

# An Evaluation Model of Venture Enterprises

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## 1. Introduction

In venture capital, it is of great importance to evaluate venture enterprises (VE). To evaluate them properly, we must make clear all factors that affect VE and the extent that they influence VE, but it is very difficult to quantify them exactly by common techniques. We build an evaluation model of VE by analytic hierarchy process (AHP) and fuzzy comprehensive evaluation (FCE), which can make exact evaluation, here is its idea: use analytic hierarchy process to build the assessment index system to determine the weights of all indexes, make qualitative evaluation use fuzzy transition to transform it to comprehensive evaluation, quantify the result of comprehensive evaluation.

## 2. Building the index system of VE and determining the weights of all indexes by AHP

### 1) Establishing the successive hierarchy model

The evaluation index system of VE includes several aspects: (1) market factors, including market demand, market share, market rising potentiality, market entering obstacle and competitive conditions. (2) product factors, including value to client, unique feature, client's identification of product feature, easiness to be imitated and complexity. (3) management factors, including marketing ability, production ability, R&D ability, employees' stuff, enterprise culture, leaders' capacity and financial ability. (4) environmental factors, including economic prosperity, government policy, social culture and the strength balance between two sides. (5) profitability, including marginal profit, investment scale, ways of quitting, the difficult degree of quitting and obstacle of quitting. The top layer is the value of VE, the rule layer including market factors, product factors, management factors, environmental factors and profitability, the child rule layer including twenty-six factors such as market demand, obstacle of quitting etc..

### 2) Building two-comparing judgment matrix

When the successive hierarchy model was built, the subjection relation between fluctuation layer factors was determined. If we take the upper factor as the rule  $B_k$ , it has dominating relation to the lower factors  $C_1, C_2, \dots, C_n$ , our aim is giving proper weights to  $C_1, C_2, \dots, C_n$  according to their comparative importance under rule  $B_k$ . But it is not easy to get the weights directly, we use two-comparing method in AHP. According to the demand of AHP, we make a judgment matrix as follows:

$$\begin{matrix} 1/2 & 1 & 1/3 & 5 & 1 \end{matrix} \begin{pmatrix} 1 & 2 & 1 & 7 & 2 \\ 1 & 3 & 1 & 7 & 2 \\ 1/7 & 1/5 & 1/7 & 1 & 1/3 \\ 1/2 & 1 & 1/2 & 3 & 1 \end{pmatrix}$$

### 3) Hierarchy arrangement and its consistency test

After calculation of the upwards judgment matrix, we get the following results:  $\lambda_{\max}=5.0543$ ,  $CI=0.0136$ ,  $CR=0.0121 < 0.1$ . We can think the judging matrix has the satisfactory consistency. The eigenvector  $S=(0.3104, 0.1571, 0.3382, 0.0435, 0.1509)$  during the assessment of VE, the weight of market

factors is 31.04%, the weight of product factors is 15.71%, the weight of management factors is 33.82%, the weight of environmental factors is 4.35%, the weight of profitability is 15.09%.

### 3. Determining the comprehensive value of VE by FCE

#### 1) Building FCE model

The element collection  $U = \{\text{market factors, product factors, management factors, environmental factors, profitability}\}$ , which can be divided into five subsidiary collections  $U_1 \sim U_5$ . The evaluation collection  $V = \{\text{very good, comparatively good, general, comparatively bad, very bad}\}$ .

#### 2) Making first-grade comprehensive evaluation on subsidiary collections respectively

According to the evaluation that experts made on every factor of  $U_1$  and the weight of every factor of  $B_1$ , we can make the fuzzy transition from  $U$  to  $V$  and get the evaluation that experts made on  $U_1$ , suppose it is  $(0.201, 0.264, 0.2, 0.193, 0.1)$ , after convergence, we can acquire  $T_1 = (0.210, 0.276, 0.209, 0.201, 0.104)$ . We can also get  $T_2 \sim T_5$  in the same way.

#### 3) Making second-grade FCE

We take  $U_1 \sim U_5$  as factors and use  $T_1 \sim T_5$  to build their single factor judgment matrix:

$$\begin{pmatrix} 0.210 & 0.276 & 0.209 & 0.201 & 0.104 \\ 0.35 & 0.3 & 0.2 & 0.15 & 0 \\ 0.2 & 0.4 & 0.2 & 0.1 & 0.1 \\ 0.1 & 0.35 & 0.25 & 0.2 & 0.1 \\ 0.25 & 0.25 & 0.3 & 0.15 & 0.05 \end{pmatrix}$$

In AHP, we have determined the weight of market factors, product factors, management factors, environmental factors, profitability corresponding to the value of VE, and the weight vector is  $S = (0.3104, 0.1571, 0.3382, 0.0435, 0.1509)$ . So the second-grade comprehensive evaluation is  $T = (0.210, 0.3382, 0.209, 0.201, 0.104)$ , after convergence, we can acquire  $(0.198, 0.318, 0.197, 0.189, 0.098)$ , According to the biggest subjection degree rule, the evaluation of this enterprise is "comparatively good".

#### 4) Quantifying the result of FCE

If the evaluation collection of FCE is  $(100, 80, 60, 40, 20)$ , the comprehension evaluation of this enterprise is 66.58.

### References:

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### Résumé

Cet article a mis en question l'évaluation de la valeur des entreprises de risque, et a établi après un modèle du système de cette évaluation.