RESEARCH ON EVALUATION OF CORE COMPETENCE OF LISTED LIQUOR COMPANIES BASED ON GREY RELATIONAL DEGREE

– Research paper –

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Abstract: The Grey Relational Degree method was applied to evaluating the core competence of the ten listed liquor companies. The study found that: the most critical factor affecting the strength of the core competence of listed liquor companies is the technological innovation capability; in general, the core competence of the ten listed liquor companies is weak, with an average Grey Relational Degree of 0.752, indicating more potentials for improvement; in addition, with the exception of Kweichou Moutai, the other nine listed liquor companies are all in an uncoordinated state regarding the development of the six capabilities, and they usually have one or several capabilities lagged behind.

Keywords: Grey Relational Degree, Listed liquor companies, Core competence, Evaluation indicator

1. INTRODUCTION

China has a long history of wine-making, which has resulted in a wide variety of wines. And some of them are renowned at home and abroad. Liquor, as a unique and traditional Chinese wine with a long history, exudes brilliance in the world's strong alcoholic beverage products, influencing people's daily life, and to some extent meeting the needs of the market and consumption.

With the globalization of the economy, beer, wine, and imported wine have grown rapidly in the domestic market, posing a great threat to the traditional liquor market. The competition between liquor companies becomes more intense and tends to be more diversified and updated. Faced with this new situation, many liquor companies have realized that they must have their own core competence if they want to gain long-term competitive advantage. Therefore, the research on the core competence evaluation

system will help Chinese liquor companies to correctly evaluate their core competence, and then formulate measures to cultivate and enhance the core competence, which will help Chinese liquor companies to cope with domestic and foreign competition challenges. The theoretical circles have different opinions on the understanding of the core competence. American management experts Prahalad and Hamel are the first scholars who proposed the concept of core competence and defined the concept. In 1990, the Harvard Business Review published their co-authored article "Core Competence of Corporation", which established the position of core competence in management theory and practice. Prahalad and Hamel (1990) believed that the core competences are "the company's collective knowledge about how to coordinate diverse production skills and technologies." Dosi (1993) proposed the concept of technology competitiveness, that is, the company's ability to develop and

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design new products and processes, and to operate equipment effectively, which has laid the foundation for the research on core technical ability. Later et al. (1995) first proposed the concept of "core technology competitiveness" and studied the impact of core technology competitiveness on corporate strategic management. Gallon et al. (1995) further specified the concept and structure of "core technology ability". Prencipe (1997) applied the concept of core technology competitiveness to study the "product evolution dynamics" of the company. Coombs (1996) defined the company's core competence as a specific combination of corporate capabilities, as well as the accumulation of special experiences regarding the interaction between companies, market, and technology, highlighting the technical expertise and organizational capability.

With regard to the source of the company's core competence, scholars, such as Quélin (2000), Fellman (2008), Dai & Sun (2013), Seddighi (2015), Huang et al.(2015), Prahalad (2016), Mccr (2016), mainly focused on the environment, resources, and capabilities to elaborate their respective viewpoints and gradually developed different theoretical schools. To sum up, these theories include the theory of corporate competitiveness with emphasis on environmental factors, the theory of corporate competitiveness with emphasis on resources factors, and the theory of corporate competitiveness with emphasis on capabilities factors. Among them, the theory corporate competitiveness with emphasis on capability factors is usually called the "corporate capability theory". It regards the corporate competitiveness as a capability system, emphasizing the understanding of the company's core competence from the internal factors and conditions of the company. This theory has been widely recognized.

Main approaches used to evaluate the core competence of companies are the Data Envelopment Analysis, Grey Relational Analysis, Comprehensive Exponential Evaluation, Analytic Hierarchy Process, Fuzzy Comprehensive Evaluation, and Mathematical Statistics. Among them, the Grey Relational Analysis regards the evaluation system of corporate competence as a grey system and selects limited main indicators to make evaluations. And there is no strict requirement for the size of samples, and no need to follow any distribution, which makes it more applicable. On the basis of previous studies, this paper uses the Grey Relational Degree method to construct an evaluation indicator system based on the principles of objectivity, availability, relevance, and importance. This paper selects ten Chinese listed liquor companies as samples and uses data of sample companies in 2017 to evaluate and compare their core competence, in hope of providing reference for the objective evaluation of liquor companies and the improvement of companies' core competence.

2. MATERIALS AND METHODS

Grey Relational Analysis (GRA) is a multi-factor statistical analysis method. It ranks objects by comparing the relational degrees of multiple factors of these objects, and is widely used in evaluating the social, economic, and management issues. The basic idea of applying the Grey Relational Analysis to evaluate the core competence of listed liquor companies is to take the indicator values of the most competitive liquor companies (ideal listed liquor companies) in the industry as the actual values x_{0k} of the reference series X_0, and the indicator values of the sample companies as the actual values X_i of the comparison series X_i, and get the relational degree r_i. The greater the relational degree, the more similar the sample company is to the listed companies with the strongest core competence, and the stronger the core competence of the sample company; otherwise, the weaker the core competence. Therefore, the order of the relational degrees is the order of core competences of sample listed liquor companies. The evaluation procedures are as follows.

(1) Select the reference series

Suppose: i is the serial number of the evaluation unit i (listed liquor company), and $i = 1, 2, L, m$. k is the serial number of the evaluation indicator k, and $k = 1, 2, L, n$. v_{ik} is the evaluation value of the evaluation indicator k of the evaluation unit i.

Take the optimum value of each indicator as the actual value of the reference series V_0, then:

$$V_0 = (v_{01}, v_{02}, L, v_{0n})$$

where, $v_{ok} = \text{Optimum}(V_{ik})$, $i = 1, 2, L, m$, and $k = 1, 2, L, n$.

For a system of m evaluation units (listed liquor companies) and n evaluation indicators, the matrix is as follows.

$$V = (Vik)m \times n = \begin{bmatrix} V_{11} & V_{12} & L & V_{1n} \\ V_{21} & V_{22} & L & V_{2n} \\ M & M & & M \\ V_{m1} & V_{m2} & L & V_{mn} \end{bmatrix}$$

Then the selected reference series are:

$$V_0 = (v_{01}, v_{02}, L, v_{0n})$$

(2) Standardize the indicator values

In order to make each indicator comparable, it is necessary to standardize the indicator values. The standardization formula is employed as follows.

$$X_{ik} = \frac{V_{ik} - \min_i V_{ik}}{\max_i V_{ik} - \min_i V_{ik}}$$

After the standardization, we get:

$$X = (X_{ik})_{m \times n} = \begin{bmatrix} X_{11} & X_{12} & L & X_{1n} \\ X_{21} & X_{22} & L & X_{2n} \\ M & M & & M \\ X_{m1} & X_{m2} & L & X_{mn} \end{bmatrix}$$

(3) Calculate the correlation coefficients

Take the standardized series $X_0 = (x_{01}, x_{02}, L, x_{0n})$ as the reference series, and $X_i = (x_{i1}, x_{i2}, L, x_{in})(i = 1, 2, L, m)$ as the comparison series. The correlation coefficients are calculated by:

$$\xi_{ik} = \frac{\min_i \min_k |X_{0k} - X_{ik}| + \rho \max_i \max_k |X_{0k} - X_{ik}|}{|X_{0k} - X_{ik}| + \rho \max_i \max_k |X_{0k} - X_{ik}|}$$

$$i = 1, 2, L, m; k = 1, 2, L, n$$

where, ρ is the discrimination coefficient, and $\rho \in [0,1]$.

Use the formula to calculate the correlation coefficients $\xi_{ik}(i = 1, 2, L, m; k = 1, 2, L, n)$, and get the following matrix of correlation coefficients.

$$E = (\xi_{ik})_{m \times n} = \begin{bmatrix} \xi_{11} & \xi_{12} & L & \xi_{1n} \\ \xi_{21} & \xi_{22} & L & \xi_{2n} \\ M & M & & M \\ \xi_{m1} & \xi_{m2} & L & \xi_{mn} \end{bmatrix}$$

where, ξ_{ik} is the correlation coefficient of the indicator k of the evaluation unit i (listed liquor company) and the optimum indicator k.

(4) Calculate the single-layer relational degree

Considering the different importance of every indicator, the relational degree is calculated by weight multiplying correlation coefficient. Suppose the priority weight of each indicator at certain layer to upper layer objective is:

$$W = (w_1, w_2, L, w_n)$$

where, $\sum_{k=1}^{t} w_k = 1$, and t is the number of indicators at the layer. Then the formula to calculate the relational degree is:

$$R = (r_i)_1 m = r_1, r_2, L, r_m = WE^T$$

(5) Calculate the final relational degree of the multi-layer evaluation system

For an L-layer evaluation system, the final relational degree can be calculated by this way: integrate the correlation coefficients of indicators at the layer k and respectively get the relational degree of each indicator at the layer $k-1$; take the relational degrees at this layer as the original data and get the relational degree of each indicator at the layer $k-2$ by integration, and so on and on, till get the relational degree of each indicator at the top layer.

(6) Rank the core competences of listed liquor companies

Rank the relational degree $r_i(i = 1, 2, L, m)$ and the order of relational degrees is the order of the core competences of listed liquor companies.

3. THE ESTABLISHMENT OF EVALUATION INDICATOR SYSTEM

3.1 The selection of indicators

In order to objectively and scientifically evaluate the core competence of listed liquor companies and observe the position of listed liquor companies in market competition, a set of scientific, complete, comprehensive indicators reflecting the core competence of listed liquor companies need to be designed. According to the principles of scientific, complete, and rational design, the Analytic Hierarchy Process (AHP) is employed to decompose the factors affecting the core competence of listed liquor companies by referencing previous studies. After several times of selections and assessments on indicators, an indicator system is established to evaluate the core competence of listed liquor companies (see Table 1). The first layer of the indicator system is the target layer, which evaluates the core competence (A) of the liquor companies. The second layer is the principle layer, which evaluates the target factors from six aspects, that is, operational capability (B_1), operational safety capability (B_2), profitability (B_3), market control capability (B_4), technological innovation capability (B_5), and employee quality (B_6). The third layer is the indicator layer, including 18 indicators (C_1, C_2, L, C_{18}).

3.2 Calculate the weights of indicators

When applying the Analytic Hierarchy Process (AHP) to constructing a judgement matrix, the most common method for judging the relative importance of indicators is A. L. Sally's 1-9 scale method. The first is to establish the layers of evaluation matrix. The second is to complete the ranking and examine the consistency. And the last is to calculate the relative weights of the bottom-layer indicators to the top-layer indicators. The AHP is employed to calculate the weight of each indicator at the target layer and the principle layer, as shown in Figure 1. At the same time, the calculation results show that the consistency ratio of the overall system CR is 0.014, and the consistency ratios of the six layers CR are respectively 0.002, 0.001, 0.005, 0.017, 0.029, and 0.016, all satisfying the hypothesis of CR<0.10. It means the judgement of experts is quite rigorous, and the results of hierarchical ranking have good consistency.

According to Figure 1, the relative importance of each factor of the principle layer is: B5> B4> B3> B2> B1 (B6). Therefore, at the principle layer, the "technological innovation capability (B5)" is the most critical component of the listed liquor companies' core competence, followed by "market control capability (B4)", "profitability (B3)" and "operational safety capability (B2)" in sequence, and both "operational capability (B1)" and "employee quality (B6)" rank fifth. It means these six capabilities are indispensable for the cultivation and promotion of the core competence of listed liquor companies. However, importance of these six capabilities is not exactly the same. In the practice of cultivating and enhancing core competence, companies must fully consider the influences of the six capabilities and the differences that restrict the realization of the targets, as well as the internal and external conditions, and focus on the improvement of technological innovation capability and market control capability.

4. RESULTS AND DISCUSSIONS

4.1 Evaluation results

A total of ten listed liquor companies, including Kweichou Moutai (GZMT), Wuliangye (WLY), Yanghe Shares (YHGF), Luzhou Laojiao (LZLJ), Shanxi Fenjiu (SXFJ), Kouzijiao (KZJ), Gujing Kongjiu (GJGJ), Shuijingfang (SJF), Laobaigan Liquor (LBGJ), and Shede Liquor (SDJY), were selected as research samples, and these companies' data of 2017 was used for the evaluation. Most of the original data was obtained from companies' annual reports and corporate (industry) websites, and some of original data was obtained through in-depth corporate investigation. According to the steps of Grey Relational Analysis, the core competences of the selected ten listed liquor companies were evaluated. The results are given in Table 1.

4.2 Discussions of evaluation results
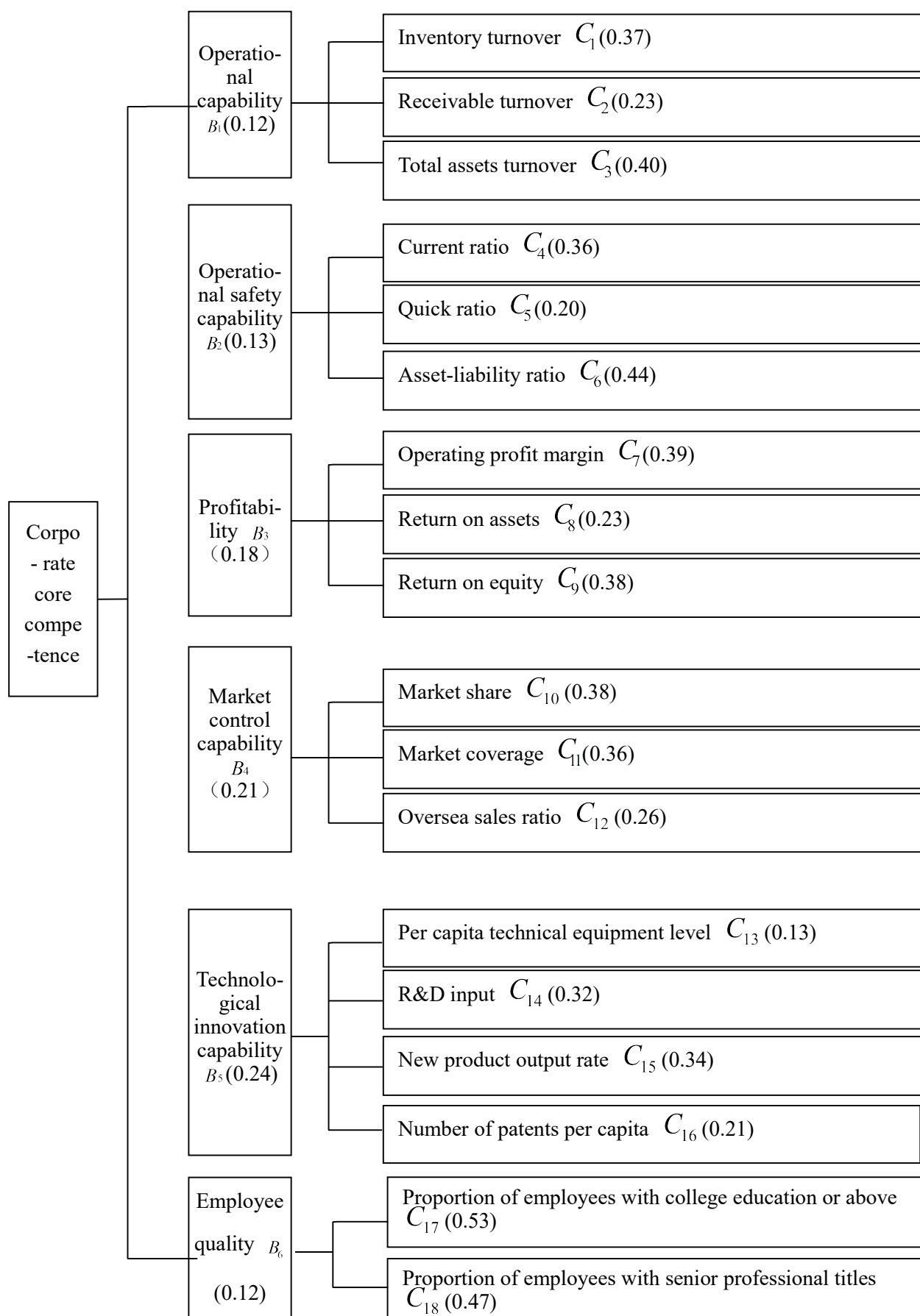*(1) Discussions of indicator weights.*

Figure 1. The evaluation indicator system of core competence of listed liquor companies

Table 1. The results of Grey Relational Degree-based evaluation of core competences of listed liquor companies

	GZMT	WLY	YHGF	LZLJ	SXFJ	KZJ	GJGJ	SJF	LBGJ	SDJY	Mean
Operational capability (R_{B1})	0.956	0.725	0.672	0.768	0.614	0.508	0.655	0.469	0.491	0.435	0.629
Ranking	1	3	4	2	6	7	5	9	8	10	
Operational safety capability (R_{B2})	0.872	0.763	0.907	0.864	0.636	0.841	0.697	0.605	0.598	0.524	0.731
Ranking	2	6	1	3	5	4	7	8	9	10	
Profitability (R_{B3})	1.000	0.901	0.814	0.683	0.592	0.882	0.656	0.745	0.542	0.501	0.732
Ranking	1	2	4	6	8	3	**7**	5	9	10	
Market control capability (R_{B4})	0.982	0.692	0.791	0.728	0.717	0.769	0.825	0.874	0.687	0.811	0.788
Ranking	1	9	5	7	8	6	3	2	10	4	
Technological innovation capability(R_{B5})	0.858	0.846	0.797	0.765	0.769	0.783	0.731	0.722	0.817	0.780	0.789
Ranking	1	2	4	9	7	5	8	10	3	6	
Employee quality(R_{B6})	0.851	0.815	0.849	0.821	0.765	0.771	0.724	0.794	0.802	0.796	0.799
Ranking	**1**	4	2	3	9	8	10	7	5	6	
Core competence (R_A)	0.922	0.795	0.804	0.762	0.690	0.771	0.723	0.721	0.671	0.664	0.752
Ranking	1	3	2	5	8	4	6	7	9	10	

(2) Discussions of comprehensive evaluation results

As shown in Table 1, in terms of operational capability, Kweichou Moutai and Luzhou Laojiao rank the top two, with values of 0.956 and 0.768 respectively, indicating that the two companies have relatively stronger operational capability. The last two are Shuijingfang and Shede Jiuye, with values of 0.491 and 0.435 respectively, indicating that the two companies have relatively weaker operational capability. In terms of operational safety capability, Yanghe Shares and Kweichow Moutai rank the top two, with values of 0.907 and 0.872 respectively, and Laobaigan Liquor and Shede Liquor are the last two. In terms of profitability, the top two are Kweichow Moutai and Wuliangye, with values of 1.000 and 0.901 respectively, and the last two are

Laobaogan Liquor and Shede Liquor, with values of 0.542 and 0.501 respectively. In terms of market control capability, the top two are Kweichow Moutai and Shuijingfang, with values of 0.982 and 0.874 respectively, and the last two are Wuliangye and Laobaigan Liquor, with values of 0.692 and 0.687 respectively. In terms of technological innovation capability, the top two are Kweichow Moutai and Wuliangye, and the last two are Luzhou Laojiao and Shuijingfang. In terms of employee quality, Kweichow Moutai and Yanghe Shares rank the top two, while Shanxi Fenjiu and Gujing Gongjiu rank the last two.

According to Table 1, the ranking of the ten listed liquor companies' core competences is: Kweichow Moutai > Yanghe Shares > Kouzijiao > Luzhou Laojiao > Gujing Gongjiu> Shuijingfang >

Shanxi Fenjiu > Laobaigan Liquor > Shede Liquor. The scores are respective 0.922, 0.800, 0.799, 0.771, 0.762, 0.723, 0.721, 0.690, 0.671, and 0.664, with an average score of 0.752. As a whole, the core competences of listed liquor companies are weak and there are great potentials for improvement.

Specifically, among these ten listed liquor companies Kweichow Moutai ranks the top respectively in terms of the rankings of five capabilities and rank the second in terms of the ranking of one capability, which is a more satisfying match and coordination of these six capabilities, that is, operational capability, operational safety capability, profitability, market control capability, technological innovation capability, and employee quality, indicating that Kweichow Moutai has a strong core competence. The remaining nine listed liquor companies are in a completely different status. Their six capabilities of the core competence are not in coordination and some of capabilities are seriously lagged behind. Take Wuliangye as an example. It gets higher scores in terms of operational capability, profitability, technological innovation capability, and employee quality, but lower scores in terms of operational safety capability and market control capability, ranking sixth and ninth respectively, which indicates an imbalance and a big gap between different capabilities. For Laobaigan Liquor and Shede Jiuye, they have many capabilities ranking last, indicating their weak core competences.

5. CONCLUSIONS

By applying the Grey Relational Degree method to evaluate the core competence of listed liquor companies, the following conclusions can be drawn:

- Firstly, to evaluate the core competence of listed liquor companies, the indicator system is based on six dimensions, that is, operational capability, operational safety capability, profitability, market control capability, technological innovation capability, and employee quality. The weights of indicators are determined by the Analytic Hierarchy Process. Results show that the technological innovation capability has the highest weight, which means technological innovation capability is the most critical factor affecting the core competence of listed liquor company.

- Secondly, in general, the overall core competences of the ten listed liquor companies are relatively weak, and there are great potentials for improvement. With the diversification and individualization of consumer demand, the uncertainty and risks in the future will be greatly increased. Only by possessing the core competence will Chinese liquor companies succeed in the long-term competition. Therefore, Chinese liquor companies need to face the reality, actively respond to the challenges from domestic and foreign competition, and strive to cultivate and enhance their own core competences so as to achieve the sustainable development of the company.

- Thirdly, most listed liquor companies have unbalanced development of the six capabilities, and some capabilities are lagging behind seriously. Therefore, these companies should adjust their development strategies according to their own strengths and weaknesses, optimize their business management processes and resources distribution, and fundamentally cultivate and enhance their core competence.

In short, the core competence system of listed liquor company is actually an information-incomplete and uncertain system. Using the Grey Relational Degree method to evaluate the core competence of listed liquor company makes the complicated decision-making problem easier and clearer. Besides, the organic combination of qualitative and quantitative methods with simple and convenient calculations improves the credibility of the evaluation. And the evaluation results help to understand the advantages and disadvantages of each company in business management, improving the effectiveness of scientific decision-making in company.

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