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Applying ANP approach to partner selection for strategic alliance

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Abstract

Purpose – The purpose of this paper is to establish a mechanism for partner selection via adapting relative weights of criteria according to the priority of motivations for establishing strategic alliance.

Design/methodology/approach – The analytic network process (ANP) approach derived from the idea of the Markov chain is employed to deal with this dynamic situation and to establish a partner selection mechanism. With this approach, the priority of motivations and the relative importance of criteria are determined simultaneously.

Findings – Although choosing an appropriate partner is an important variable influencing success of alliance, attempts to identify a universal list of criteria and their corresponding relative importance which enterprises should employ when seeking a proper partner would be futile since the objectives of forging alliances vary depending on specific motivations. Based on this iterative review approach proposed in this paper, a proper weight setting for these criteria is available and will comply with the original motivation for establishing the strategic alliance. This is essential for selecting an appropriate partner for establishing an alliance that matches the original motivation.

Research limitations/implications – The limitation of this research is the neglect of the possible inner dependence among criteria and sub-criteria, although that can be coped with by choosing them properly.

Practical implications – The content of motivations and criteria as well as their priority and weightings may vary with different kinds of alliances or situations. The partner evaluation and selection mechanism proposed in this paper can meet different situations by adapting the relative weights of criteria and attributes according to the relationship between the criteria and motivations for every particular situation, thus enabling decision-makers to think more comprehensively before conducting a selection process. If the priority of the motivations obtained from the mechanism is consistent with that set initially, the relative weights of these criteria can then be employed to evaluate the candidate partners in the selection mechanism. If it is not, the decision maker should reconsider the weighting process or measure again the relative weights for the criteria before conducting the evaluation and selection processes to avoid selecting an inappropriate partner that runs contrary to the original motivations.

Originality/value – The emphasis is on the interdependence between motivations and criteria for partner selection. This paper systematically deals with the interdependence of these two factors. Based on this iterative review approach proposed in this paper, a proper weight setting for these criteria is available and will comply with the original motivation for establishing the strategic alliance.

Keywords Strategic alliances, Decision making, Partnership

Paper type Research paper

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Introduction

Companies must do their best in research and development (R&D) to strengthen their competitiveness due to the situation of ever-changing technology and short life cycle of products. Unfortunately, R&D not only involves high uncertainty and risk but much capital is consumed in the development of complicated/sophisticated technology. It is difficult for small-medium enterprises (SMEs) to invest in R&D owing to the lack of sufficient resources such as capital, R&D personnel and equipment required. Therefore, establishing alliance with other companies for cooperation may be a feasible way for SMEs to acquire the necessary techniques and assistance though alliances may incur risks.

Although the strategy alliance policy has been adopted by companies for many years and there are different models of collaboration (Todeva, 2005), Mathews and Harvey (1988) and Gonzalez (2001) found that only 50 per cent or less of the alliance participants considered the alliance successful. There were researches discussed possible reasons that caused the failure (Petrovic and Kakabadse, 2003; Owens and Quinn, 2007). Some reports and studies (Brouthers *et al.*, 1995; Broadhead, 1995; Dacin *et al.*, 1997; Das and Teng, 1998; Hill and Jones, 1998; Neill *et al.*, 2001; Hoffman and Schlosser, 2001; Kim and Lee, 2003) indicated that most of the strategic alliances failed because the partners were not capable of performing their assigned function in the venture or becoming dissatisfied with each other and finally the alliance was broken up. When an enterprise has resolved to form a strategic alliance, it should then carefully select the partner and the different types of deceitful behaviour of alliance partners also have to be controlled (Das, 2005) in order to ensure success.

When selecting a strategic alliance partner, it is risky to consider only the financial contribution to the alliance, many criteria such as level of technology, enterprise culture, top manager attitude and marketing ability must be taken into account simultaneously. Most of these criteria are qualitative and cannot be easily evaluated using mathematic formulation. In addition to assessing how a potential partner can contribute to those preset criteria, an enterprise should confirm its motivations and their priorities for establishing the alliance. The top managers of an enterprise may keep multiple motivations for forging alliance with other enterprises but with different priorities in mind, thus affecting the weighting on criteria for evaluating the suitability of candidate partners. On the other hand, the way of setting weights on the criteria also reveals the priority of the motivations. This implies that the priority of motivations and the relative weights set for the criteria interact with each other. When the criteria weights are set, the enterprise should review if its original priority of motivations is still kept. If it is so, the relative weights of these criteria are then utilized to evaluate the candidate partners in the selection mechanism. If it is not, the enterprise should reconsider the weighting process or measure again the relative weights for the criteria before conducting the evaluation and selection processes so as to prevent selecting an inappropriate partner.

Since there is interdependence relationship exists in the motivations for forging an alliance and the criteria for selecting partner, the analytic network process (ANP) analysis technique is employed to deal with this recursive relationship. This approach proposed by Saaty (1980, 1996) has been applied to many similar problems. Sarkis and Talluri (2002) used the ANP technique to integrate the elements and sub-criteria of corporate environmental management into a strategic assessment system. Lee and

Kim (2000) used the ANP within a zero-one goal programming model for selecting information systems. Meade and Presley (2002) discussed using ANP for selection of R&D projects. Sarkis and Talluri (2002) showed how the ANP model combined with another optimization model could be employed to conduct a comprehensive evaluation of the factors affecting the job location at a digital equipment corporation. Yurdakul (2003) provided a multicriteria performance measurement model using ANP that addressed the competitive strategies and interdependence between attributes to measure a manufacturing firm's performance.

To select an adequate strategic alliance partner, the motivations, criteria and attributes for evaluating the potential enterprises have to be identified before the ANP approach is implemented. Since the objectives of establishing strategic alliances varies according to different motivations, attempting to identify a universal list of criteria that enterprises should employ when seeking a proper partner would be futile. In this study, we proposed a feasible mechanism for enterprises to think comprehensively when selecting a partner for their strategic alliances. In the next section, the motivations that drive an enterprise to forge a strategic alliance with other enterprises are examined. In the next section, the criteria and corresponding attributes are presented and employed to evaluate the suitability of each of the potential enterprises. In the next section, the ANP approach is developed and verified by a numerical example. The last section comprises a final conclusion to this study.

Motivations for forging strategic alliance

Despite the inherent risks, it is often necessary for enterprises, especially the SMEs owing to their lack of necessary resources, to forge strategic alliances with other firms for acquiring complementary skills. Before establishing a formal relationship with other enterprises, an enterprise must realize its motivations and priorities. The general motivations for forging a strategic alliance include sharing the cost for R&D activities, acquiring the resources that are necessary for its technological development, learning new technology and marketing capability for strengthening competitiveness. Many researchers have devoted themselves to exploring the theories of motivations for strategic alliance (Barney and Baysinger, 1990; Zuckerman and D'Aunno, 1990; Badaracco, 1991; Hagedoorn, 1993; Tripsas *et al.*, 1995; Hagedoorn and Narula, 1996; Lambe and Spekman, 1997; Sakakibara, 1997; Robertson and Gatignon, 1998). Four clusters of motivations have appeared as recurring themes in the literature and will be referred to as the following four motivations with different orientations in this research:

(1) *Strategy-oriented.* Enterprises forge alliance for strategic objectives such as maximizing the profit and possible cooperation. Tactic practices are increasing the market share, stepping up the pace of employee exchange, shortening the time for technological development and new products to enter market, and preventing vicious competition from competitors.

(2) *Cost-oriented.* Another motivation behind forging an alliance is to reduce cost. To share the cost for developing a technology and avoid duplicating investment, to reduce the cost for searching the necessary information, to reduce the risk of R&D, and to cooperate with governmental organizations for tax policy are the common considerations for this motivation.

(3) *Resource-oriented.* The availability of critical resources is the third motivation for establishing an alliance. To exchange the critical equipment and technologies with the alliance partner for reducing the risk of R&D, and to make use of the marketing channels of the partner will bring benefits to the participants of the alliance.

(4) *Learning-oriented.* Learning newest knowledge and technology is the fourth motivation for forging an alliance. The R&D personnel can learn from the venture by conducting joint technological development. Communicating and exchanging technological information and experience with each other will shorten the time and reduce the risk for developing a new technology.

In short, an enterprise enters into an alliance with other enterprises not only can benefit from the strengths of complementary skills of participants for developing new technology and product, but can also have the chance to learn some specific technology and capability. The application of skills existing in an enterprise can be extended to other area of products offered by the alliance partners. Interactive learning will extend the sources of knowledge, thus enhancing the creativity and competitive ability of an organization.

Criteria for alliance partner selection

An appropriate partner is essential for the establishment of a successful alliance. Technological improvement, financial ability or the ability to open market for new products, are illusory incentives for undertaking an alliance if the participants cannot get along. Partner selection for forming strategic alliance has been discussed in the literature from both theoretic and practical points of view. Harrigan (1988) pointed out that when selecting a partner for technical cooperation, due consideration must be given to its scale and scope, technological level, management style, and experience of the similar affairs. However, Geringer (1998) believed that there exists no optimal standard in the partner selection procedure; instead, one should consider the industrial property, relative capability, and complementation of resources and organization compatibility for each other. William and Lilley (1993) stressed the compatibility of organizations between the partners. Walters *et al.* (1994) emphasized that complementary skill is the most important when selecting a partner, while mutual trust and commitment on finance are also essential. Brouthers *et al.* (1995) proposed a thinking schema composed of 4Cs for answering when a strategic alliance should be chosen. They are complementary skill, cooperative culture, compatible goal, and commensurate risk. Dacin *et al.* (1997) explored 14 criteria for selecting a partner and advised a long-term observation and sufficient understanding of the expectations of the partner to ensure success in alliance formation. The study of Chang and Tsai (2000) highlighted that complementary resources, symmetrical position, and extension of social resources are necessary conditions for becoming a partner of an alliance. Kim and Lee (2003) had the opinion that partners of an alliance must have mutual trust and be willing to share complementary resources to enhance competitiveness for each other. Das and He (2006) had reviewed the alliance partner selection criteria and a list of recommendations is developed for firms choosing their alliance partners. In the studies mentioned above, many criteria or factors have been explored and discussed. In this research, we organize these criteria into the following four clusters. The attributes

of each cluster of criteria for evaluating the suitability of candidate partners are also addressed:

(1) *Corporation compatibility (CC).* The first key to creating cooperative cultures is the concept of symmetry. From the size to financial resources as well as the internal working environment, all these conditions should be comparable. This criterion takes into account the compatibility of corporation strategies (CCS), the symmetry of scale and scope (SSS), past cooperation experience (PCE), management and organization culture (MOC), and mutual trust and commitment (MTC).

(2) *Technology capability (TC).* To find a partner with complementary technologies, it is essential to conduct a comprehensive search. Considerations to be taken should include an examination of skills, technologies, and what the potential partner can produce. In this criterion, we consider the capability of manufacturing technology (CMT), product development and improvement (PDI), capability of innovation and invention (CII), and possible extent of skill application (ESC).

(3) *Resources for R&D (RD).* Paap (1990) commented that alliances in which one party is out to take as much as can be obtained without giving anything in return are bound to fail. Not only should alliance partners be willing to give to one another, they must also be willing to depend on each other. Hence, measuring what the potential partner can offer for the alliance is necessary. This criterion concerns measuring the intensity of investment in R&D (IRD), the extent of complementary resources such as equipment or experience for R&D (ECR), number of personnel in R&D (NUP), and quality of personnel in R&D (QUP).

(4) *Financial conditions (FC).* Enterprise must not enter alliances in which they may be called on to contribute more money than it can comfortably afford, either at the outset or in the future. To avoid financial pressures because of partners' problem, measuring robustness of their financial situation is important. In this criterion, the return of investment in recent five years (ROI), debt ratio and refund ability (DRR), profitability in the future (PRF), and potential for growth (POG) should be considered.

The abovementioned motivations and clusters of criteria constitute a partner selection mechanism for an alliance. Figure 1 depicts the relationship between the motivations and clusters of criteria as well as their corresponding attributes. In this research, we realize the interdependence between motivations and criteria. The weighting process of criteria is affected by the priority of these motivations. On the other hand, emphasis on some particular criteria also reveals the priority of motivations. The property of recursive interdependence must be handled carefully. In the following section, the operational procedure of the ANP approach to selecting an alliance partner is illustrated using the case study of a top manager of a gear wheel manufacturing company.

Analytic network process for alliance partner selection

Our case study concerns a precision machinery company that designs and manufactures turbine reduction device, gear reduction device, gearbox for transmission, and precision gear device in central Taiwan, Republic of China. Its

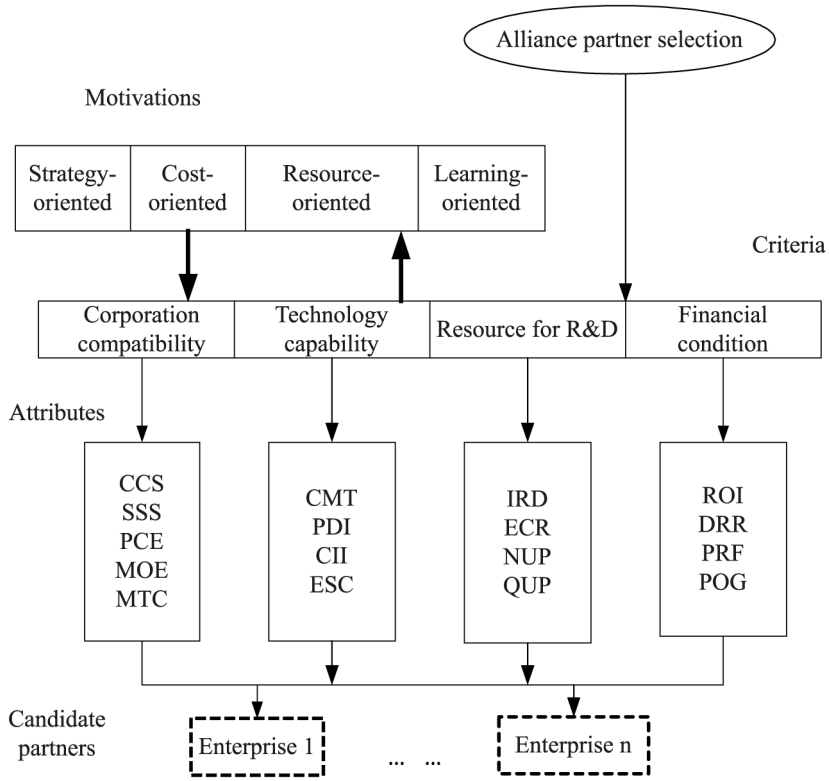

Figure 1.
The relationship between motivations, criteria, and attributes in the selection problem

capital is about US$ 3.5 million and there are about 130 employees, most of them with engineering training. It is a typical SME in Taiwan. To upgrade the technological level of these SMEs, the Ministry of Economic Affairs (MOE) of Taiwan encourages them to forge alliances in developing technology through tax reduction and other incentives. Anticipating a promising future of the green energy market, the case company submitted a proposal for developing a wind-power generating set, which was later approved by the MOE. Lacking about 30 per cent of the technique necessary for developing the set, and encouraged by the incentive measures from the government, the case company decided to forge an alliance with other companies for developing technology. The top manager hoped that he could benefit from the alliance through:

- maintaining close contact with other top managers of partner companies, thus strengthening the social relationship of the company in the industry;
- encouraging the R&D personnel to communicate and share information for promoting their technology level;
- learning new knowledge about power generation for extending the future scope of business; and
- reducing the risk and cost for developing the wind power generation set.

The case company had screened four candidate companies for its final evaluation.

Since the relative weights for these criteria and their corresponding attributes must be determined before they can be used in the evaluation process, the ANP approach was applied to this decision-making problem.

Many studies (Badaracco, 1991; Hoffman and Schlosser, 2001; Neilsen, 2003; Sampson, 2004) advised that a company should first figure out its motivation before an appropriate alliance partner can be selected. This implies that the weighting of criteria is affected by motivations. For instance, if the primary motivation for establishing an alliance is acquiring resources for technological development, then the criteria concerning technological capability and resource for R&D should be assigned larger weights than other criteria. If the primary motivation is oriented toward extending the market penetration, the criterion of corporation compatibility should be emphasized. From the opposite perspective, emphasis on a particular criterion also reveals the priority of motivations. For instance, the criterion of corporation compatibility is more related to strategy-oriented motivation than resource-oriented motivation. Hence, criteria should be weighted according to the primary priority of motivations of a decision-maker. In the meantime, the priority of motivations must then be rechecked when the relative weights of criteria are determined.

To deal with this dynamic environment, the ANP approach is applied. It is capable of handling interdependence among different layers of elements of a hierarchical structure by obtaining the composite weights to develop a "super matrix". Similar to AHP, ANP involves eliciting preferences of various criteria and attributes, and pairwise comparisons of the elements at each level are conducted with respect to a control element. The control element for these pairwise comparisons can be the elements at the upper or lower levels of the hierarchical structure. This is the fundamental requirement for developing the "super matrix" in the ANP. The pairwise comparison for the elements at one level with respect to the control element at another level is expressed in a matrix form (R). Once the pairwise comparisons are completed, the local priority vector w is computed as the unique solution to:

$$Rw = \lambda_{\max} w$$

where $\lambda_{\max}$ is the largest eigenvalue of matrix R. The vector w is the weighting vector corresponding to $\lambda_{\max}$. The solution process becomes tedious with increasing dimension n of matrix R. There are several algorithms available for approximating the vector w (Saaty and Takizawz, 1986; Saaty, 1988). However, in this paper, a two-stage algorithm proposed by Meade and Sarkis (1998) is used for averaging normalized columns and for approximating the vector w. This is represented as:

$$w_i = \left(\sum_{j=1}^{n} \left(R_{ij} \Big/ \sum_{i=1}^{n} R_{ij} \right) \right) \Big/ n, \; i = 1, \ldots, n \tag{1}$$

In the assessment process, the deviation from consistency of the pairwise comparisons must be addressed. Saaty (1980) provided an index defined as the following equation (2) that is referred to as the consistence index (CI) for this test and is suggested to be acceptable as $CI \leq 0.1$:

$$CI = (\lambda_{\max} - n) / (n - 1) \tag{2}$$

in which $\lambda_{\max}$ is approximated by $\sum_{i=1}^{n} \left[(Rw)_i / w_i\right] / n$.

We now apply the ANP framework to the partner evaluation problem for the case company. The scores 1, 3, 5, 7 and 9 denote indifferent, weakly more, strongly more, very strongly and absolutely more important, respectively. The numbers 2, 4, 6 and 8 are employed to facilitate compromise between slightly different judgments. Obviously, the reciprocal values of these numbers indicate the degree of unimportance.

A pairwise comparison matrix of the criteria with respect to strategy-oriented motivation is presented in Table I. The participants only have to fill out the upper-right part of the matrix. The value in the lower-left part of the matrix is obtained from the reciprocal value of its corresponding cell at the upper-right part of the matrix. The relative weight vector is obtained using equation (1) with the data in Table I. From the data in the rightmost column, when considering the strategy-oriented motivation, the top manager would put more weights on the criteria of corporation compatibility and financial condition when selecting an alliance partner. This is partly because under the strategy-oriented motivation, increasing the market share, stepping up the pace of employee exchange, shortening the time for technological development and new products to enter market are the major concerns. The partner with relative strength on these two criteria can be expected to contribute to this motivation.

The data in Table II describe the relative weight of the criteria with respect to each of the other three motivations. As can be seen, the relative weights of criteria vary when different motivations are considered, indicating that the weighting for criteria is affected by motivations.

On the other hand, for each criterion, the relative tendency of motivations is measured by conducting pairwise comparison. Table III compares the motivations with respect to the criterion of corporation compatibility. The relative tendency vector

Table I.
Pairwise comparison for criteria with respect to strategy-oriented motivation

Strategic-oriented	Corporation compatibility	Technology capability	Resource for R&D	Financial condition	Relative weights
Corporation compatibility	1	5	2	3	0.457
Technology capability	1/5	1	1/3	1	0.106
Resource for R&D	1/2	3	1	1/2	0.194
Financial condition	1/3	3	2	1	0.243

Notes: $\lambda_{\max} = 4.12$; CI = 0.04

Table II.
Relative weights of criteria with respect to motivations

	Strategy-oriented	Cost-oriented	Resource-oriented	Learning-oriented
Corporation compatibility	0.457	0.285	0.165	0.298
Technology capability	0.106	0.248	0.283	0.403
Resource for R&D	0.194	0.202	0.432	0.112
Financial condition	0.243	0.265	0.120	0.187

is obtained using equation (1) with the data in Table III. As can be seen, if the criterion of corporation compatibility is emphasized, the top manager will think that the greatest relative tendency of the four motivations is strategy-oriented followed by learning-oriented. The other possible relative intensities of these motivations with respect to other criteria are summarized in Table IV. As can be seen, emphasis on different criteria emphasizing reveals different tendencies of motivations.

To express the effects of interdependence between the motivations and criteria at different levels of the hierarchical structure, a "super matrix" is formed. Matrices 2 and 4 are now combined to form the initial "super matrix" as shown in Table V. In this research, we emphasize the relationship between different groups of factors that affect alliance partner selection and neglect the effect in the same group of factors. This means the inner relationship of motivations and criteria are supposed to be independent respectively provided that we select and construct them properly. Consequently, as seen in the data of Table V, cells of the blocks of motivations to motivations and criteria to criteria are filled with zero value.

Since motivations affect the weighting of criteria and vice versa, the initial "super matrix" can be treated as a transition matrix in the Markov chain (Hillier and Lieberman, 2001). The transition matrix will converge to a steady state after a long time period. According to the Markov chain, each transition is accomplished by multiplying the transition matrix by itself once. Finally, this matrix converges to a steady state after multiplying it 13 times, as shown in Table VI.

As can be seen, with any of the four motivations for forging an alliance, the top manager has set relatively heavier weights on the criteria of corporation compatibility and technological capability for the selection mechanism. In the meantime, it also unveils that strategy-oriented and learning-oriented motivations rank first and second on the priority motivations of the decision-maker. At this phase, the top manager contemplates the results and compares them with his initial priority of motivations in mind. From the discussion of the first paragraph in this section, the top manager

Corporation compatibility	Strategy-oriented	Cost-oriented	Resource-oriented	Learning-oriented	Relative tendency
Strategy-oriented	1	5	3	2	0.466
Cost-oriented	1/5	1	1/3	1/5	0.069
Resource-oriented	1/3	3	1	1/2	0.168
Learning-oriented	1/2	5	2	1	0.297

Notes: $\lambda_{max} = 4.13$; CI = 0.04

Table III. Pairwise comparison for motivations with respect to corporation compatibility

	Corporation compatibility	Technology capability	Resource for R&D	Financial condition
Strategic application-oriented	0.466	0.265	0.129	0.291
Cost reduction-oriented	0.069	0.103	0.203	0.307
Resource availability-oriented	0.168	0.227	0.454	0.215
Learning-oriented	0.297	0.405	0.214	0.187

Table IV. Relative weights of motivations with respect to different criteria

Table V.
Initial "super matrix" comprising the relative weights of motivations and criteria

	Strategy-oriented	Cost-oriented	Resource-oriented	Learning-oriented	Corporation compatibility	Technology capability	Resource for R&D	Financial condition
Strategy-oriented	0	0	0	0	0.466	0.265	0.129	0.291
Cost-oriented	0	0	0	0	0.069	0.103	0.203	0.307
Resource-oriented	0	0	0	0	0.168	0.227	0.454	0.215
Learning-oriented	0	0	0	0	0.297	0.405	0.214	0.187
Corporation compatibility	0.457	0.285	0.165	0.298	0	0	0	0
Technology capability	0.106	0.248	0.283	0.403	0	0	0	0
Resource for R&D	0.194	0.202	0.432	0.112	0	0	0	0
Financial condition	0.243	0.265	0.120	0.187	0	0	0	0

	Strategy-oriented	Cost-oriented	Resource-oriented	Learning-oriented	Corporation compatibility	Technology capability	Resource for R&D	Financial condition
Strategy-oriented	0	0	0	0	0.301	0.301	0.301	0.301
Cost-oriented	0	0	0	0	0.156	0.156	0.156	0.156
Resource-oriented	0	0	0	0	0.259	0.259	0.26	0.259
Learning-oriented	0	0	0	0	0.284	0.284	0.284	0.284
Corporation compatibility	0.309	0.309	0.309	0.309	0	0	0	0
Technology capability	0.258	0.258	0.258	0.258	0	0	0	0
Resource for R&D	0.234	0.234	0.234	0.234	0	0	0	0
Financial condition	0.199	0.199	0.199	0.199	0	0	0	0

Table VI. Long-term M^{13} "super matrix" and the relative weights of motivations and criteria

agrees with the priority vector for the motivations obtained from the long-term "super matrix". Consequently, the long-term converged weights of these criteria will be used in the following evaluation procedure.

The next step is to analyse the relative importance of the attributes of each criterion. In our example, we assume that the criteria and the attribute levels are unidirectionally interdependent. A similar pairwise comparison and equation (1) are used again to obtain the relative weights of the attributes with respect to each criterion. Table VII illustrates the attributes' pairwise comparison matrix with the criterion of corporation compatibility considered.

As can be seen, under the criterion of corporation compatibility, the attributes of compatibility of corporation's strategies and past cooperation experience are more important than the other three attributes. We need to construct similar comparison matrices for the other three criteria.

The final analysis step is partner evaluation. Each candidate enterprise needs to be evaluated by each attribute. This is accomplished by making a pairwise comparison of the suitability of each candidate enterprise with respect to each attribute. The scores 1, 3, 5, 7 and 9 denotes indifferent, weakly more, strongly more, very strongly and absolutely more suitable, respectively. The numbers 2, 4, 6 and 8 are employed to facilitate compromise between slightly different judgments. Similarly, the reciprocal values of these numbers indicate the degree of unsuitability. Table VIII expresses the relative suitability for the four candidate partners with respect to the attribute of compatibility of corporation strategies. Since there are 17 attributes in this illustrative example, an additional 16 pairwise comparison matrices are required for the evaluation. Equation (1) again is utilized to calculate the relative suitability for each candidate partner. As seen in Table VIII, Enterprises 4 and 1 have higher suitability

Corporation compatibility	Corporation strategies compatibility	Symmetric of scale and scope	Past cooperation experience	Management and organization culture	Mutual trust and commitment	Relative weights
Corporation strategies compatibility	1	7	3	5	3	0.440
Symmetric of scale and scope	1/7	1	1/5	1/3	1/5	0.042
Past cooperation experience	1/3	5	1	3	3	0.245
Management and organization culture	1/5	3	1/3	1	1/5	0.082
Mutual trust and commitment	1/3	5	1/3	5	1	0.191

Notes: $\lambda_{max} = 5.36$; CI = 0.09

Table VII.
Comparison of attributes with respect to criterion of corporation compatibility

scores than the other two enterprises when considering the attribute of compatibility of corporation strategies.

After the evaluation process, the synthetic index that integrates the weights of criteria and attributes as well as the suitability scores for candidate partners are calculated using the "suitability index" D_i which is defined as:

$$D_i = \sum_{j=1}^{s} \sum_{k=1}^{k_j} p_j q_{kj} r_{ikj}, \quad (3)$$

where:

- s = the number of criteria;
- k_j = the number of attributes of criterion j;
- p_j = the relative importance weight for criterion j;
- q_{kj} = the relative importance weight for attribute k of criterion j; and
- r_{ikj} = the relative suitability of potential enterprise i on attribute k of criterion j.

The potential enterprise with the largest suitability index should be selected as the partner for establishing the alliance. Table IX summarizes the results of this selection process. As can be seen, Enterprise 1 obtains the largest suitability index than the other three enterprises because it performs much better at the attributes of the criteria of corporation compatibility and technology capability. These two criteria are emphasized and given heavy weights by the top manager. Enterprise 4 also has a larger suitability index because it performs better at attributes of criteria of corporation compatibility and resource for R&D and will be considered as a candidate partner, too.

Conclusion

Selecting a proper collaborated partner to supplement the insufficient technique level is a possible policy that a company adopts when it is confronted by the severe competition. It is important to assure that the criteria as well as their relative weights have been constructed and set properly while selecting a strategic alliance partner. Although many studies have proposed criteria for selecting partners and explored motivations for forging alliance, the relationship between these two factors has received limited attention. This paper first systematically deals with the interdependence of these two factors. An enterprise trying to forge alliance with

Corporation strategies compatibility	Enterprise 1	Enterprise 2	Enterprise 3	Enterprise 4	Relative suitability
Enterprise 1	1	3	3	1	0.357
Enterprise 2	1/3	1	1/3	1/5	0.083
Enterprise 3	1/3	3	1	1/3	0.161
Enterprise 4	1	5	3	1	0.399

Notes: $\lambda_{max} = 4.12$; CI = 0.04

Table VIII. Suitability comparison for the four candidate partners

Table IX.
Suitability indices for candidate partners

Criteria	w	Attributes	w	Enterprise 1 score	Enterprise 1 Weighted score	Enterprise 2 Score	Enterprise 2 Weighted score	Enterprise 3 Score	Enterprise 3 Weighted score	Enterprise 4 Score	Enterprise 4 Weighted score
CC	0.309	CCS	0.44	0.357	0.049	0.083	0.011	0.161	0.022	0.399	0.054
		SSS	0.042	0.446	0.006	0.163	0.002	0.231	0.003	0.16	0.002
		PCE	0.245	0.382	0.029	0.066	0.005	0.241	0.018	0.311	0.024
		MOE	0.082	0.072	0.002	0.506	0.013	0.311	0.008	0.111	0.003
		MTC	0.191	0.122	0.007	0.082	0.005	0.343	0.02	0.453	0.027
TC	0.258	CMT	0.426	0.506	0.056	0.093	0.01	0.141	0.015	0.26	0.029
		PDI	0.262	0.533	0.036	0.141	0.01	0.085	0.006	0.241	0.016
		CII	0.061	0.36	0.006	0.346	0.005	0.133	0.002	0.161	0.003
		ESC	0.251	0.184	0.012	0.152	0.01	0.523	0.034	0.141	0.009
RD	0.234	IRD	0.184	0.376	0.016	0.192	0.008	0.23	0.01	0.202	0.009
		ECR	0.151	0.28	0.01	0.112	0.004	0.246	0.009	0.362	0.013
		NUP	0.602	0.406	0.057	0.151	0.021	0.192	0.027	0.251	0.035
		QUP	0.063	0.503	0.007	0.124	0.002	0.112	0.002	0.261	0.004
FC	0.199	ROI	0.092	0.132	0.002	0.182	0.003	0.474	0.009	0.211	0.004
		DRR	0.133	0.136	0.004	0.602	0.016	0.201	0.005	0.061	0.002
		PRF	0.522	0.381	0.04	0.346	0.036	0.082	0.009	0.191	0.02
		POG	0.253	0.231	0.012	0.533	0.027	0.075	0.004	0.161	0.008
Suitability indices					0.349		0.188		0.202		0.260

other enterprises must know its motivations first and then sets adequate weights for criteria and attributes according to the priority of motivations for evaluating the candidate partners. Since the weighting process for criteria is affected by motivations and reversely the weighting of criteria also reveals the priority of motivations, these two factors have mutual influence on each other. The ANP approach is employed to deal with this recursive relationship. The concept of transition in Markov chain is applied to the "super matrix" of ANP. Finally, the interaction converges to a steady state as a result of long-term transition. At this phase, the decision maker should recheck the priority of motivation obtained from the converged matrix to see if it coincides with the initial one set for the enterprise. If it is, the weights of criteria obtained from the converged matrix will be used in the subsequent selection procedure; otherwise, the partner selected by the current weights of criteria will twist the motivation set initially for the enterprise. The weighting of criteria should be measured again and the above procedure should be repeated. Based on this iterative review approach, a proper weight setting for these criteria is available and will comply with the original motivation for establishing the strategic alliance. This is essential for selecting an appropriate partner for establishing an alliance that matches the original motivation.

It is impractical to identify a universal list of criteria and their corresponding relative importance for all enterprises when selecting partners. The content of motivations and criteria as well as their priority and weightings may vary with different kinds of alliances or situations. The partner evaluation and selection mechanism proposed in this article can meet different situations by adapting the relative weights of criteria and attributes according to the relationship between the criteria and motivations for every particular situation, thus enabling decision makers to think more comprehensively before conducting a selection process.

Besides the rational selection mechanism, since the alliance partner could be chosen through a long negotiation process, hence there are external factors that may influence the selection process. Bringing those factors into the selection mechanism is likely to be a fruitful area of future research.

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