An Analysis of Fuzzy Cognition on Factors Affecting the Co-Branding in Technical Standards Alliance: From Partner Selection Perspective

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***Abstract*--Brand is an important resource in the technical standards alliance. As a kind of essential resource utilization pattern, the brand joint is beneficial for enterprises in the alliance to realize the increment of value. The selection of cooperative partner is the first step of co-branding, which plays a significant role in co-branding. This paper emphasized the critical significance of alliance member selection to the co-branding and regarded it as the breakthrough point to analyze the key influence factors and causal correlation of co-branding. By the combination of fuzzy cognitive map and non-linear Hebbian learning algorithm, this research established the fuzzy evaluation model, realized the dynamic simulation of complex network system with multiple causal correlations and obtained the final steady state of co-branding for the technical standards alliance, thus it could better understand the mutual relations among different influence factors of co-branding and their effect degrees in order to propose the policy reference for the improvement of numerous influence factors and the conversion efficiency of optimal results.**

I. INTRODUCTION

With the development of economic globalization and the progress of science and technology, the standards，as the new focus of international competition，have become an important means to make the marketing rules of the game. Under the background of enterprise network, it is difficult for a single company to master all the knowledge and develop new technologies independently. Hence, setting up standards system though standards alliance has become a common choice nowadays. A company can acquire resources including technologies and knowledge to obtain lasting competitive advantages by joining the standards alliance.

The brand is an important resource for standards alliance, and co-branding is a major way to utilize brands resources, contributing to good performance of firms [1][2]. Being a new form of co-branding, technical standards alliance can be regarded as the co-branding alliance in the industrial chain [3]. Members of the technical standards alliance improve brand image of the firms through collectively developing new technologies and setting up new technical standards. Therefore it will surely generate co-branding.

However, it should be noted that the long-term development of technical alliance has been in a state of instability. Spekman, Danci and Hitt and other researchers state that the failure rate of enterprise alliance is 60%. Furthermore, Woodman holds that the failure rate may be up to 70%[4]. It is widely believed by the scholars the selection of members is an important factor resulting to high failure rates. Does the member selection of technical standards alliance influence co-branding? If any, what's the mechanism it has? This paper will make an exploratory study on such topic.

II. THE CONSTRUCTION OF THE INDEX SYSTEM

A. Technical Standards Alliance

Technical standards alliance, an important means of modern enterprises strategic adjustment and value creation, has become an important means for company to maintain competitive advantage. However, it should be noted that it lacks of definitions about technical standards alliance. Dai Yihua and Zhang Ping hold that technical standards alliance is a strategic alliance made by companies which focuses on technical standards. Besides that, they believe the purpose of setting up technical standards alliance is to promote technology standardization through the alliance and acquire standards value through the spread of technology standards [5]. Li Taiping and Zeng Deming believe that "Technical standards alliance in reality is a combination of licenses where firms of the alliance reach agreements through negotiation, forging contractual relationship in the process. In a word, technical standards alliance is a typical alliance of contracts pattern."[6]

Based on the analysis of the related literature, this research text defines that the technical standard alliance refers to the institutional arrangement made by the companies centering on the technical standard in light of the market force and technology. The ultimate goal of creating technical standard alliance lies in that it helps the creation, spreading and commercialization of the technical standard so as to acquire competitive advantages. The nature of technical standard alliance is value network, and the technical standard alliance has accumulated a considerable number of technical and social resources.

B. Co-branding

1. The Definition of Co-branding

Brand is an important resource of the technical standard alliance. Alliance members can utilize the brand resources and improve brand value through co-branding. The definition of brand alliance first proposed by Boone, originates in the red lobster's cooperation with Holiday inn for restaurant openings in 1980. In the initial stage, the scope of co-branding is broad, which links with fields including brands cooperation, brand alliance, cross promotion, joint promotion and cooperation marketing etc. However, with the development of professional study, scholars are all inclined to call brand alliance and brand cooperation as co-branding. But it should point out that there is no uniform view on the

definition of co-branding yet. With the purpose of improving brand image and strengthening products quality, Shocker regards co-branding as a way of alliance which cooperate with other brands [7].Park, Jun and Shocker have defined the co-branding as the cooperation of two brands which put forward new products collectively. It is the final form of the cooperation between the two firms. And the reputation of the two firms is deeply influenced by the cooperation project [8].On the other hand, Blakett and Boad state that co-branding calls for cooperation between two companies and among more than two firms which are highly regarded by the clients, while saving the brand names of those who take part in the alliance. In addition, they apply two standards to judge the cooperation pattern: notably first expectations of the time of duration for the cooperation, second the potential for creating values for the firms through cooperation in nature and quality [9].

Scholars in China started late on co-branding research. The main ideas are listed as follows:Fan Xiucheng and Zhang Tongyu hold that co-branding refers to cooperation between two companies and among more than two firms which are highly regarded by the consumers, and the original brands are retained in those new brands[10].Xue Zhe and Chen Xiaoyun think that in a broad sense, it is a market behavior to bind two brands, for example the marketing of ads and products. In its narrow sense, it refers to the action of putting the new brand products in the market through the cooperation between the two brands[11].Xu Jinan, from the perspective of economy, has explained the relation of chess playing of co-branding. It indicates that the overall benefits are greater than the sum before cooperation, which shows the economic blessings of the co-branding.

2. Classification of Co-branding

Through literature collection, it can be concluded that the classification of co-branding are mainly based on two means including cooperative brands and cooperative relation. Combined with the theme, the paper focuses on the latter one. Hence, the paper is inclined to the grade separation created by the cooperative relation, which is proposed by Blackett and Boad. They divide the brand alliance into four categories as Figure 2-1 [13].

Contact/Cognitive brand alliance means that members of the alliance propagate the local brands, services and products with the consumers of other firms in the alliance. Being the lowest level of cooperative brand, it accelerates consumers' impression on the co-branding.

Value recognized brand alliance demand that the firms of the alliance get brand value consistency from consumers' recognition. When the two brands are closely linked in core features and values, those two parts will improve brand reputation and stipulate product sale through cooperation.

Elemental composition alliance means that two brands coexist in a type of product or service where one is the end product brand and the other the elemental product brand.

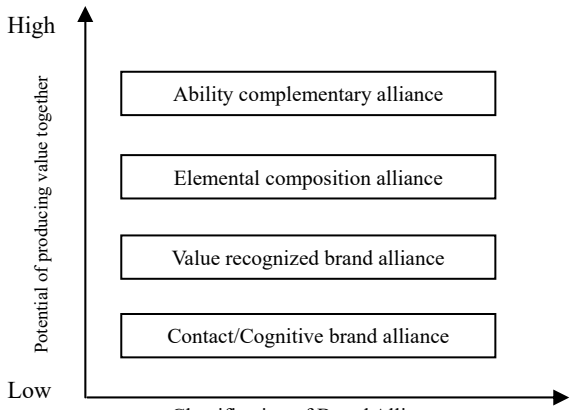

Figure 2-1 Classification of Co-branding

Ability complementary brand alliance refers to the feature that the firms can make up the shortages of each other in ability. Being the top level brand alliance, they will utilize their strengths and make joint efforts to create brand products or service.

The paper mainly focuses on the co-branding in the technical standards alliance. We have the following cognitive on the brand alliance among alliance members:

Firstly, co-branding in technical standards alliance is the middle or long-term cooperation made by the independent firms which aims to create more values through cooperation.

Secondly, brand joint in technical standards alliance is dynamic. With the development of the alliance, members can deepen their cooperation and strengthen their potential to create values. Thus, the co-branding upgrades from low level to high level.

Thirdly, co-branding of the technical standards alliance has the ultimate goal of seeking brand alliance that is complementary in company operation, notably seeking complementation in core technology and competence without merely focusing on part fabrication.

C. Co-branding effect

The effect caused by co-branding, also known as co-branding effect, is an important index to evaluate the effects of co-branding. The success of co-branding depends on the consumers views. Hence, in light of the researches made by other scholars, the study defines co-branding effect as the market influences and it regards the consumers view as the standard [14-15]. As is often the case, people's views on a brand rely on their change of attitude and consumers' views on co-branding are their attitudes towards the products.

View on co-branding is gained through individuals' study and review on products of co-branding, showing their opinions on the product [16]. Currently, studies mainly place emphasis on emotional level which focuses on consumers mental feelings. However, it should be noted that it only focuses one part of people's view on co-branding, ignoring the other two aspects notably their understanding of the brand and their behavior. The former refers to individuals view on the brand and the evaluation on the products while the latter focuses on people's willingness to buy the product. The paper

holds that all the three aspects including view on the co-branding, perceived quality and willingness to buy, should be paid enough attention.

D. Factors influencing co-branding effect

The influence factors of co-branding are various and dynamic. If one wants to make a sensible choice in the process of co-branding, you should take all the factors into consideration. Combination of partner selection with co-branding is a brand-new effect. Partner selection is the first step of co-branding. Partner selection is the key issue for the success of co-branding, affecting the performance of co-branding. Hence, the paper studies the influence factors of co-branding in light of partner selection and strengthens the importance of partner selection for co-branding.

The paper absorbs theories including Brouthers' 4C, and researches made by Hua Jinke and Zenf Deming, and Han Wenhui [17-19]. It focuses on three main factors of partner selection notably resource advantages, compatibility and consumers. The study has the features of novelty and peculiarity.

The main purpose for creating technical standards alliance is to gain complementary resources such as technology and brands etc. In other words, co-branding, a major means to use brand resources, refers to the process of partner selection. The influence factors also have a negative effect on partners' resource ability, matching degree and brand trust.

Partners' resource ability is composed of technology capability and market capability.

Technology capability means that the firm gain advanced technology and information from the outside world and combine with data in the firm to develop new technology and information. It contributes to technical innovation and spreading, and accumulates technology and data at the same time. In return, the firm will provide technology research and development capacity, technology management capacity and technology standardization capacity for developing the standard technology.

Developing technology is the first step for technology standard spreading. According to network externality theory, only those technical standards which get to the tipping point of installment ruled by network externality can be called the de facto standard. That needs strong spreading capacity of the alliance. It requires necessary market capacity, such as market perceptive capacity, market research and development capacity, and compatibility of marketing development. Consumer groups of the alliance members have laid a market foundation for cooperative brand, and have launched widely promotion which contributes to public understanding on the co-branding [20].

Matching degree refers to compatibility of the co-branding members including products, brand, and targeting market [21]. In particular terms, matching degree of product level focuses on the complementarity of products and the consistency of perceived quality. It promotes clients' understanding and perception on co-branding. From the brand level, it mainly tells whether the co-branding is consistent in brand image, brand core value and brand market position. With good brand matching degree, it helps the cooperative brand in sending messages to the target market efficiently. Hence, consumers have positive attitudes towards co-branding and would like to buy the products. Matching degree of the target market focuses on the consistency of the consumer group. Co-branding pays more attention to the matching degree of the target market. Its main purpose is to use consumers' loyalty to improve the willingness of perception on co-branding.

Brand trust is also an important factor for partner selection. It indicates the positive expectations the consumers made on the co-branding when the brand is at stake [22]. It can be evaluated from brand reliability and brand intentions. The influence of brand trust on co-branding is shown as follows: consumers' lack of perception and selection capacity on the new co-branding. If consumers have much confidence on the cooperative brand, they will increase perceptive quality of the co-branding and strengthen their will to buy.

E. Evaluation index system on co-branding effect based on partners selection

According to the four basic factors which affect partner selection, the paper provides an index system consisting of technology capacity, matching degree and brand trust, which is shown in table2- 1.

TABLE 2-1 INDEX SYSTEM INFLUENCING THE CO-BRANDING IN TECHNICAL STANDARDS ALLIANCE BASED ON PARTNER SELECTION

Partner Selection feature	Evaluation index
Technology capability (T)	technology R&D capability（T1）
	technology management capability（T2）
	technology standardization capability（T3）
Marketing capability (M)	marketing cognitive capability（M1）
	marketing development capability（M2）
	fit of marketing and R&D（M3）
Matching degree (N)	product matching（N1）
	brand matching（N2）
	target market matching（N3）
Brand trust (B)	brand reliability.（B1）
	brand intentions（B2）
Co-branding effect (J)	Brand belief（J1）
	Perceived quality（J2）
	Purchase Intention（J3）

III. METHODS OF FUZZY COGNITIVE MAP

A. Fuzzy cognitive map

Co-branding is a complex nonlinearity system where the factors influence each other, and the comments on co-branding are fuzzy. In addition, co-branding is a dynamic process, as previously stated in this paper. With the development of technical standards alliance, cooperative brand will develop towards high level to create more values.

Currently, Structural Equation Modeling (SEM) and Analytic Hierarchy Process (AHP) or Analytic Network Process (ANP) are widely used to evaluate factors that influence co-branding. The former takes the index′s mutual influences into consideration while it is static and lacks of efficient feedback and updating system.

However, AHP can better solve problems of multiple targets decision combined with qualitative and quantitative methods. The shortcoming is that it ignores the mutual effects of these factors. ANP makes up the shortcomings of AHP. It takes the mutual effects of these factors into consideration and provides feedback system. But it needs to outline complex judgment matrix, and the results deeply rely on network structure. Hence, it lowers the results reliability.

Fuzzy cognitive map (FCM), according to Kosko, is a signed digraph combining fuzzy logic with neural network, having strong expressiveness on fuzzy message and causality[23]. FCM is composed of vertex and directed arc. Vertex means various concepts and key factors of the issues. Arc shows causality of concepts. As for the structure, it can be seen as a single belt of neural network. It supports experts' experience and expressiveness and inference of causality. Knowledge lies in the concept vertex and among them. It imitates the dynamic action of the system through the mutual effects of the concept vertex in the map. Currently, FCM is applied in the fields of social science, behavioral science, stock exchange market, military doctrine etc. [24-26], and it has been verified in these fields with the development of evaluation domain.

As for its application in the multiple decisions, FCM has forged knowledge network through abstract evaluation on mutual effects and feedback. It assesses the partner of the co-branding with fuzzy inference principles. Compared with SEM, it simulates the dynamic process of the comment system. Compared with AHP, it takes mutual effects of index into consideration and it is less complex.

B. FCM model of factors affecting comments on co-branding

According to FCM, the paper outlines fuzzy evaluation model of comment index system on co-branding effect in light of partner's selection.

1) Defining the causality of factors affecting co-branding of technical standards alliance and sketch fuzzy cognitive map

Use FCM to describe the mutual relation among those factors (as Figure3-1). In the cognitive map, each vertex stands for a comment index, and the arc among the vertex affects each other. "+" means positive effect while "－" stands for negative effect.

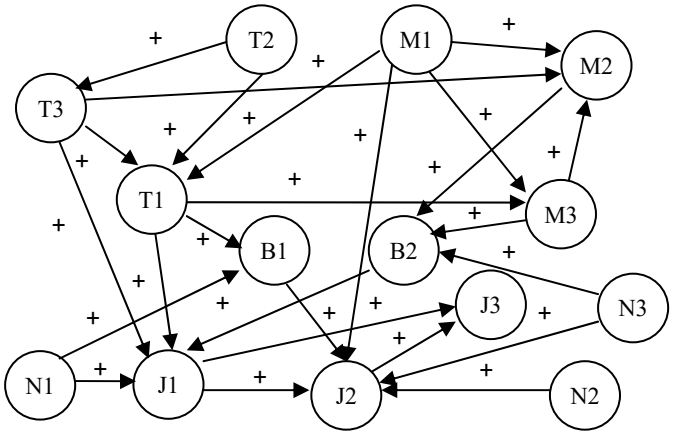

Figure3-1 fuzzy cognitive map of factors affecting co-branding of technical standards alliance

From Fig 3-1 we have the following findings. In the Technical Capacity Sector, Technology Management Capacity affects the Technological Absorptive Capacity, while Technological Innovation is built on the basis of Technology Absorption; therefore Technological Innovation Capacity reflects directly or indirectly almost all of the changes in evaluation factors, so it is the direct index for evaluation of the Alliance Members.

The position of the Market Capacity Sector in the system is never to be underestimated, this sector connects multiple factors outside the sector, wherein the market Development Capacity has the closest relationship with the other factors, followed by Market Awareness and Market Compatibility.

As an objective existence, Market Compatibility is relatively stable and hardly affected by other factors, but once it fluctuates, it will bring chain reactions to other factors.

The Sector of Brand Trust is relatively active, it has established more than one relationship with each sector, on the one hand, it is influenced by the Technical Capacity, Market Capacity and Brand Compatibility, and on the other hand, it has a direct impact on the Co-Branding Effect. It is of great importance to the evaluation of Alliance Members.

In the Sector of Co-Branding Effect, the three factors of Brand Belief, Perceived Quality, and Willingness to Buy almost all have a direct or indirect response to the changes of all other factors, they are the evaluation index for co-branding. Among them, Brand Belief has the most relationship lines with perceived quality, the two reflects more directly the relationship trend of the whole system; while both of the Brand Belief and Perceived Quality have a causal relationship with Willingness to Buy, so the factors influencing the first two eventually also affect the latter, which means enhanced Consumer Awareness and Feelings Of Co-Branding will increase his / her Willingness to Buy, namely, the "Conversion of awareness and feelings into action", so we

can see that the Willingness to Buy co-brands can reflect a more comprehensive situation of the system.

2) Building adjacent matrix to evaluate the mutual influence degree

With the fuzzy experts' approach, the paper makes assignment on evaluation index causality of table2-1. Experts use linguistic variable to evaluate the intensity of influence relation. The experts' critical terms is composed of 7 variable notably T= {no, very weak, weak, medium, strong, very strong, extremely strong}. These terms synchronize with membership function in Figure 3-2.

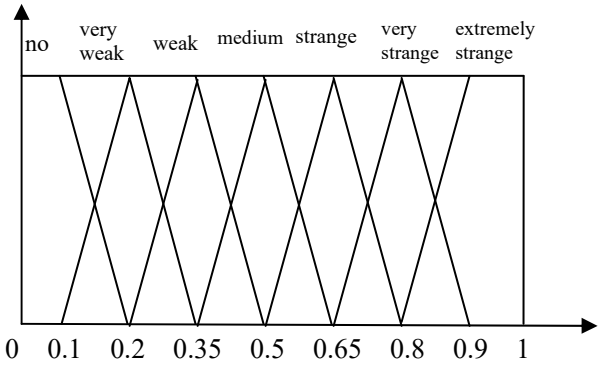

Figure 3-2 Membership function of experts' evaluation terms

Three experts from enterprise, scientific institution and college are invited to evaluate the mutual effects of evaluation index for this study. The K expert defines the causality assessment of fuzzy value from the vertex i to the vertex j as follows:

$$W_{ij}^{k}=(LW_{ij}^{k};MW_{ij}^{k};UW_{ij}^{k}) \quad (1)$$

Here, LW_{ij}^{k} is the minimum value, MW_{ij}^{k} is mid-value and UW_{ij}^{k} is the maximum value.

Then experts' fuzzy evaluations are integrated. In the hypothesis that the three experts' views are equally important, we work out their fuzzy value of polymerization triangular with the formula (2).

$$Wij=\frac{1}{3}\otimes(W_{ij}^{1}\oplus W_{ij}^{2}\oplus W_{ij}^{3}) \quad (2)$$

Here,$\otimes$ stands for fuzzy multiplication and $\oplus$ refers to fuzzy addition.

Finally, use fuzzy relative distance of formula (3) for defuzzification to gain a general linguistic weight BNP_{ij}.($BNP_{ij}\in$[-1,1]):

$$BNP_{ij}=\frac{d_{ij}^{-}}{d_{ij}^{-}+d_{ij}^{*}} \quad (3)$$

Here, $d_{ij}^{-}=d(W_{ij}^{-},W_{ij})$, $d_{ij}^{*}=d(W_{ij},W_{ij}^{*})$.

Hence, there is the adjacent matrix W for factors affecting technical standards alliance co-branding which is shown in table 3-1.

3) Setting the initial status values of concept vertex

Evaluation index in table 1 is qualitative. The experts set initial values for evaluation index, and evaluation term collection is V={very low，low，medium，very high，high}. The corresponding number is V. Using the formula listed below to deal with experts' evaluations in a standardization manner, setting the number ranging from 0-1.

$$y_i=\frac{\sum_{j=1}^{5}V_j*n_{ij}}{5*\sum_{j=1}^{5}n_{ij}} \quad (4)$$

Here, the y_i stands for i qualitative index standardization, n_{ij}means that the expert give the number of j to the index i.

4) Using weight learning algorithm to iterate and gain general weight.

The iteration of FCM can be described as the following formula:

$$C^{(k+1)}=f(C^{(k)}W) \quad (5)$$

TABLE 3-1 ADJACENT MATRIX W FOR FACTORS AFFECTING CO-BRANDING OF TECHNICAL STANDARDS ALLIANCE

	T1	T2	T3	M1	M2	M3	N1	N1	N3	B1	B2	J1	J2	J3
T1	0	0	0	0	0	0.48	0	0	0	0.32	0	0.46	0	0
T2	0.67.	0	0.54	0	0	0	0	0	0	0	0	0	0	0
T3	0.48	0	0	0	0.37	0	0	0	0	0	0	0.38	0	0
M1	0.37	0	0	0	0.64	0.51	0	0	0	0	0	0	0.33	0
M2	0	0	0	0	0	0	0	0	0	0	0.43	0	0	0.54
M3	0	0	0	0	0.37	0	0	0	0	0	0.36	0	0	0
N1	0	0	0	0	0	0	0	0	0	0.32	0	0.29	0	0
N2	0	0	0	0	0	0	0	0	0	0.26	0	0	0.36	0
N3	0	0	0	0	0	0	0	0	0	0	0.26	0	0.43	0
B1	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0
B2	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0
J1	0	0	0	0	0	0	0	0	0	0	0	0	0.43	0.65
J2	0	0	0	0	0	0	0	0	0	0	0	0	0	0.76
J3	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Here, C stands for the vertex of state matrix, $C^{(k)}$ for the k iteration of state variable, $C^{(k+1)}$ for k+1 iteration of state variable.

The iteration process from $C^{(k)}$ to $C^{(k+1)}$ mainly rely on adjacent matrix W and threshold function f(x). As the model is qualitative and the concept vertex may be negative, the threshold function serves as normalization concept vertex input value. The paper use hyperbola tangent function *f(x) = tanh(x)* as the threshold function[27]:

$$f(x) = tanh(x) = (1 - e^{-x})(1 + e^{-x}) \quad (6)$$

After a period of iteration, if the status value of concept vertex gets to any of the three states below, it can be regarded as a stable state, and at that time the iteration finishes. The three states are as follows: status value remains a stable number; the change of status value is periodic; status value is changeable and random, which is in a state of ambiguity.

Seen from the iteration process above, it can be concluded that there are two shortcomings of FCM: notably it relies much on experts view; second, the final status may be out of expectation. To strengthen the effectiveness and robustness of FCM, one needs to study algorithm to refresh weighting matrix, with the purpose of leading to the final status as expected.

The study uses Papageorgiou nonlinearity of Hebbian learning algorithm which based on the hypothesis that all the concept vertex of FCM model will be stimulated in each step of iteration and the status value will be changeable[28]. The modified iteration formula of Hebbian algorithm is as follows:

$$C_i^{(k+1)} = f(C_i^{(k)} + \sum_{\substack{j=1 \\ j \neq i}}^{N} C_j^{(k)} \bullet W_{ji}^{(k)}) \quad (7)$$

$$W_{ji}^{(k)} = \gamma w_{ji}^{(k-1)} + \eta C_i^{(k-1)}(A_i^{(k-1)} - sgn(w_{ji}) w_{ji}^{(k-1)} \bullet C_i^{(k-1)}) \quad (8)$$

Here, $w_{ji}^{(k)}$ is the number of the k iteration concept vertex ranging from relation weighting C_j to C_i. $\eta(0<\eta<0.1)$ stands for study rate parameter, which is generally set through trial and error. γ $(0.9 <\gamma<1)$ is the weight decay factor. $sgn(w_{ij})$ is used for maintaining the physical significance of the original weighting signal. $-sgn(w_{ji})\, w_{ji}^{(k-1)}(C^{(k-1)})^2$ is applied to prevent weighting develop towards direction out of expectation. In addition, we need to clarify what concept nodes are output nodes, whose status values can be represented by DOC. According to the previous analysis, the output node of the system is J3- Willingness to buy co-brands.

Generally speaking, Hebian nonlinearity learning algorithm is corresponding to two completion criteria notably through refreshing weighting values to get two minimum standard functions.

The first standard function also known as output vertex DOC is used for meeting experts' requirements, which is shown as follows:

$$F_1 = |DOC_1 - T_1|$$

Here, Ti is the average target value of output vertex DOC:

$$T_i = \frac{T_i min + T_i max}{2}$$

If the number of vertex FCM has is m, the standard function F1 is:

$$F_1 = \sqrt{\sum_{i=1}^{M}(DOC_i - T_i)^2} \quad (9)$$

The second standard function is F2 which means the change after or before output concept vertex.

$$F_2 = \left|DOC_i^{(k+1)} - DOC_i^{(k+)}\right| < e \quad (10)$$

By using nonlinearity Hebbian learning algorithm to refresh weighting matrix, ideal stable status is obtained.

IV. SIMULATION

Through the analysis of the FCM structure, one finds that in the system of factors affecting technical standards alliance co-branding effect, the causality of variable attributes to the three factors affecting co-branding effect. These three indexes serve as outcome variables of the system, being the final valid remark of co-branding. Hence, in the simulation, brand belief, perceptive quality and willingness to buy are regarded as controlled variables and the others as the control variables.

The paper selects Zhejiang Province biotechnology industry as the object of study for technical standards alliance. It simulates the initial status of the founding stage in light of the condition for selecting alliance members. The initial variable number after standardization is $C^{(0)}$=[0.4, 0.5, 0.5, 0.5, 0.4, 0.5, 0.5, 0.2, 0.4, 0.3, 0.4, 0, 0, 0], as follows: Technology management capacity and technology standardization capacity are 0.5. Technology R&D capacity is as weak as 0.4. The market cognitive capacity and fit of marketing R&D are both 0.5, marketing development capability is 0.4. The degrees of members' brands matching and targeting market matching are respectively 0.2 and 0.4, while the products matching degree is 0.5 in the medium. The brand reliability of alliance is 0.6, and the brand intention is 0.5. Due to the fact that the cooperation is not operating yet in the initial stage, as the controlled variables, the values of brand belief, perceptive quality and willingness to buy are zero.

Then, we use Hebbian learning algorithm to practice the W matrix. With the aid of trial method, the learning efficiency η= 0.01 and the weight decay factor is 0.95. Table4-1 shows the iteration process of influencing factors of co-branding in technical standards alliance. The input initial variables get balanced after 12 times iteration. The concept vertex in the balanced status is: C_{final}=[0.8752, 0.5935, 0.6853, 0.5671, 0.7735, 0.7247, 0.9126, 0.4614, 0.8173, 0.8605, 0.8143, 0.9164, 0.8849, 0.9035].

TABLE 4-1 ITERATION PROCESS OF INFLUENCING FACTORS OF CO-BRANDING

	T1	T2	T3	M1	M2	M3	N1	N2	N3	B1	B2	J1	J2	J3
Input	0.4	0.5	0.5	0.5	0.4	0.5	0.5	0.2	0.4	0.3	0.4	0	0	0
Iteration 1	0. 5675	0.3918	0.4933	0.4281	0.9014	0.719	0.7443	0.3589	0.5774	0.6159	0.6378	0.8134	0.7721	0.8805
Iteration 2	0.7800	0.4256	0.3294	0.6234	0.9075	0.7211	0.6524	0.3741	0.8035	0.3042	0.5123	0.8517	0.8629	0.894
Iteration 3	0.8253	0.5770	0.6159	0.8509	0.9018	0.7228	0.7633	0.4066	0.8096	0.8045	0.4179	0.8845	0.8711	0.8962
……							……							
Stable value	0.8752	0.5935	0.6853	0.8671	0.9126	0.7247	0.7735	0.4614	0.8173	0.8105	0.8143	0.9164	0.8849.	0.9035

It indicates that the process of co-branding is dynamic. The factors are affecting each other. The brand cooperation is deeply enhanced, thus getting to an expected status. The balanced status value of controlled variable is: Consumers' brand belief and purchase Intention are up to respectively 91.37% and 90.35%. The perceptive quality is 88.49%. All of this indicates that the effect of co-branding is obvious.

V. CONCLUSION AND PROSPECT

A. Conclusion

From the perspective of partner selection, the paper establishes co-branding evaluation frame, focusing on the dynamic process of co-branding of technical standards alliance. With the aid of FCM, the paper discusses and analyzes the causality of the factors, describing the alliance co-branding FCM structure chart. In addition, with the use of nonlinearity Hebbian learning algorithm, the fuzzy feedback system on co-branding evaluation is created. Through analysis of the FCM, we avoid relying much on experts in the process of evaluation. Finally, with the aid of computer software platform, the dynamic simulation is achieved where the stable status provides referential paths for co-branding members, improving efficiency and effects of co-branding activities. The conclusion of the paper is shown as follows:

First, being a major way of resource utilization for the technical standards alliance, co-branding contributes to increment of value for enterprises. However, with the development of technical standards alliance, the cooperation between co-branding partners advance further. The firms rely more on complementation of core technology and competitive force to make products, not only by parts fabrication.

Second, FCM, which is a new intelligent technology, has the advantages of fuzzy information expressiveness and the ability of solving multiple target decisions. The paper introduces FCM to the evaluation of factors affecting co-branding, and sets up comprehensive self-adaptation FCM model in light of experts' knowledge. The paper judges and evaluates considerable number of evaluation issues of qualitative index multiple targets in a scientific and logic way by combining experts' knowledge and intelligent algorithm.

Third, the paper studies the simulation results. Through imitation, it predicates the final status and transformation process for co-branding of technical standards alliance. The iteration process and results of stimulation iteration provide reference paths for co-branding. In each stage, it will be adjusted in light of the desired quantity which helps increase overall efficiency and effects of co-branding.

(1)The final status value is regarded as evaluation standard for factors affecting co-branding. It selects cooperative brands, which will exclude unqualified enterprises from beginning to avoid loss;

(2)In the initial stage of co-branding, it predicts the final status through stimulation iteration, which is measured according to the investment in the co-branding. It saves the time needed for the cooperation and improves co-branding efficiency.

(3)Through studying of stimulation iteration in each stage, the paper predicates the changing trend of factors affecting co-branding. Hence, it monitors and tracks the entire process of co-branding activities, which avoids the factors affecting co-branding deviating largely from the ideal state and hindering the overall process and effect of co-branding.

Last but not the least, some novel and interesting information are obtained from results of fuzzy evaluation model reasoning as follows:

1) Focus on the Market Power of Alliance Partners

The three indicators of Market Capability module constantly grow in the iterative process of the model, with steady-state values 0.8671、0.9126 and 0.7247, and mean of 1, ranking in the second place of all modules, exceeding the Capacity of Technical Standardization. This indicates that, with the deepening of co-branding between the Technical Standard Alliance Members, the requirements for the Members' Market Capability are increasingly demanding. But in effect, this is often ignored, resulting in the common occurrence of the crowding out of advantageous technologies by disadvantageous ones. On the one hand, Alliance Members' good Market Capability is the key for sustainable development of the Technical Standard Alliance. Only when the number of installation users of technical standards reaches critical capacity point, can the Alliance survive. On the other hand, according to Emotion Transference Theory, the consumer perception of a partner's good Market Capability can be transferred to the co-brands, then the consumer will be more confident over the outlook for technology development, leading to brand trust, brand awareness and Willingness to Buy.

2) Develop consumer confidence on co-branding

In the fuzzy cognitive map, the Brand Trust Sector is rather active, and has established contacts with all the other sectors, it is not only influenced by the technical Capacity and Market Capability Sectors, but it directly affect the

co-branding effect; While using fuzzy evaluation model for simulation, the two index values of the compatibility sector continued to increase along with the iteration, ranking the top three of all control factors. Cultivating consumer trust for co-branding has conducive effect upon the promotion of the Alliance's Technology. In cases of risks, brand trust enables consumers' willingness to rely on brands while prioritizing the Alliance's technology, and affecting the Consumers' Current Selection, Word of Mouth and Willingness to Buy. The Alliance should therefore make a positive commitment to develop consumer confidence over co-branding, to enhance its effect.

3) Attach importance to the compatibility of the cooperation parties

In the simulation iteration, the three secondary indicators of Compatibility vary little, and their respective final steady state value is not high, reflecting its stability as an objective existence. This is also reflected in the fuzzy cognitive map, the Compatibility Sector is hardly affected by other factors, but it acted as the "cause" of impact on other factors: higher compatibility of co-brands is in favor of the transition from cooperation brand images to co-branded images, this can enhance consumer confidence in and active evaluation of the co-brands. Therefore, while choosing partners, the Technology Standard Alliance should focus on the compatibility of brands, products and target markets, to achieve maximum benefit of co-branding.

B. Research Prospect

1) From the perspective of cooperative partner, this paper established the evaluation index system of brand alliance, which is a new attempt and has some weaknesses. For example, the evaluation system is mainly applied to the general technical standard alliances and the selected indexes are all the qualitative indexes. It needs to be further discussed for how to establish the evaluation system and explore the quantitative evaluation indexes aimed at more specific fields and industries.

2)The paper combines the fuzzy cognitive map with non-linear Hebbian learning algorithm for the modeling, which realized the integration of qualitative analysis and quantitative calculation. However, the affirmation of casual correlation and the scoring of adjacent matrix are still dependent on the experience and knowledge of experts. Therefore, the further researches may focus on the improvement of algorithm. For example, the Particle Swarm Optimization algorithm achieves the conception of automatic establishment of fuzzy cognitive map by data learning so as to overcome the shortcomings above and improve the adaptation of FCM model. It is our future research direction.

ACKNOWLEDGEMENTS

This work is partially supported by Soft science project of Zhejiang Province—Research on risk prevention mechanism and countermeasure in Strategic Emerging Industries' Technical Standards Alliances: the Ecosystem Perspective [2015C35002], and Natural Science Foundation project of Zhejiang Province—Research on the Influencing Mechanism of Partner Selection on Co-Branding Effect of Technical Standard Alliance based on Embedness——in case of Zhejiang [LQ16G020004]

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