

A Research on the Entrepreneurial Opportunity Identification Based on the AHP-TOPSIS Method

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Abstract: Entrepreneurial opportunity is the core of entrepreneurship research, entrepreneurial opportunity identification has decisive influence to entrepreneurship success. After the literature review, the paper propose the entrepreneurial opportunity identification index system from five perspectives, including innovation and growth, financial return, investment return, internal factors and customer, and implement case study by the method of AHP-TOPSIS. The research shows that the AHP-TOPSIS method can better identify business opportunities.

Key words: Entrepreneurial opportunity; Identification; Index system; AHP-TOPSIS method

1 Introduction

Entrepreneurship is the process of providing new production or service to create wealth, and try to gain success for enterprises by combining productive factors. It is also a process of discovering, creating and using commercial opportunities. The real entrepreneurial process starts from the discovery of entrepreneurial opportunity, and its exploitation and utilization are both based on the discovery. With the deepening study of entrepreneurship, more and more researchers realize that entrepreneurial opportunity is the core factor for entrepreneurship recently, and it is the research clue. Entrepreneurial activity is different from general management activity. Discovering and developing entrepreneurial opportunity should be the key problem in the field of entrepreneurship research (Shane & Venkataraman, 2000). In short, entrepreneurial opportunity is the core of entrepreneurship research.

Entrepreneurial opportunity is the commercial opportunity which is fit for entrepreneurship briefly. And specifically, entrepreneurial opportunity has attractiveness, abiding entrepreneurial space for commercial activities, and it is able to create added value for customers or production. Meanwhile, entrepreneur can get profit from the opportunity. Any wrong choice will cause enormous losses for enterprise, so entrepreneurs should choose the entrepreneurial opportunity with development value in numerous selections. The ability of grasping correct opportunity is essential for entrepreneurs.

Opportunity identification and evaluation refers to a comprehensive evaluation with customer demands. This evaluation includes five points of view, such as finance, investment return, internal factor, innovation and growth and customers. The evaluation will provide references for investors to decide whether to invest large material and financial resources. It also helps investors determine what to do next. There is no a relatively comprehensive standardized appraisal system of entrepreneurial opportunity evaluation at home, and some existed qualitative analysis can not reflect the actual comprehensive value of entrepreneurial opportunity objectively. Because of the above reasons, it has practical significance to study on opportunity evaluation. Based on related literatures at home and abroad, this paper presents the AHP-TOPIS method to identify entrepreneurial opportunity. This method combines quantitative analysis and qualitative analysis related to opportunity evaluation.

2 Literature Review

2.1 The definition of entrepreneurial opportunity

It is infeasible to identify opportunity using simple logical judgments or filtering unilateral financial or technical index. The definition of entrepreneurial opportunity mainly comes from the view of output and source. In view of output, opportunity represents the possibility of marketable value by integrating resources and meeting market demand (Kirzner I M, 1973). Opportunity represents value sought from the perspective of prospective customers (Ardichvili et al. 2003). From the perspective of source, entrepreneurial opportunity is a kind of new product, new service, new material, even a new organizational form, which can be brought into production and realize sales with price higher than cost. Entrepreneurial opportunity is distinct from general profit opportunity, especially for those opportunities by improving product and service, material and efficiency of organizational operation. Consequently, the author considers the former needs technical or organizational innovation, but the latter just needs some adjustment in existing organizational framework.

2.2 Researches of entrepreneurial opportunity identification

It is significant to identify and evaluate opportunity for enterprises. The process of entrepreneurship starts from the identification of entrepreneur, and then exploiting the opportunity continually and make it into a real enterprise. The potential prospective value of opportunity and natural abilities of entrepreneur can be weighted in this process, and it becomes explicit for opportunity strategy orientation. Such a process is regarded as opportunity identification or opportunity recognition (Ardichvili et al. 2003), and it is also called as opportunity development or opportunity formulation (Lindsay N J, Craig J., 2002). Obviously, the process of opportunity identification and opportunity exploitation is actually the whole process of entrepreneurship. In fact, certain researchers come to realize that opportunity becomes the crucial issue relative to massive researches which take organizational growth as the core clue of entrepreneurial process. Entrepreneurial process is a series of process about opportunity identification, opportunity exploitation and utilization (Gartner, 1985; Carter et al. 1996).

The effective opportunity identification depends on the following two aspects, the objectively good evaluation system and index, and the capability of seizing proper information to perceive opportunity subjectively. Majority of existing studies focus on the latter aspect and refers to some personal characteristic related to entrepreneur and opportunity identification, including alertness, risk perception, self-efficacy, prior knowledge, social network and so on. We can summarize the specific of opportunity in itself on several principal dimensions. There is less comprehensive analysis of characteristics of opportunity from the present condition on domestic and international research, therefore, it is fuzzy when entrepreneurs select proper evaluation index evaluating opportunity. In researches at home and abroad, the evaluation framework proposed by Timmons in 1999 is usually adopted to evaluate opportunity, this framework contains seven kinds of evaluation index (TIMMONS J A, 1999). Different entrepreneurs even different stakeholders in entrepreneurship process have distinct emphases about each dimension. For instance, Jiang Yanfu and Qiu Qiong (2004) make an empirical analysis based on Timmons opportunity evaluation framework using real data of Chinese senior entrepreneurs, and finds that the factors of people, just as whether the entrepreneurial team is comprised of excellent managers, if there are outstanding employees and management team in the organization and so on, play important role when entrepreneurs evaluating opportunity.

At present, four quantitative evaluation methods of opportunity identification are proposed in the literature, including standard scoring matrix, Westing-house method, Hanan Potentionmeter and Baty's selection factor method (John G. Burch, 1986). Whereas, opportunity has many characteristics, where some can be quantified and some are qualitative. Using qualitative or quantitative evaluation method simply is difficult to evaluate opportunity comprehensively. In addition, the opportunity identification depends on subjective perception of entrepreneurs to a certain extent. It also influences the objectivity of opportunity evaluation. In order to fill the above gaps, the AHP-TOPSIS method which combined qualitative and quantitative analysis, subjective and objective is provided.

3 Establishment of Entrepreneurial Opportunity Identification Index System

According to the literature review, entrepreneurial opportunity identification mainly focus on the following five aspects, including innovation and growth index, financial return index, investment return index, internal factors, and customer index. These five factors also known as performance factors of entrepreneurial opportunities. Based on the summarization from the five dimensions of the key indicators of entrepreneurial success, the paper build an entrepreneurial opportunity identification index system, shown in table 1. Perspective of innovation and growth is mainly focus to promote sustained progress of entrepreneurship. Perspective of financial return is mainly focus on the product market gains of entrepreneurial opportunities. Perspective of return on investment indicates the return for the entrepreneurs or shareholders of the best entrepreneurial opportunities. Internal factor refers to the resources of the main body that develop the entrepreneurial opportunities, reflecting the fresh company's core competitiveness. Customer factors indicate whether entrepreneurial opportunities to create sustainable value for customers, and which reveals entrepreneurial opportunities can continue to exist at all.

After defining the indicator of these five dimensions, combine the first primary entrepreneurial opportunities, and use the method of AHP-TOPSIS to select the business opportunity according the five dimensions evaluation index.

4 An Example

4.1 Features of AHP-TOPSIS method

AHP-TOPSIS method is an integrative and comprehensive evaluation model which combines AHP method and TOPSIS method. AHP-TOPSIS method use the consistency test and determine the evaluation index weights through AHP method, and use the standardization of evaluation index value and sorting calculation through TOPSIS method, and finally arrive at the most optimal solution. The AHP-TOPSIS method improves the traditional AHP and TOPSIS methods, and realizes effective integration of the AHP method and TOPSIS method. And the method uses the advantages of the AHP method to make up for the inadequacies of TOPSIS method. Overall, AHP-TOPSIS method has the features of simple, easy to understand, and easy to operate, and also improve the objectivity and accuracy of evaluation results.

Table 1 Entrepreneurial Opportunity Identification Index System

Entrepreneurial opportunity identification index system (A)					
innovation and growth (b ₁)		financial return (b ₂)	investment return (b ₃)	internal factors (b ₄)	customer (b ₅)
entrepreneurs quality (C ₁)	external conditions (C ₅)	sales growth (C ₆)	expected internal rate of return (C ₁₀)	entrepreneurs resources (C ₁₃)	market acceptance (C ₁₇)
entrepreneurs' potential (C ₂)	opportunities for continuous (C ₅₁)	sales margin (C ₇)	expected rate of return on investment (C ₁₁)	competitive advantage (C ₁₄)	market size (C ₁₈)
entrepreneurial team' potential (C ₃)	ability to adapt to the environment (C ₅₂)	cost structure (C ₈)	payback period (C ₁₂)	fatal flaw (C ₁₅)	product Price (C ₁₉)
management level quality (C ₄)	anti-risk ability (C ₅₃)	capital requirements (C ₉)		strategic direction (C ₁₆)	market share (C ₂₀)
	advance of technology (C ₅₄)				

4.2 Calculation process

After the initial investigation, a business team gets five entrepreneurial opportunities, P1, P2, P3, P4, P5. In order to select the best entrepreneurial opportunity, the paper establish the entrepreneurial opportunity identification index system as shown in table 1, and then use AHP-TOPSIS method to implement comprehensive identification.

Step 1: establishes the comparison matrix

According to the identification index system and expert scoring, using 9-scales method, establish the comparison matrix (A) to the various indicators.

$$A = \begin{matrix} b_1 \\ b_2 \\ b_3 \\ b_4 \\ b_5 \end{matrix} \begin{bmatrix} 1 & 2 & 3 & 1/2 & 4 \\ 1/2 & 1 & 2 & 1/3 & 1/5 \\ 1/3 & 1/2 & 1 & 1/4 & 1/6 \\ 2 & 3 & 4 & 1 & 1/2 \\ 4 & 5 & 6 & 2 & 1 \end{bmatrix}$$

This matrix indicates that the current identification of entrepreneurial opportunities is still very biased towards the customer and internal factors.

Step 2: weight calculation

Based on the above matrix, the weight of different indicators can be achieved by method of Asymptotic Normalization Coefficient (ANC).

(1) normalize A based on the column, because of $b_{ij} = a_{ij} / \sum_{k=1}^n a_{kj}$

$$B_1 = \begin{bmatrix} 0.13 & 0.17 & 0.19 & 0.12 & 0.12 \\ 0.06 & 0.09 & 0.13 & 0.08 & 0.09 \\ 0.04 & 0.04 & 0.06 & 0.06 & 0.08 \\ 0.26 & 0.26 & 0.25 & 0.25 & 0.24 \\ 0.51 & 0.44 & 0.37 & 0.49 & 0.47 \end{bmatrix}$$

(2) implement Row-sum, calculate v_i , $v_i = \sum_{j=1}^n b_{ij}$ $i = 1, 2, \dots, n$, then $B_2 = [0.73 \ 0.45 \ 0.28 \ 1.26 \ 2.28]^T$

(3) normalizes v_i , gets w_i , $w_i = \frac{v_i}{\sum_{i=1}^n v_i}$ $i = 1, 2, \dots, n$, then $w_1 = [0.146 \ 0.090 \ 0.056 \ 0.252 \ 0.456]^T$

And then the weight of b_1, b_2, \dots, b_5 can be achieved.

(4) to solve λ_{max}

$$Aw = \begin{bmatrix} 1 & 2 & 3 & 1/2 & 1/2 \\ 1/2 & 1 & 2 & 1/3 & 1/5 \\ 1/3 & 1/2 & 1 & 1/4 & 1/6 \\ 2 & 3 & 4 & 1 & 1/2 \\ 4 & 5 & 6 & 2 & 1 \end{bmatrix} \begin{bmatrix} 0.146 \\ 0.090 \\ 0.056 \\ 0.252 \\ 0.456 \end{bmatrix} = \begin{bmatrix} 0.734 \\ 0.450 \\ 0.289 \\ 0.266 \\ 2.33 \end{bmatrix}$$

$$\lambda_{max} = \frac{\sum_{j=1}^n a_j w_j}{\sum_{i=1}^n n w_i} = \frac{1}{5} \left(\frac{0.734}{0.146} + \frac{0.450}{0.09} + \frac{0.289}{0.056} + \frac{1.266}{0.252} + \frac{2.33}{0.456} \right) = 5.06$$

Step 3: consistency test

Because of $C.I = \frac{\lambda_{max} - n}{n - 1} = \frac{5.06 - 5}{5 - 1} = 0.015 \leq 0.1$, which means that consistency test is satisfied.

Similarly available, comparison matrix of the five-level indicators of B_1 is:

$$C_1 = \begin{bmatrix} c_1 & 1 & 2 & 1/2 & 2 & 4 \\ c_2 & 1/2 & 1 & 1/2 & 2 & 3 \\ c_3 & 2 & 2 & 1 & 3 & 6 \\ c_4 & 1/2 & 1/2 & 1/3 & 1 & 2 \\ c_5 & 1/4 & 1/3 & 1/6 & 1/2 & 1 \end{bmatrix}$$

Weight matrix of each index is $C_{13} = (0.251 \quad 0.183 \quad 0.387 \quad 0.117 \quad 0.062)^T$

$$\lambda_{max} = 4.96 \quad C.I = \frac{\lambda_{max} - n}{n - 1} = -0.01 \leq 0.1$$

Which means that consistency test is satisfied. Similarly available, consistency test to B_2, B_3, B_4 , are all satisfied.

Step 4: determine the overall weight

According to the formula of $w_{overall} = \sum_{j=1}^m w_j w_{ij}$, overall weight of the second level indicators can be expressed as table 2.

Table 2 Overall Weights of the Second Level Indicators of Entrepreneurial Opportunity Identification

First level indicator \ Second level indicator	innovation and growth (b ₁)	financial return (b ₂)	investment return(b ₃)	internal factors(b ₄)	customer (b ₅)	overall weights
	0.146	0.090	0.056	0.252	0.456	
entrepreneurs quality (C ₁)	0.251					0.0366
entrepreneurs' potential (C ₂)	0.183					0.0267
entrepreneurial team' Potential (C ₃)	0.387					0.0565
management level quality (C ₄)	0.117					0.0171
external conditions (C ₅)	0.062					0.0091
sales growth (C ₆)		0.35				0.0315
sales margin (C ₇)		0.35				0.0315
cost structure (C ₈)		0.11				0.0099
capital requirements (C ₉)		0.19				0.0171
expected internal rate of return (C ₁₀)			0.4			0.0224
expected rate of return on investment (C ₁₁)			0.4			0.0224
payback period (C ₁₂)			0.2			0.0112
entrepreneurs resources (C ₁₃)				0.50		0.1260
competitive advantage(C ₁₄)				0.28		0.0706
fatal flaw (C ₁₅)				0.09		0.0227
strategic direction (C ₁₆)				0.13		0.0328
market acceptance (C ₁₇)					0.46	0.2098
market size (C ₁₈)					0.28	0.1277
product Price (C ₁₉)					0.16	0.0730
market share (C ₂₀)					0.10	0.0456

Step 5: establish decision matrix

Here the data of decision matrix is related to the data of the five primary entrepreneurial opportunities. c_2, c_5, c_{17} are empirical data, and other data all achieved from expert scoring. Scoring criteria shown in table 2.

Table 3 Scoring Criteria

Index	best (high)	better (Higher)	General	worse (lower)	worst (low)
Quantitative value	10	08	05	03	01

Based on expert scoring method, decision matrix obtained as follows.

$$D = \begin{matrix} & C_1 & C_2 & C_3 & C_4 & C_5 & C_6 & C_7 & C_8 & C_9 & C_{10} & C_{11} & C_{12} & C_{13} & C_{14} & C_{15} & C_{16} & C_{17} & C_{18} & C_{19} & C_{20} \\ \begin{matrix} 0.5 & 0.32 & 0.6 & 0.4 & 32\% & 0.6 & 0.8 & 23\% & 0.7 & 0.6 & 0.5 & 0.6 & 0.4 & 0.7 & 0.3 & 0.6 & 1.59 & 0.8 & 0.5 & 0.8 \\ 0.5 & 0.51 & 0.5 & 0.6 & 41\% & 0.7 & 0.7 & 51\% & 0.8 & 0.7 & 0.4 & 0.8 & 0.5 & 0.8 & 0.4 & 0.8 & 2.05 & 0.7 & 0.6 & 0.9 \\ 0.8 & 0.35 & 0.8 & 0.5 & 29\% & 0.5 & 0.5 & 33\% & 0.6 & 0.5 & 0.6 & 0.7 & 0.6 & 0.6 & 0.2 & 0.7 & 1.78 & 0.9 & 0.4 & 0.7 \\ 0.6 & 0.43 & 0.7 & 0.7 & 35\% & 0.8 & 0.6 & 46\% & 0.9 & 0.7 & 0.7 & 0.5 & 0.5 & 0.7 & 0.8 & 0.5 & 1.81 & 0.6 & 0.8 & 0.8 \\ 0.7 & 0.41 & 0.6 & 0.6 & 37\% & 0.7 & 0.7 & 41\% & 0.8 & 0.8 & 0.8 & 0.8 & 0.7 & 0.6 & 0.5 & 0.6 & 1.95 & 0.7 & 0.5 & 0.7 \end{matrix} \end{matrix}$$

Step 6: Sstandard matrix

The paper employs Vector normalization method to get the normalized matrix.

$$\begin{bmatrix} 0.3544 & 0.3496 & 0.4140 & 0.3143 & 0.4084 & 0.4018 & 0.5357 & 0.2569 & 0.4082 & 0.4018 \\ 0.3544 & 0.5571 & 0.3450 & 0.4714 & 0.5232 & 0.4688 & 0.4688 & 0.5696 & 0.4666 & 0.4688 \\ 0.5671 & 0.3823 & 0.5521 & 0.3928 & 0.3701 & 0.3348 & 0.3348 & 0.3686 & 0.3500 & 0.3348 \\ 0.4253 & 0.4679 & 0.4830 & 0.5500 & 0.4467 & 0.5357 & 0.4018 & 0.5138 & 0.5249 & 0.4688 \\ 0.4962 & 0.4479 & 0.4140 & 0.4714 & 0.4722 & 0.4688 & 0.4688 & 0.4579 & 0.4666 & 0.5357 \\ 0.3627 & 0.3889 & 0.3255 & 0.4576 & 0.2762 & 0.4140 & 0.3859 & 0.4789 & 0.3881 & 0.4566 \\ 0.2902 & 0.5186 & 0.4069 & 0.5230 & 0.3682 & 0.5521 & 0.4975 & 0.4191 & 0.4657 & 0.5137 \\ 0.4353 & 0.4537 & 0.4883 & 0.3922 & 0.1841 & 0.4830 & 0.4320 & 0.5389 & 0.3105 & 0.3995 \\ 0.5078 & 0.3241 & 0.4069 & 0.4576 & 0.7365 & 0.3450 & 0.4393 & 0.3592 & 0.6209 & 0.4566 \\ 0.5804 & 0.5186 & 0.5697 & 0.3922 & 0.4603 & 0.4140 & 0.4733 & 0.4191 & 0.3881 & 0.3995 \end{bmatrix}$$

Step 7: standard weight matrixes

The overall weight matrix was multiplied by the weight of each row standardized matrix can be achieving the standard weight matrix:

$$\begin{bmatrix} 0.0130 & 0.0093 & 0.0234 & 0.0054 & 0.0037 & 0.0127 & 0.0169 & 0.0025 & 0.0070 & 0.0090 \\ 0.0130 & 0.0149 & 0.0195 & 0.0081 & 0.0048 & 0.0148 & 0.0148 & 0.0056 & 0.0080 & 0.0105 \\ 0.0208 & 0.0102 & 0.0312 & 0.0067 & 0.0034 & 0.0105 & 0.0105 & 0.0036 & 0.0060 & 0.0075 \\ 0.0156 & 0.0125 & 0.0273 & 0.0094 & 0.0041 & 0.0169 & 0.0127 & 0.0051 & 0.0090 & 0.0105 \\ 0.0182 & 0.0120 & 0.0234 & 0.0081 & 0.0043 & 0.0148 & 0.0148 & 0.0045 & 0.0080 & 0.0120 \\ 0.0081 & 0.0044 & 0.0410 & 0.0323 & 0.0063 & 0.0136 & 0.0810 & 0.0612 & 0.0283 & 0.0208 \\ 0.0065 & 0.0058 & 0.0513 & 0.0370 & 0.0084 & 0.0181 & 0.1044 & 0.0535 & 0.0340 & 0.0234 \\ 0.0098 & 0.0051 & 0.0615 & 0.0277 & 0.0042 & 0.0158 & 0.0906 & 0.0688 & 0.0227 & 0.0182 \\ 0.0114 & 0.0036 & 0.0513 & 0.0323 & 0.0167 & 0.0113 & 0.0922 & 0.0459 & 0.0453 & 0.0208 \\ 0.0130 & 0.0058 & 0.0718 & 0.0277 & 0.0104 & 0.0136 & 0.0993 & 0.0535 & 0.0283 & 0.0182 \end{bmatrix}$$

Step 8: determine the ideal solution and negative ideal solution, V^+ and V^-

According to $V^+ = \left\{ \left(\max_{1 \leq i \leq m} v_{ij} \mid j \in J^+ \right), \left(\min_{1 \leq i \leq m} v_{ij} \mid j \in J^- \right) \right\} = \{v_1^+, v_2^+, \dots, v_n^+\}$

So $V^+ = \begin{bmatrix} 0.0130 & 0.0093 & 0.0312 & 0.0094 & 0.0048 & 0.0169 & 0.0169 & 0.0025 & 0.0090 & 0.0075 \\ 0.0065 & 0.0044 & 0.0718 & 0.0370 & 0.0042 & 0.0181 & 0.0993 & 0.0688 & 0.0453 & 0.0234 \end{bmatrix}$

$V^- = \left\{ \left(\min_{1 \leq i \leq m} v_{ij} \mid j \in J^+ \right), \left(\max_{1 \leq i \leq m} v_{ij} \mid j \in J^- \right) \right\} = \{v_1^-, v_2^-, \dots, v_n^-\}$

$V^- = \begin{bmatrix} 0.0208 & 0.0149 & 0.0195 & 0.0054 & 0.0034 & 0.0105 & 0.0105 & 0.0056 & 0.0060 & 0.0420 \\ 0.0130 & 0.0058 & 0.0410 & 0.0277 & 0.0167 & 0.0113 & 0.0810 & 0.0459 & 0.0227 & 0.0182 \end{bmatrix}$

Step 9: calculate the gap

Calculate the gap between the different entrepreneurial opportunity and the ideal solution, the results are:

$$S_1^+ = 0.0423, S_1^- = 0.1616; \quad S_2^+ = 0.0039, S_2^- = 0.0354; \quad S_3^+ = 0.1974, S_3^- = 0.380; \quad S_4^+ = 0.0352, S_4^- = 0.0307; \quad S_5^+ = 0.3104, S_5^- = 0.0395$$

Step 10: calculate the close degree

Calculate the close degree of the different entrepreneurial opportunity and the ideal solution, the results are $C_1^+ = 0.7926$, $C_2^+ = 0.9003$, $C_3^+ = 0.1613$, $C_4^+ = 0.4661$, $C_5^+ = 0.1129$

Step 11: sequence

Based on the close degree, the sequence of the different entrepreneurial opportunity can be resulted as following: $C_2^+ > C_1^+ > C_4^+ > C_3^+ > C_5^+$

Sequence results show that the second entrepreneurial opportunity has the highest close degree to the ideal solution, and so it is the best innovation opportunity among the five opportunities.

5 Conclusion

To the study aim of entrepreneurial opportunity of the core issue of the entrepreneurship research, based on the literature review, the paper establishes the entrepreneurial opportunity identification evaluation system, taking into account the strengths and weaknesses of current assessment methods, mainly the AHP method and TOPSIS method, use the AHP-TOPSIS comprehensive evaluation method to implement entrepreneurial opportunities recognition research, which provide a new way to the issue of entrepreneurial opportunity identification.

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