

Effect Evaluation of Supply Chain Alliance Co-Evolution

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Abstract This paper designs the principles and processes of supply chain alliance co-evolution effect evaluation, set up an appraise index system of two levels by subdividing the influence factors of supply chain alliance co-evolution with fuzzy evaluation model. It evaluates effect of supply chain alliance co-evolution and provides an effect evaluation approach of supply chain alliance co-evolution of strong practicality and easy to operating. Though discussing the Effect Evaluation of Supply Chain Alliance Co-evolution can clearly improve the capability of supply chain alliance co-evolution.

Key words Strategic alliances; Co-evolution; Fuzzy evaluation

1 Introduction

Set up supply chain alliance co-evolution effect evaluation system to measure the situation of alliance co-evolution and find problems exist in process of alliance co-evolution and perfect evolutionary mechanism of supply chain alliance coordination further. Base on that, this paper use fuzzy evaluation model to evaluate the effect of supply chain alliance co-evolution, the model provides a strong practical, easy operating of supply chain alliance co-evolution effect evaluation approach.

2 The Principle and Procedure of Supply Chain Alliance Co-evolution Effect Evaluation

2.1 The principle of supply chain alliance co-evolution effect evaluation

In order to report reality of alliance co-evolution effect evaluation comprehensively, objectively and systematically, it should abide by following guidelines while constructing supply chain alliance effect evaluation system:

(1) Objective principle. Effect evaluation system must response to the nature and characteristics of supply chain alliance co-evolution scientifically, reasonably and realistically and effectively.

(2)Teleonomy principle. Effect evaluation should be based on supply chain alliance long-term cooperative goals, effectively address the problem of the process in evolution, and provide scientific guidance to the alliance operation in the future.

(3) Development and static state appearance union principle. Supply chain alliance co-evolution is a dynamic optimization process, evaluation system not only response the dynamic characteristics of supply chain alliances co-evolution, but also reflect the stability of a particular period.

(4) Completeness principle. Evaluation system should summarize all key elements and evaluate the cooperative of alliance comprehensively and systematically, and reflect the capabilities of alliance evolution complete and multi-dimensional.

(5) Adaptability principle. Evaluation system should have general adaptability, can reflect the common and specific characteristics of different enterprises in alliance, and can make changes and adjustments according to the specific environmental of alliance.

(6) Hierarchy and systemic principle. Evaluation system can strictly reflect the characteristics of the entire alliance from the entirety, and reflect the co-evolution status of each alliance enterprise from the subsystem-level as well.

(7) Operational principle. Evaluation system index should be easily understood. We need to select the information which can influence alliance co-evolution and can obtain easily, avoiding complicated calculations later, in favor of management comparison and analysis.

(8) Qualitative and quantitative indicators principle. The alliance co-evolution process deals with many aspect factors of which can be quantified, determine the nature treatment more appropriately and practically. It can report the effect of evolution more comprehensive and systematic when qualitative and quantitative indicators are combined^[1].

2.2 The procedure of supply chain alliance co-evolution effect evaluation

The effect evaluation of supply chain alliance co-evolution must follow the standard evaluation procedures, as follows:

Initialization: Ascertain the supply chain alliance participating in valuation, give valuation grade and their corresponding standard and comment collection to the evaluation index system.

Determine the weight distribution of evaluation index. Assign different weight to every index. The distribution principle is based on the influence that the evaluation index to alliance co-evolution.

Determine the evaluation method: According to the specificity of evaluation index system and index, establish the appropriate evaluation methods, construct evaluation model.

Making comprehensive evaluation according to the evaluation model, get the results of comprehensive evaluation. Supply chain alliance evaluation index system has multi-level structural characteristics, should comprehensive consider every influence factors in the process of evaluation.

3 Set up Effect Evaluation Index System of Supply Chain Alliance Co-evolution

Comprehensive considering every kind of factors of supply chain alliance co-evolution, divides supply chain alliance co-evolution effect evaluation into the following indicators: supply chain alliance performance, supply chain alliance environmental adaptability, innovation and co-evolution capability, knowledge and information co-evolution capacity, membership co-evolution capacity and supply chain alliances cultural co-evolution capacity.

The efficiency of supply chain alliance enterprises maintain their survival and development effectively, and ensure the stable operation of the alliance. There for, the supply chain alliance performance should be first factor be brought into the supply chain alliance co-evolution effect evaluation system. Then, supply chain alliance co-evolution is to be effective adapt to changes of environmental, and it need to measure supply chain alliance environmental adaptability, so, make it as second evaluation index of supply chain alliance co-evolution.

Supply chain alliance co-evolution system has innovation which is the power of alliance evolution, thus, make learning and innovation of supply chain alliance as the third supply chain alliance co-evolution evaluation index. That the knowledge metastasis and the information share can makes alliance enterprise transparent-rization in cooperation and come out into the open, against self-interest in alliance effectively, to reduce the incidence of opportunistic behavior and promote the co-evolution of supply chain alliance. Therefore, knowledge and information co-evolution capacity will be made as fourth evaluation index of supply chain alliance co-evolution.

Stability is one of the preconditions of supply chain alliance co-evolution, while the stability is decided by the coordination between alliance enterprises. Stronger the co-evolution capacity of the relationship among alliance enterprises is, stable the alliance is, and is more beneficial to alliance co-evolution. Thus, alliance membership co-evolution capacity will be the fifth evaluation index of supply chain alliance co-evolution. The soul of the supply chain alliance is culture which plays a guiding role to the co-evolution of supply chain alliance. Culture collaboration among alliance enterprises can avoid conflicts and enhance cooperation among enterprises, to promote the evolution of alliance, therefore, supply chain alliances cultural co-evolution capacity will be the sixth evaluation index of supply chain alliance co-evolution.

In the process of designing and selecting the evaluation index system of supply chain alliance co-evolution capacity, should take full account of the dynamic optimization of supply chain alliance co-evolution. Evaluation of the whole process should start from the capacity level, objective evaluation alliance capabilities with the development of vision. We must adjust the evaluation index system according to the practical setting of alliance, set up evaluation system from multi-dimensional aspect reasonably^[2]. In summary, supply chain alliance co-evolution effect evaluation system includes six first-level indexes with each index composed of numbers of second-level indexes. Specific indexes as Table 1 shows:

4 Supply Chain Alliance Co-evolution Effect Evaluation Based on Fuzzy Theory

Since there are some qualitative indicators in index system, the evaluation of these indexes full of subjective factor of assessment person, these indexes leading the complexity and ambiguity of supply chain alliance co-evolution effect evaluation, which cannot use precise math tools to do quantitative analysis. In addition, due to the multi-level of evaluation system, this paper use multi-level fuzzy comprehensive evaluation model to assess the effect of supply chain alliance co-evolution^[3].

(1) Establish factor set

Table 1 Valuation Factor Assembles of Supply Chain Alliance Co-evolution Effect

First-level indexes	Second-level indexes
supply chain alliance manage achievement effect, U_1	The product of supply chain alliance meet customer requirements U_{11}
	The customer satisfaction of product delivery rate and service level of supply chain alliance U_{12}
	The proportion of supply chain alliance inventory, purchasing, manufacturing and R & D cost to the total cost. U_{13}
	The proportion of the total cost of supply chain alliance to the total revenue U_{14}
	The capacity of management control and the rate of cost reduction of supply chain alliance U_{15}
	The market share of the product of supply chain alliance U_{16}
	The profit growth rate of supply chain alliance U_{17}
	The ROI and net cash flow of supply chain alliance U_{18}
supply chain alliance environmental adaptability U_2	The degree of supply chain alliance comply with state , local laws and regulations U_{21}
	The proportion of supply chain alliance members to comply with alliance contract U_{22}
	Society compatible degree U_{23}
	Environment compatible degree U_{24}
	The alliance influence U_{25}
	The alliance member organism's habits place changes degree U_{26}
	Framework of organization matching with the alliance inner or outsider environment degree U_{27}
Market responsiveness U_{28}	
innovation and co-evolution capability of supply chain alliance U_3	The R&D capability of new product U_{31}
	Technology innovation influence to environment U_{32}
	The proportion of total R & D expenses to sales revenue U_{33}
	The effectiveness of alliance implement management innovation U_{34}
	The sophistication of management system of supply chain alliance U_{35}
	The effectiveness of alliance implement institution innovation U_{36}
The scientificalness and validity of the organizational structure of supply chain alliance U_{37}	
knowledge and information co-evolution capacity of supply chain alliance U_4	Knowledge and information transfer capability in alliance U_{41}
	Alliance knowledge and information share degree U_{42}
	Knowledge creation capability U_{43}
	The distortion in the process of knowledge and information sharing and transfer U_{44}
	Supply chain alliance information transparency U_{45}
membership co-evolution capacity of supply chain alliance U_5	The fair degree of interest among alliance members U_{51}
	The alliance supervisor mode and stake between alliance member U_{52}
	Mutual alliance enterprise trust degree U_{53}
	Implement reasonableness degree of stimulate tactics and system of rewards and penalties in supply chain alliance U_{54}
	The diversity of communication level among alliance members U_{55}
Capacity of supply chain alliances cultural co-evolution U_6	The cooperative degree of alliance member culture U_{61}
	If supply chain alliance culture accord with alliance long-term goal and environment U_{62}
	Supply chain alliance culture promotes degree to attaining alliance objectives U_{63}
	The degree of supply chain alliance invest in cultural construction U_{64}
	The adaptability and adjustment of the culture of supply chain alliance U_{65}
	Cultural identity U_{66}

Taking the six first-level indexes in the effect evaluation index system of supply chain alliance co-evolution as first-main influence factor of supply chain alliance co-evolution, denoted by $U=\{U_1, U_2, U_3, U_4, U_5, U_6\}$, make the second-level indexes under every first-level index U_i ($i=1, 2, \dots, 6$) as secondary factor set, meanwhile, $U_1=\{U_{11}, U_{12}, \dots, U_{18}\}$, $U_2=\{U_{21}, U_{22}, \dots, U_{28}\}, \dots, U_6=\{U_{61}, U_{62}, \dots, U_{66}\}$. As Table 1 shows:

(2) Determine grades assemble of effect evaluation

Divided effect of supply chain alliance co-evolution into five grades, that is $V=\{X_1, X_2, X_3, X_4, X_5\}$, in that X_1 means very good, X_2 means good, X_3 means fairly good, X_4 means normal, X_5 means not good.

(3) Establish weight assemble

In the effect evaluation system of supply chain alliance co-evolution, ensure the weight of each index is vital to the scientificness of the results of evaluation. Weight distribution can use binary comparison method, experts grading method and AHP method. This paper use AHP method to establish the weight of each factor.

Suppose the weight of first-level index U_i is W_i ($i=1, 2, \dots, 6$), so the weight assemble of first-level index is:

$$A_1 = \{W_1, W_2, \dots, W_6\}, \text{meanwhile } 0 < W_i < 1, \sum_{i=1}^6 W_i = 1$$

Suppose the weight of second-level index U_{ij} is W_{ij} ($i=1, 2, \dots, 6; j=1, 2, \dots, 8$), so the weight assemble of second-level index is:

$$A_2 = \{W_{i1}, W_{i2}, \dots, W_{im}\}, 0 < W_{ij} < 1, \sum_{j=1}^m W_{ij} = 1$$

(4) Establish fuzzy matrix

Evaluation matrix is the membership grade of each factor U_{ij} in U_i to the comment set, for V has five evaluation ranks, so, the matrix is:

$$R_{ij} = \begin{bmatrix} r_{ijx} & r_{ij2} & \dots & \dots & r_{ij5} \\ r_{ij1} & r_{ij2} & \dots & \dots & r_{ij5} \\ \dots & \dots & \dots & \dots & \dots \\ r_{im1} & r_{im2} & \dots & \dots & r_{im5} \end{bmatrix}$$

r_{ijx} means the U_i j th factor that judge try an expert think that it belongs to mansion x valuation rank, in that $i= (1, 2, \dots, 6)$, $j=(1, 2, \dots, m)$, $x=(1, 2, \dots, 5)$. Concrete reckoning is if N experts consider i index belongs to the rank of j , then $r_{ij} = n/N$.

(5) Multiple comprehensive evaluation

This paper divides evaluation index into two layers in the supply chain alliance co-evolution effect evaluation system. In order to get final evaluation results, need to start from the bottom, and gradually move up.

Due to second-level weight index is $A_2 = \{W_{i1}, W_{i2}, \dots, W_{im}\}, 0 < W_{ij} < 1$, in that,

$i= (1, 2, \dots, 6)$, $j=(1, 2, \dots, m)$, though the first-level fuzzy transform, can get that:

$$B_i = (W_{i1}, W_{i2}, \dots, W_{im}) \otimes \begin{bmatrix} r_{ij1} & r_{ij2} & \dots & \dots & r_{ij5} \\ r_{ij1} & r_{ij2} & \dots & \dots & r_{ij5} \\ \dots & \dots & \dots & \dots & \dots \\ r_{im1} & r_{im2} & \dots & \dots & r_{im5} \end{bmatrix} = (b_{i1}, b_{i2}, b_{i3}, b_{i4}, b_{i5})$$

Make second-level fuzzy evaluation to the first-level index of index system, matrix $R = (B_1, B_2, \dots, B_6)^T$ make up of results of first fuzzy evaluation B_1, B_2, \dots, B_6 . Meanwhile the weight of first-level index is:

$$A_1 = \{W_1, W_2, \dots, W_6\}, \text{meanwhile } 0 < W_i < 1, \sum_{i=1}^6 W_i = 1$$

Get result of second-level evaluation:

$$B = A_1 \otimes R = (W_1, W_2, \dots, W_6) \otimes (R_1, R_2, \dots, R_6)^T = (b_1, b_2, b_3, b_4, b_5)$$

(6) Results analysis

Through give different values to evaluation set V in course, can get a quantitative evaluation results:

$$S = B \otimes V^T$$

Finally, get the effect of supply chain alliance co-evolution according to the size of S values^[4].

5 Conclusion

This paper selects the factors have certain influence on the effect evaluation of supply chain alliance co-evolution, establish the effect evaluation system of supply chain alliance co-evolution from system point of view, and set up effect evaluation model of supply chain alliance co-evolution with fuzzy evaluation method, give the overall evaluation to the effect of supply chain alliance co-evolution.

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