COMPREHENSIVE FUZZY EVALUATION FOR ENTREPRENEURIAL OPPORTUNITIES BASED ON INDUSTRY CHAIN

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ABSTRACT. *In this paper, according to the fuzziness and randomness existing in business opportunity evaluation, we create a target system for entrepreneurial opportunities fuzzy evaluation from the perspective of industry chain. In the system the weighted value for each and every evaluation index is determined by combining the entropy weight with subjective weight so as to make the evaluation more objective and scientific.*

Keywords ： Industry Chain; Entrepreneurial Opportunity; Entropy Weight; Fuzzy Comprehensive Evaluation

1. Introduction. With the development of science technology and information technology, the global economy has gradually become integrated, enterprises are facing competition from one or more areas to the whole world, entrepreneurship and new enterprises have become an important force driving economic growth. Entrepreneurship has aroused widespread attention, entrepreneurial opportunity, as a key in the initial business stage, affects the entire business activity. In recent years, theorists made a number of models on the identification and development of opportunities (Bhave, 1994; Schwartz and Teach, 1999; Singh et al, 1999; Sigrist, 1999; Ardichvili et al., 2003). In these models, the opportunity evaluation is in a very important position. Shane and Venkataraman consider that the factors impacting entrepreneurial opportunity evaluation is divided into two aspects, namely, entrepreneurial opportunity's properties and the entrepreneur's qualities. Zheng Bingzhang et al. (2008) believe that evaluating entrepreneurial opportunity must take into account four factors. First, financial affairs. Whether the business opportunity could create value for entrepreneurs or shareholders (financial returns); Second, the customer. Whether the entrepreneurial opportunities could create sustainable value for customers (use value); the third, the internal factors. It depends on who goes to develop entrepreneurial opportunities and the resources owned by entrepreneur to develop entrepreneurial opportunities; fourth, learning and innovation. That is the innovation and continuity of entrepreneurial opportunities, mainly refers to the future value of entrepreneurial opportunities, the strategic advantage of entrepreneurial opportunities.

In the "New Venture Creation: entrepreneurship for the 21th century", Timmons made an evaluation index system including 8 first-grade indexes and 55 second-grade indexes, which covers all indexes of other theories, is the most comprehensive index system to

evaluate entrepreneurial opportunity. This eight indexes include: industry and market, economic factors, harvest conditions, competitive advantage, management team, a fatal flaw, entrepreneurs' standards, the strategic differences between ideal and reality. The attractiveness of each indicator is divided into the maximum potential and minimum potential, and then describe what is the maximum or minimum potential. Timmons admited that there were thousands of particular opportunities for entrepreneurs in reality, which may not be able to fit with this evaluation frameworks. But his framework is the most complete evaluation system.

Jiang Yanfu, Qiu Qiong (2004) made a comparative study on Chinese experienced entrepreneurs and general managers by questionnaire method basing on Timmons' opportunity evaluation framework, which put forward 10 key indicators for Chinese entrepreneurs or investors to assess entrepreneurial opportunities informally and rapidly, and concluded: Chinese entrepreneurs should pay more attention to human factor during the evaluation.

But there are few scholars evaluate business opportunities from the perspective of industry chain. In this paper, according to the fuzziness and randomness existing in business opportunity evaluation, we create a target system for entrepreneurial opportunities fuzzy evaluation from the perspective of industry chain. In the system the weighted value for each and every evaluation index is determined by combining the entropy weight with subjective weight so as to make the evaluation more objective and scientific.

2. The evaluation of entrepreneurial opportunities from the perspective of chain

2.1. Value chain and industry chain. In 1985, Michael Porter first proposed the concept of the value chain in his book "Competitive Advantage," he believed that, from the perspective of process of creating value, a company's activities from creating company to put into operation connected into a cost chain, including not only input but also increase in value. The value chain, a series of consecutive completed activities, is the process of converting raw material into final products and realizing value adding continuously. The value chain is a system of interdependent activities, not only in an enterprise's value chain, but also between enterprise's value chain and supplier's value chain. Industry chain as a broader meaning than the value chain is developed by Chinese scholars based on Porter's value chain. The industrial chain describes the activities of producing final products or services for adding value within enterprise or between enterprises. It covers all stages of producing goods or services, from raw materials to final consumer goods. A complete and competitive industrial chain , not only concern consumer's demand effectively, meet their demand in the process of R & D and marketing, and create value; it also need to improve efficiency and reduce cost in the process of supply. Industrial chain is a complete process from raw materials to the users, enterprises between the upstream and downstream are interconnected due to technical linkages and relationship between input and output. Industry chain is essentially a structure of the industry, as long as industrial affiliation exists in enterprises, it can constitute industrial links or chain segment.

Industry chain can be divided into vertical supply chain and horizontal collaboration chain. Vertical supply chain is a complete chain from technical research, product

development, raw material procurement, production, marketing, until sale service. This chain's formation is based on the supply and demand of products or services between vertical industries. Horizontal collaboration take a node or a link of the vertical chain as a center, derivatives constantly and form a closely related diversified companies, these companies collaborate and form an industrial chain taking a new product (service) as the center, that is to say the lateral industrial chain is derived from the longitudinal chain, as shown in Figure 1.
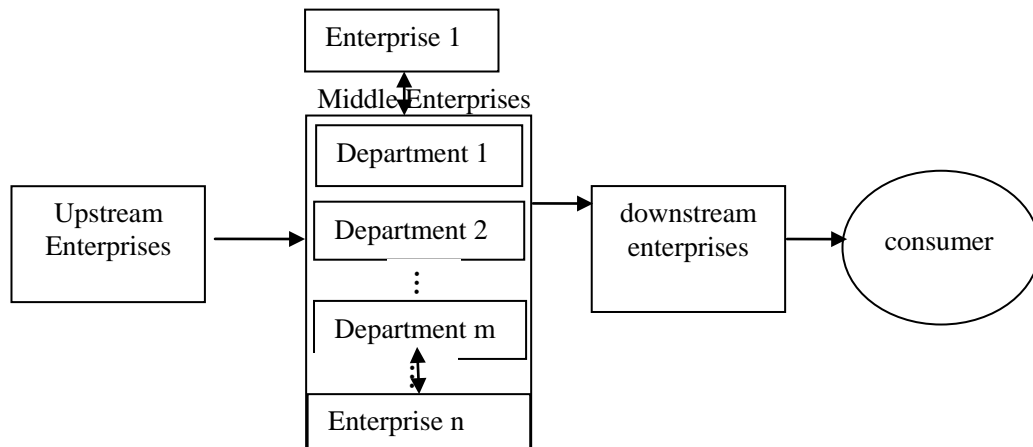

FIGURE 1. Industrial chain

2.2. Factors affecting entrepreneurial opportunity evaluation and the creation of index system from Perspective of industry chain.
Entrepreneurial opportunities, also known as business opportunities or market opportunities, is the business space with attractive, more durable and timely, and ultimately is reflected at products or services for customer or client creating value or value-added. Industrial segmentation and clustering, and the extension of industry chain, will generate business opportunities. Whether entrepreneurial opportunities have competitive advantages, or have abilities to create value for consumers, it is closely related not only to their own property, but also to the upstream and downstream enterprises, the smooth collaboration between horizontal enterprises also has a very important role in realizing entrepreneurial opportunities successfully.

Therefore, evaluating entrepreneurial opportunities must take into account three factors.

Firstly, the properties of entrepreneurial opportunities. From the definition, we know that entrepreneurial opportunities are real and can bring value for the customers; whether ideas can become business opportunities is closely related entrepreneurs' resource; persistent entrepreneurial opportunities take into account not only the current profitability, but also the future profitability; attractive opportunity can get investment, because investor should fully consider its value and risk. Whether the business opportunity could create value (financial return) for entrepreneurs or shareholder, which can be reflected through financial ratios, including expected internal rate of return, expected return on investment, payback period, and net interest on sales.

Secondly, the vertical chain. Low trading activity, poor docking of supply and demand, and poor information exchange, especially low cooperation in technology and market management, will reduce the rate of product innovation, and increase operational costs.

Entrepreneurial opportunities in such a chain, it is difficult for customers and investors to create more value or realization of value added.

Thirdly, the lateral chain. As profit-driven and market barriers exist, effective resources between the various regions are not fully integrated and used, waste and inefficient operation. Enterprises under their respective interests invest and produce repeatedly, and low level and vicious competition leads to short-term opportunities.The level of invasion barriers, and the concentration of competitors will also affect the realization of entrepreneurial opportunities.

Taking Timmons' evaluation criteria as the index database, and basing on empirical and theoretical analysis, we build a evaluation index system for entrepreneurial opportunities from four aspects as attribution of opportunity, finance, vertical industrial chain,, as well as horizontal chain。 Attribution of entrepreneurial opportunities concldes Resources for entrepreneurs, The sustainability of entrepreneurial opportunities, anti-risk capability and environmental adaptability factors; Finance concldes Expected internal rate of return, Expected return on investment, Payback period, Sales growth, Net interest on sales factors; Vertical industrial chain concldes Trading activity, Information exchange, Cooperation in technology, Transaction costs factors; Lateral industrial chain concldes Intrusion Barrier, Diversity of competitors, The complexity of information, Concentration of competitors factors.

3. Comprehensive evaluation method for entrepreneurial opportunities based on entropy weight fuzzy

3.1. The calculation model of entropy. Entropy method is an objective weighting method, the principle is that weights is determined by the amount of information reflected in the variation of indicator values.

In information theory, information entropy is for measuring the degree of system's disorder. The smaller the value of information entropy is, the greater variation and the more information appears. So it play more important role in the comprehensive evaluation, that is, the greater weight. Therefore, according to the degree of variation in various indicators, use information entropy to calculate the weight of each index.

Suppose there are n attributes, m programs, and form a original data matrix $X'=(x'_{ij})_{m \times n}$, Entropy value is calculated as follows：(1) Normalize every data of index in matrix X' to obtain a new matrix $X=(x_{ij})_{m \times n}$, and then calculate the contribution of plan i under attribute j: $P_{ij}=\dfrac{x_{ij}}{\sum\limits_{i=1}^{m} x_{ij}}$; (2) count the entropy value of attribute j: $E_j=-K\sum\limits_{i=1}^{m} p_{ij}\ln p_{ij}$, where $K=\dfrac{1}{\ln m}$; (3) Calculate the difference factor attribute j: $d_j=1-E_j$; (4) determine the entropy value of attribute j: $w_j=\dfrac{d_j}{\sum\limits_{j=1}^{n} d_j}$

3.2. Comprehensive evaluation method based on entropy weight fuzzy. Firstly, establish the evaluation index system. Assuming the set of evaluation factors for the U which is

layered.   First   class   index $U = \{U_1, \cdots, U_i, \cdots, U_q\}$;   Second   class   index
$U_i = \{U_{i1}, \cdots, U_{ij}, \cdots, U_{im}\}$. Where U_{ij} represents indicator j in criteria layer i.

Secondly, establish evaluation criteria set V. $V = \{V_1, \cdots, V_j, \cdots, V_k\}$, V_j is criteria j in the set.

Thirdly, matrix of membership R is established.

$$R = \begin{bmatrix} R_1 \\ R_2 \\ \vdots \\ R_m \end{bmatrix} = \begin{bmatrix} R_{11} & R_{12} & \cdots & R_{1k} \\ R_{21} & R_{22} & \cdots & R_{2k} \\ \vdots & \vdots & & \vdots \\ R_{m1} & R_{m2} & \cdots & R_{mk} \end{bmatrix}$$

R_{ij} (i=1,2,…,m; j=1,2,…,k) is the the degree of membership of indicator i to criteria j, which reflects fuzzy relation indicated by the degree of membership between evaluation index and assessment levels; m represents the number of index; k is the number of evaluation grades.

Then we get a comprehensive weight set by a combination of subjective and objective methods. Let the first class comprehensive weight set be W = {W$_1$,…,W$_i$,…,W$_q$}; the second class is W$_i$= {W$_{i1}$,…,W$_{ij}$,…,W$_{im}$}. Subjective weight λ_i is determined by expert survey, and objective weight is β_i, so we can get comprehensive weight by $W_i = \lambda_i \alpha + \beta_i (1-\alpha)$, $\alpha \in [0,1]$, we take $\alpha = 0.5$ temporarily. This method is the combination of subjective and objective calculation, which enhance the credibility of the weight.

Finally, we conducted multi-level fuzzy comprehensive evaluation. At first, we conduct first class comprehensive evaluation basing on the entropy weight W and matrix of membership R, using fuzzy algorithms to get the membership grade matrix Si;

$$S_i = W_i \bullet R_i = \begin{bmatrix} W_{i1} & W_{i2} & \cdots & W_{im} \end{bmatrix} \times \begin{bmatrix} R_{11} & R_{12} & \cdots & R_{1k} \\ R_{21} & R_{22} & \cdots & R_{2k} \\ \vdots & \vdots & & \vdots \\ R_{m1} & R_{m2} & \cdots & R_{mk} \end{bmatrix}$$

Then, we do second class comprehensive evaluation to get a total evaluation vector A:

$$A = W \bullet S$$

4. Conclusion. Firstly, whether entrepreneurial opportunities can create value is closely related to not only their attribution, but also the upstream and downstream enterprises, the smooth collaboration between horizontal enterprises also has a very important role in realizing entrepreneurial opportunities successfully.

Secondly, In the system the weighted value for each and every evaluation index is determined by combining the entropy weight with subjective weight so as to make the evaluation more objective and scientific.

Thirdly, Comprehensive Assessment System provides a basis for the full knowledge and application of integrated design, so that the integrated design method can be more widely used.

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