of the two methods the evaluation process will be easier to be operated and the evaluation result will be more objective.

3 The Establishment of Evaluation Index System:

After determining the evaluation method of KM strategic alliance partner we need to establish the corresponding evaluation index system. The establishment of evaluation index system is the basis of the evaluation to KM strategic alliance factors. The evaluation index system reflects the characteristic of IT enterprises and the environment of IT industry. There are many factors that influence the evaluation and selection of IT factors. The key factors on IT partner's evaluation are finance, customer, human resource, information technology and learning and growth of organization. According to the key factors that the IT enterprise in the KM alliance cares about, this paper use BSC index model as reference and determines the evaluation index system of partner in KM alliance.

3.1. BSC reference model:

Kaplan and Norton (Kaplan, R. S. & Norton, D. P. 1996) have proposed the use of balanced scorecard (BSC) as a tool for performance measurement and strategic management to business organization for more than a decade. The balanced scorecard provides a framework for selecting multiple performance measures that supplement traditional financial measures with operating measures of customer satisfaction, internal processes, and learning and growth activities (table 1). These performance metrics involved in BSC are adopted as the basic criteria for evaluating a IT enterprise’ performance. But we can also remove or add metrics based on this reference model according to the content and target of our research.

| Financial     | Sales margins                  |
|              | Sales growth per store         |
|              | Inventory turnover             |
|              | Debt-to-assets ratio           |
| Customer     | Price relative to competitors’ price |
|              | Customer satisfaction rating   |
|              | Sales per square foot of retail space |
|              | Number credit card per store   |
| Internal process | Brand recognition rating     |
|              | Number of stock-outs           |
|              | “Mystery shopper” audit rating |
|              | Time to process customer returns |
| Learning and Growth | Employee satisfaction |
|              | Employee suggestions per year  |
|              | Store computerization          |
|              | Hrs. of training invested in brand managers per year |

3.2. Determination of the Final Index System:

On the basis of BSC model and considering the operating characteristic of the IT enterprises, we establish the evaluation index system of KM alliance partner. The index system can be divided into three layers according to the principle of AHP, as shown in Figure1. The top layer of these indexes is the goal of the evaluation system, namely selecting the most appropriate factors. The second layer is the brief criteria which defines the basic factors to achieve the goal of the evaluation system. The third layer is the detailed criteria which describes the detailed indexes that belong to each brief criteria. Through applying this index system and effective evaluation method to the evaluation of factors, decision makers can get the final decision about which factors to select.
4 Evaluation and Selection Process Based on AHP-TOPSIS:

After the determination of the index system and primary selection of cooperative factors, we can employ AHP and TOPSIS to carry on the evaluation of these primary factors and to select the final appropriate factors. The concrete evaluation and selection courses are shown as follows: First of all, establish the determine matrix. By comparing the relative significance levels of one layer of criteria to its upper criteria between every two layers from the second layer we can get the determine matrix \( A \) of relative significance levels.

\[
A = \begin{bmatrix}
    a_{11} & a_{12} & \cdots & a_{1n} \\
    a_{21} & a_{22} & \cdots & a_{2n} \\
    \vdots & \vdots & \ddots & \vdots \\
    a_{n1} & a_{n2} & \cdots & a_{nn}
\end{bmatrix}
\]

Secondly, the evaluation matrix should be normalized. The process of normalization is to transform different units among various criteria into common measurable units to allow comparisons across the criteria. The method of normalization is showed in equation (1):

\[
r_{ij} = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}} \quad (j = 1,2,\ldots,n) \quad (1)
\]

Third, Check the consistency of determine matrix, if it can pass and examine, calculate the accumulative weight coefficients of criteria on this layer \( w_j \).

Forth, construct the weighted normalized evaluation matrix. From calculating the matrix of weight and the result of \( r_{ij} \), we can get the weighted normalized evaluation matrix. It can be calculated by multiplying the normalized evaluation matrix \( r_{ij} \) with its associated weight \( w_j \) to obtain the result \( V = [w_j r_{ij}] = [v_{ij}] \) (T.L. Saaty, 1980).

Fifth, determine positive and negative ideal solutions: the PIS (positive ideal solution) \( A^+ \) indicates the most preferable alternative, and the NIS (negative ideal solution) \( A^- \) indicates the least preferable alternative (T.L. Saaty, 1980).

Sixth, calculate the separation measure: the separation from the positive and negative ideal for each alternative can be measured by the n-criteria Euclidean distance:

\[
DA^+ = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_{ij}^+)^2} \quad i = 1,2,\ldots,n \quad (2)
\]

\[
DA^- = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_{ij}^-)^2} \quad i = 1,2,\ldots,n \quad (3)
\]

Seventh, calculate the relative closeness to the ideal solution: the relative closeness of the \( i^{th} \) alternative with respect to ideal solution \( A^+ \) is defined as:

\[
CC_i = \frac{DA^-}{DA^+ + DA^-}
\]

Eighth, to rank the priority: According to equation (4) we can get the relative closeness of to the ideal solution to each of the alternatives. A greater value of \( CC_i \) indicates a higher priority of the factors, so the factors can be ranked based on the value of \( CC_i \), and we can get the most appropriate factors.

5 Conclusion:

This paper proposes a comprehensive evaluation process of the IT enterprise in KM strategic alliance to evaluate and select factors by combining AHP with TOPSIS method. This paper first establish the evaluation index system of the selection of KM alliance factors according to the characteristics of KM strategic alliance and the principle of AHP, then we sum up the calculate process of applying AHP and TOPSIS to the evaluation and selection of KM alliance factors. By combining AHP and TOPSIS we can get more objective and optimized. At the end of this paper we provide concrete process about how to evaluate and select the KM strategic alliance factors based on AHP-TOPSIS.
Fig. 1: The index system of partner evaluation and selection in KM strategic alliance of IT Enterprise.

REFERENCES


