A FUZZY COMPREHENSIVE EVALUATION OF ENTREPRENEUR BASED ON ABILITY CAPITAL

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Abstract: In this paper, the fuzzy mathematics method is applied to build a fuzzy comprehensive evaluation model of multilevel selection of entrepreneur ability capital. Fuzzy comprehensive evaluation is very effective in multiple factor decision-making and layered authorization is used in AHP to decide authority preferences. All these make the difference in subjective evaluation controlled to the minimum scope, hence the evaluating results are more objective and exact. The paper provides a scientific, practical and quantitative method for the system analysis and comprehensive evaluation of entrepreneur ability capital.

Key words: entrepreneur ability capital, evaluation index system, fuzzy comprehensive evaluation

Entrepreneur ability capital is concerned by society widely. Human's knowledge, intellence and creative ability have become the main resources and power of current economic development of society. Entrepreneur ability capital is to capitalize, to value the entrepreneur's ability and to pursue the maximum profits through the market. As of lucubrating of entrepreneur ability capital, is concerned whether exerting the entrepreneur's effect sufficiently, moreover, is concerned whether promoting development of economic society rapidly. Therefore, it's very important for comprehensive evaluation of entrepreneur ability capital. It includes many aspects of the constitute of entrepreneur ability capital. How to assess entrepreneur exactly is a researching hotspot which is researched by entrepreneur and theorist. In this text fuzzy comprehensive evaluation and analysis hierarchy process are applied for evaluation of entrepreneur ability capital on the basis of establishment of the index system of entrepreneur ability capital. That provides a scientific and useful quantity method for systematic analysis and impersonaly evaluation of entrepreneur ability capital.

1. ENTREPRENEUR ABILITY CAPITAL

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Entrepreneur is the key of the development of the enterprise and its ability is the core element. Therefore，the research of entrepreneur ability acquires rife recognition of experts and scholars all around the world.

Foreign scholars have investigated entrepreneur ability as earlier as 18th century. Experts and scholars have discussed entrepreneur ability extensively from different perspectives. Cantillon(1775) indicated that entrepreneur should be provided with the power of speculation from the aspect of the spirit of the venture；Say (1804) emphasized the power of the coordination of the organization of entrepreneur；Maxieer (1843) indicated entrepreneur ability should be "the operating power of the utilization of the capital" from the perspective of organization；Knight (1921) figured that the chief function of entrepreneur is to "determine which to do and how to do" on the condition of uncertainty risk from the perspective of risk as well as to undertake uncertainty, its essential requirement was that entrepreneur should possess the ability of guarantee for economic income; Schumpeter (1934) put forward and reviewed the creative ability of entrepreneur from the perspective of abolishing old equilibrium；Kirzner(1937) analyzed entrepreneur ability from the perspective of bringing into playing market revising disequilibrium； Coase (1938) figured that entrepreneur should possess the ability of market demand prediction, organization management and ordination from the perspective of organization management and production operation；Schultz (1973) figured that entrepreneur should have the ability of dealing with disequilibrium through classifying the ability of entrepreneur；Carson (1981) figured that entrepreneur should have the ability of decision-making judgement and pointed out that it was decision-making according to the owned information under uncertainty condition from the perspective of the normal frame of the company research. Different experts figured out distinct opinions for entrepreneur ability with varied and disunified views in their fields respectively. This indicated different scholars not only emphasized entrepreneur ability research but also opened out the difference of entrepreneur ability between different scholars in understanding.

No few scholars carried through concerned research and acquired a few performances on the matter of entrepreneur ability capital. So called entrepreneur is special talent based on ability capital and professional on operating corporation through promoting survival and development of entrepreneur to come true maximum of self and entrepreneur and social profit. Ability is the display of human's comprehensive quality in real life and an positive and efficient pattern in dominating certain activity exactly and real skill and energy in solving some problem and coming true human's value. The basic signification ,so called capital, is a mean for future profit through certain investment activity. All acquired belongings that will gain certain profit or benefit in future and pay out toll in current certain period is capital. Entrepreneur ability capital is summation of coagulation with knowledge and technology and information and health and quality and reputation and group collaboration power through investment.

2. ENTREPRENEUR ABILITY CAPITAL EVALUATION INDICATOR SYSTEM CONSTRUCTION

Entrepreneur ability capital is a concrete and intact and dynamic system and its constrction of evaluation indicator system is established according to the elements of entrepreneur ability capital. Different scholars have distinct opinions on the elements of entrepreneur ability capital. Author chose and confirmed elements system of entrepreneur ability capital construction cautiously through considerating elaborately and comparing repeatedly after reading a lot of literature materials and also confirmed a indicator system which could reflect entrepreneur ability capital completely and scientificly. Entrepreneur ability capital construction include four aspects with knowledge, intelligence, quality and health. Knowledge include organization knowledge, environment knowledge and expertise knowledge；Intelligence include decision-making ability, analysis ability and innovation ability；Quality include particularity feature and politics quality ；Health include mind health and body health. Every

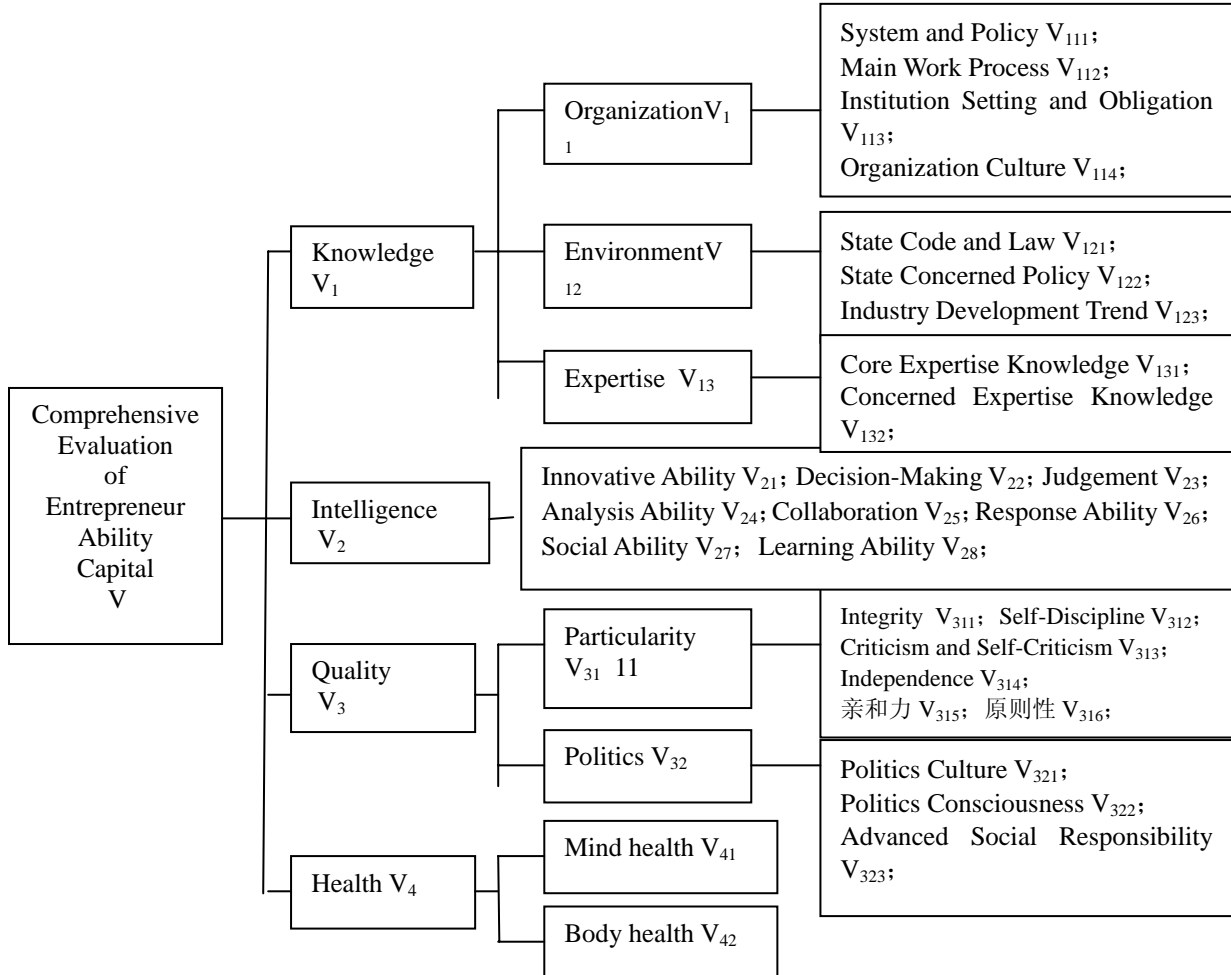element of ability capital construction includes several concrete elements.（as of chart one）.

		OrganizationV$_{11}$	System and Policy V$_{111}$; Main Work Process V$_{112}$; Institution Setting and Obligation V$_{113}$; Organization Culture V$_{114}$;
Comprehensive Evaluation of Entrepreneur Ability Capital V	Knowledge V$_1$	EnvironmentV$_{12}$	State Code and Law V$_{121}$; State Concerned Policy V$_{122}$; Industry Development Trend V$_{123}$;
		Expertise V$_{13}$	Core Expertise Knowledge V$_{131}$; Concerned Expertise Knowledge V$_{132}$;
	Intelligence V$_2$		Innovative Ability V$_{21}$; Decision-Making V$_{22}$; Judgement V$_{23}$; Analysis Ability V$_{24}$; Collaboration V$_{25}$; Response Ability V$_{26}$; Social Ability V$_{27}$; Learning Ability V$_{28}$;
	Quality V$_3$	Particularity V$_{31}$ 11	Integrity V$_{311}$; Self-Discipline V$_{312}$; Criticism and Self-Criticism V$_{313}$; Independence V$_{314}$; 亲和力 V$_{315}$; 原则性 V$_{316}$;
		Politics V$_{32}$	Politics Culture V$_{321}$; Politics Consciousness V$_{322}$; Advanced Social Responsibility V$_{323}$;
	Health V$_4$	Mind health V$_{41}$	
		Body health V$_{42}$	

Chart 1 The evaluation indicator system of entrepreneur ability capital construciton element

3. THE CONSTRUCTION MATHEMATICS MODEL OF FUZZY COMPREHENSIVE EVALUATION OF MULTILEVEL SELECTION

3.1 Fixing on evaluation rank theory field, it is a pool which is consist of evalution results likelihood according to evaluation standard for evaluation object. $U = (u_1, u_2, \cdots, u_p)$. Amongst of them, element u_k , $k = (1, 2, \cdots, p)$, p is several possible evaluation results. u_k may be the remark or evaluation rank for evaluation object. Here if p is too big to judge rank vested easily, and if p is too small to make entire description for evaluation object easily, commonly $p \in [4\ 9]$, and $p = 4$ or $p = 5$ is more utility. In this paper evaluation field for entrepreneur ability capital is

$U = (u_1, u_2, u_3, u_4, u_5)$ ={quite satisfaction，very satisfaction，satisfaction，dissatisfaction，sepecial dissatisfaction}={100-90，90-80，80-70，70-60，60-50}.

3.2 Fixing on evaluation element field, $V = (v_1, v_2, \cdots, v_m)$，Amongst of them, element $v_i (i = 1, 2, \cdots, m)$ is the i number element of the first selection element, which is determined by n_i number sub-element of the second selection.

Fuzzy relation matrix $R = (r_{ij}) = u_{ij} / w$ may be founded from V_m to U.

3.3 Comprehensive Evaluation

As every element is determined by several sub-element of the lower selection，therefore, the single element evaluation for every element may be viewed as a lower multi-element comprehensive evaluation. The purpose of setting up multilevel element fuzzy comprehensive evaluation model is hoping for confirming the important degree relatively and enhancing nicety degree more conveniently in a lesser scope. For the problem of multilevel element model, method of request is consistent though element-level is apart of more or less. Now taking second-level for example, on the circumstance of considering two level element, second-level element fuzzy comprehensive evaluation is the fuzzy comprehensive evaluation for all elements of the first selection $V_i (i = 1, 2 \cdots, m)$ .Thus it can be seen, first-level element fuzzy comprehensive evaluation pool $\underset{\sim}{B}_i$ is also evaluation matrix $\underset{\sim}{R}$ for second-level fuzzy comprehensive evaluation, namely

$$\underset{\sim}{R} = \underset{\sim}{b}_i = \begin{bmatrix} \underset{\sim}{b}_1 \\ \underset{\sim}{b}_2 \\ \vdots \\ \underset{\sim}{b}_n \end{bmatrix} = \begin{bmatrix} \underset{\sim}{a}_1 \circ \underset{\sim}{R}_1 \\ \underset{\sim}{a}_2 \circ \underset{\sim}{R}_2 \\ \vdots \\ \underset{\sim}{a}_n \circ \underset{\sim}{R}_n \end{bmatrix}$$ Amongst of them, the subjection degree of u_k which is the

evaluation result by the sub-element V_{ij} of the second selection element is $r_{ijk} (i = 1, 2, \cdots, n; j = 1, 2, \cdots, m; k = 1, 2, \cdots, p)$, so the evaluation matrix of the second selection element can be showed as below：

$$\underset{\sim}{R}_i = \begin{bmatrix} r_1 \\ r_2 \\ \vdots \\ r_n \end{bmatrix} = \begin{bmatrix} r_{i11} & r_{i12} & \cdots & r_{i1p} \\ r_{i21} & r_{i22} & \cdots & r_{i2p} \\ \vdots & \vdots & \ddots & \vdots \\ r_{im1} & r_{im2} & \cdots & r_{imp} \end{bmatrix}$$ Amongst of them, the j row shows the consideration of

evaluation pool of the second element of the j number sub-element, which is the fuzzy pool of the pool of U. And then, when the pool of element weight coefficient $\underset{\sim}{A}_i$ and evaluation matrix $\underset{\sim}{R}_i$ is given, you can gain fuzzy comprehensive evaluation pool $\underset{\sim}{B}_i$ according to the synthesis operation of fuzzy relationship, namely $\underset{\sim}{b}_i = \underset{\sim}{a}_i \circ \underset{\sim}{R}_i$ or

$$(b_{i1}, b_{i2}, \cdots, b_{ip}) = (a_{i1}, a_{i2}, \cdots, a_{im}) \circ \begin{bmatrix} r_{i11} & r_{i12} & \cdots & r_{i1p} \\ r_{i21} & r_{i22} & \cdots & r_{i2p} \\ \vdots & \vdots & \ddots & \vdots \\ r_{im1} & r_{i11} & \cdots & r_{i11} \end{bmatrix}$$

b_{ik} expressed the subjection

degree of the evaluation object of the number k element v_k for the evaluation pool of U in considerating every sub-element v_{ij} $(j = 1, 2, \cdots, m)$ of determined element v_i for comprehensive evaluation in the second selection. Second level element fuzzy comprehensive evaluation is also the fuzzy comprehensive evaluation for all the elements v_i $(i = 1, 2, \cdots, n)$ of the first selection. Thus it can be seen, first-level element fuzzy comprehensive evaluation pool $\underset{\sim}{B}_i$ is also evaluation matrix for second-level fuzzy comprehensive evaluation, and then, second-level fuzzy comprehensive evaluation pool is as below：

$$\underset{\sim}{b} = \underset{\sim}{a} \circ \underset{\sim}{R} = \underset{\sim}{a} \circ \begin{bmatrix} \underset{\sim}{a}_1 \circ \underset{\sim}{R}_1 \\ \underset{\sim}{a}_2 \circ \underset{\sim}{R}_2 \\ \vdots \\ \underset{\sim}{a}_n \circ \underset{\sim}{R}_n \end{bmatrix} = (b_1, b_2, \cdots b_n,)$$ Amongst of them, fuzzy relationship synthesis

" $\circ$ "adopts （ $\bullet$ ，$+$ ）. Adopting the arithmetic operators （$\wedge, \vee$） operation of *Zadeh* in the fuzzy relationship synthesis of the comprehensive evaluation model small operation $(\wedge)$ gets value between the intersection of $a_i (i = 1, 2, \cdots, n)$ and $r_{ij} (i = 1, 2, \cdots, n; j = 1, 2, \cdots, m)$ ，which value shouldn't exceed the lesser between a_i and r_{ij}. When there are a large number of elements, as if weight coefficient a_i goes back to single, which value must be much lesser, it makes all r_{ij} for $r_{ij} \rangle a_i$ be overlooked and a_i will be the upper limit of r_{ij} ；In contrast, when the element is lesser and the value of a_i is greatness, it makes all a_i for $a_i \rangle r_{ij}$ be overlooked and r_{ij} will be the upper limit of a_i. Therefore, it is difficult to acquire reasonable evaluation result because of possibly losing lots of evaluation information which makes distortion as element is much more or much less, so fuzzy relationship synthesis " $\circ$ " adopts （ $\bullet$ ，$+$ ） evaluation model， which will consider effect of every element more sufficiently and reflect evaluation information completely. There isn't necessary for implementing the limitation of upper limit besides requiring a_{ij} going back to singleness in operation, and the result of the evaluation is finer than （ $\wedge, \vee$ ）.

Aiming at fuzzy comprehensive evaluation of entrepreneur ability capital, firstly, choosing evaluation indicator, such as evaluation indicator $V_{11} = (V_{111}, V_{112}, V_{113}, V_{114}) = $（system and policy in organization, main work process for corporation, institution setup and section obligation, organization culture）.

Secondly, conducting expert judgement, speciality group（setting up ten person）computes statistical jugdement result and evaluates order diagram comprehensively after conducting level judgement for the concrete structure element of the evaluation indicator V_{11}, the fuzzy relationship matrix R_{11} from V_{11} to U is as below：

Evaluatation Order Diagram for V_{11} Indicator

Indicator	Evaluation				
	u_1	u_2	u_3	u_4	u_5
System and policy	4	5	1	0	0
Main work process	0		2	3	0
Institution and obligation	1	3	4	2	0
Organization culture	5	4	1	0	0

$$R_{11} = \begin{bmatrix} 0.4 & 0.5 & 0.1 & 0 & 0 \\ 0 & 0.2 & 0.5 & 0.3 & 0 \\ 0.1 & 0.3 & 0.4 & 0.2 & 0 \\ 0.5 & 0.4 & 0.1 & 0 & 0 \end{bmatrix}$$

Determination of weight coefficient of the evaluation element is desinged according to indicator program, every indicator is ordered according to the importance among the main indicator by experts，and the coefficient is determined according to order result. The weight coefficient

$A_{11} = (a_{111}, a_{112}, a_{113}, a_{114})$ of $V_{111}, V_{112}, V_{113}, V_{114}$ is given by expert group. And $\sum_{j=1}^{4} a_{11j} = 1$.

Conducting classification evaluation again, evaluation result for the indicator of V_{11} is

$B_{11} = A_{11} \bullet R_{11} = (u_{111}, u_{112}, u_{113}, u_{114}, u_{115})$ ，evaluation result of choosing indicator V_{12}, V_{13} is respectively as below：

$B_{12} = A_{12} \bullet R_{12} = (u_{121}, u_{122}, u_{123}, u_{124}, u_{125})$

$B_{13} = A_{13} \bullet R_{13} = (u_{131}, u_{132}, u_{133}, u_{134}, u_{135})$

Fuzzy relationship matrix of the knowledge indicator from V_1 to U is gained by B_{11}, B_{12}, B_{13}，

$$R_1 = \begin{bmatrix} u_{111} & u_{112} & u_{113} & u_{114} & u_{115} \\ u_{121} & u_{122} & u_{123} & u_{124} & u_{125} \\ u_{131} & u_{132} & u_{133} & u_{134} & u_{135} \end{bmatrix}$$

Weight coefficient $A_1 = (a_{11}, a_{12}, a_{13})$ of V_{11}, V_{12}, V_{13}

is given by expert group. Evaluation result for indicator V_1 is: $B_1 = A_1 \bullet R_1 = (u_{11}, u_{12}, u_{13}, u_{14}, u_{15})$.

In the same truth, the evaluation result of intelligence indicator V_2, quality indicator V_3 and health indicator V_4 is gained respectively as below：

$B_2 = A_2 \bullet R_2 = (u_{21}, u_{22}, u_{23}, u_{24}, u_{25})$

$B_3 = A_3 \bullet R_3 = (u_{31}, u_{32}, u_{33}, u_{34}, u_{35})$

$B_4 = A_4 \bullet R_4 = (u_{41}, u_{42}, u_{43}, u_{44}, u_{45})$

Fuzzy relationship matrix of the comprehensive evaluation indicator of entrepreneur ability capital from V to U is gained by：

$$R = \begin{bmatrix} u_{11} & u_{12} & u_{13} & u_{14} & u_{15} \\ u_{21} & u_{22} & u_{23} & u_{24} & u_{25} \\ u_{31} & u_{32} & u_{33} & u_{34} & u_{35} \\ u_{41} & u_{42} & u_{43} & u_{44} & u_{45} \end{bmatrix}$$

Weight $A = (a_1, a_2, a_3, a_4)$ of V_1, V_2, V_3, V_4 is determined by expert group. Evaluation result of the comprehensive evaluation indicator V for entrepreneur ability capital is as below：

$$\underset{\sim}{B} = \underset{\sim}{A} \bullet \underset{\sim}{R} = (u_1, u_2, u_3, u_4, u_5).$$

Finally, conducting comprehensive evaluation, as the indicator system of entrepreneur ability capital has the character of multi-level framework, therefore, multi-level fuzzy comprehensive evaluation model should be applied for evaluation. Utilizing comprehensive evaluation model of entrepreneur ability capital figures out the comprehensive value of entrepreneur ability capital, which can make you know the evaluation level of every structure element of entrepreneur ability capital and can become as the basis of selecting, training and employing for entrepreneur of enterprise.

The paper makes up entrepreneur ability capital evaluation indicator system according to the principle of the constitution element of entrepreneur ability capital, the evaluation acquired better effect in applying fuzzy mathematics and AHP for the entrepreneur ability system, it overcame the abuse of the great influence of the subject element ever in the course of the evaluation for entrepreneur ability capital, therefore, it can gain the more objective result from more exact evaluation.

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