Design Engineering

ISSN: 0011-9342

Issue: 11 | Pages: 297 - 321

Comprehensive Competitiveness Evaluation System of Resource-based Enterprises

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Abstract:

This article takes the comprehensive competitiveness evaluation system of resource-based enterprises as the research object. Based on the research of competitiveness theory and enterprise competitiveness evaluation index system, it focuses on the financial management, development strategy, international operation ability and abundant resources of resource-based enterprises, and design a multi-level evaluation index system reflecting the competitiveness of resource-based enterprises. It uses factor analysis to evaluate the comprehensive competitiveness of Chinese resource-based enterprises. This research shows that the comprehensive competitiveness evaluation index system of resource-based enterprises composed by financial capability, development potential, international operating capability, and resource endowment capability is feasible, and the evaluation method based on factor analysis is scientific.

Keywords:*Resource-based enterprises, Competitiveness, Evaluation system, factor analysis.*

I. INTRODUCTION

Academia has done a lot of research on the competitiveness of enterprises from different perspectives. The most representative ones are the "diamond theory", the competitiveness theory based on the resource view, and the enterprise competitiveness theory based on the capability view. These theories have laid the foundation for the construction of the corporate competitiveness rating index system. In the construction of the evaluation index system, there

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are explorations from the macro logic, the construction from the enterprise business process, and the enterprise accounting process perspective. From a specific perspective, these theories and methods are very successful. However, most of these evaluation theories, systems, and methods are explored from the general situation of the macro. For the evaluation of the competitiveness of enterprises under special circumstances, it is still necessary to take the particularities of enterprises or industries into consideration, such as resource-based enterprises. The evaluation of competitiveness needs to focus on the particularity of resource-based enterprises.

II. LITERATUREREVIEW

The research on the competitiveness evaluation system of multinational corporations is relatively sufficient. Wu Jiangong and Tang Bin constructed a multinational corporation competitiveness evaluation index system based on the adaptability, through the analysis of the environment and competitive situation of multinational corporations, and evaluated the competitiveness of multinational enterprises based on adaptive capacity applied data envelopment analysis (DEA) evaluation model [1]. Zeng Jianyun evaluated the international competitiveness of multinational corporations with the single index evaluation method [2]. Wu Jiangong and Mo Fan introduced existing competitiveness evaluation methods, compared and analyzed various evaluation methods, and finally selected factor analysis as the method for comprehensive evaluation and analysis of the competitiveness of multinational enterprises [3]. Zhao Yanyuan established a corporate competitiveness evaluation index system consisting of 8 categories, 4 levels, and 34 indicators based on the theoretical analysis of the competitiveness of multinational enterprises [4]. Xu Limei systematically summarized the theoretical results of the competitiveness of multinational corporations, analyzed and summarized the changes in the international competition environment of multinational corporations and the development of corporate competition, and expanded the understanding of the concepts related to enterprises, competition and corporate competitiveness [5].

At present, the evaluation of enterprise competitiveness can be divided into non-quantitative description method, semi-quantitative description method, quantitative description method and combination of semi-quantitative and quantitative method. The non-quantitative description method does not use quantitative or semi-quantitative indicators, but uses text or charts to describe the core capabilities of the enterprise [6,7]. The semi-quantitative method is to construct an indicator system, score the indicators through subjective judgment, and then perform comprehensive calculations [8]. The quantitative methods uses rigorously measurable index measures [9,10]. The combination of semi-quantitative and quantitative method constructs an

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indicator system, scores the indicators through certain subjective judgments, and then performs quantitative calculations [11].

However, from the perspective of a very special type of enterprise such as a resource-based enterprise, it is obvious that the above-mentioned evaluation index systems have defects. Firstly, they ignore environmental factors. For resource-based enterprises, the external environment not only provides opportunities for the survival and development of the enterprise, but also may cause certain adverse effects on the enterprise in its development and changes. Therefore, if an enterprise wants to take advantage of favorable opportunities and avoid adverse effects, it must be very familiar with its external environment, and understand and grasp the basic trends of its development and changes. Secondly, the weight of internationalization factors is insufficient. Regardless of whether an enterprise has its own international development strategy, when evaluating the competitiveness of an enterprise, new trends in the international market and new technological breakthroughs are vital to the development of an enterprise. Traditional enterprise competitiveness evaluation often ignores this point, and analyzes different types of enterprises in a single enterprise category throughout. Thirdly, the resource-based elements are missing. At present, the research on the comprehensive competitiveness evaluation index system of resource-based enterprises is very limited, and only part of the research is conducted on a certain type of resource-based enterprises, such as petroleum companies, energy companies, and so on. These studies have provided reference for our research to a certain extent, but they still cannot meet the evaluation needs of resource-based enterprises in a broad sense.

It can be seen that the traditional evaluation indicators of enterprise competitiveness cannot comprehensively and systematically evaluate the competitiveness of resource-based enterprises, and there is an urgent need to create new evaluation indicators and methods to evaluate the competitiveness of resource-based enterprises scientifically and systematically.

III. THE EVALUATION INDEX SYSTEM FOR THE COMPETITIVENESS OF RESOURCE-BASED ENTERPRISES

When constructing the competitiveness index system of multinational resource-based enterprises, the dynamic factors and static factors of the comprehensive competitiveness of enterprises must be considered, and they are interrelated and promote each other. At the same time, according to the principle of universality and particularity of contradictions, the comprehensive competitiveness evaluation of multinational resource-based enterprises must include the general competitiveness of the enterprise as an indicator of the general

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competitiveness of the enterprise, as well as the special aspects of multinational resource-based enterprises.

Therefore, this article constructs the evaluation index system for the competitiveness of resource-based enterprises from static and dynamic comprehensive competitiveness, and regards the two as the secondary index layer. Through research, we find that the comprehensive competitiveness of resource-based enterprises can basically be presented by financial capabilities, development potential, international operating capabilities, and resource endowment capabilities. The financial capability of an enterprise is used to describe the current competitiveness of an enterprise, and the development potential of an enterprise describes the future competitiveness of the enterprise. The international business capability of a company describes the competitive advantage that resource-based companies show when they participate in international competition. Enterprise resource endowment measures the resource-based enterprise's control over resources, which also includes the international resource competition environment. Through the evaluation of corporate financial capabilities, you can see the current development status of the company and compare it with other companies to find the company's competitive advantage or company's competitive disadvantage. Through the evaluation of the company's development potential, it is possible to understand the company's sustainable development capabilities, and then strengthen the management of the company's competitiveness. For the evaluation of the company's international management capabilities, it is possible to understand the comprehensive quality of the company's participation in international competition, so as to strengthen the shortcomings of the company in the process of international management. The evaluation of enterprise resource endowment ability can understand the enterprise's control over resources and the external environment of world resource competition, and provide a systematic analysis framework for the enterprise's international resource competition. The capabilities in these four areas can be embodied by dozens of specific indicators, which can be classified into static and dynamic comprehensive competitiveness according to certain standards. From the perspective of the nature of the above four aspects, financial capabilities and international operating capabilities basically reflect the company's work results over a period of time and show static results, so they are put into static comprehensive competitiveness. The development potential and resource endowment ability reflect the process and foundation of enterprise development, and show the dynamic effects and long-term capabilities of the enterprise development process, so they are included in the dynamic comprehensive competitiveness.

Through demonstration, the comprehensive competitiveness index system of resource-based enterprises can finally be determined, as shown in TABLE I.

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TABLE I. Omposition of comprehensive competitiveness index system of resource-based enterprises

Comprehensive competitiveness of resource-based enterprises	**Static comprehensive competitiveness of resource-based enterprises**	**Corporate financial capability**	**Corporate profitability**	**Main business profit margin (X111, positive indicator)** **Return on total assets (X112, positive indicator)** **Return on net assets (X113, positive indicator)** **EVA (X114, positive index)**
			Solvency status	Asset-liability ratio (X121, moderately optimal index) Earned interest multiple (X122, moderately optimal index) Tangible net debt ratio (X123, moderately optimal index) Current ratio (X124, moderately optimal index) Quick ratio (X125, moderately optimal index)

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			Asset operation status	Turnover rate of total assets (X131, positive indicator) Inventory turnover rate (X132, positive indicator) Turnover rate of accounts receivable (X133, positive indicator) Liquid assets turnover rate (X134, positive indicator)
			Corporate market control	Market share (X141, positive indicator) Market responsiveness (X142, positive indicator) Market expansion ability (X143, positive indicator) Product capability (X144, positive index) Marketing ability (X145, positive index)
			Enterprise production capacity	Per capita technical equipment level (X151, positive index) International sales capability (X152, positive index) Labor productivity (X153, positive index) Advanced degree of equipment (X154, positive index) Effective utilization rate of production capacity (X155, positive index)

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		International business capability	Import and export volume (X21, positive index) Conversion rate of export commodity structure (X22, positive indicator) The level of diversification of the export commodity market (X23, positive indicator) International market share (X24, positive indicator) The ratio of the number of countries crossed to the number of countries in the world (X25, positive indicator) Total foreign investment (X26, positive indicator) The proportion of foreign investment (X27, positive indicator) Proportion of foreign employees (X28, positive index) Transnational operation methods and strategic elements (X29, uncertain indicators)	
	Dynamic comprehensive competitiveness of resource-based	Enterprise development potential	The overall size of the enterprise	Total number of employees (X311, positive index) Total assets (X312, positive indicator)

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	enterprises		Innovation capacity	R&D expenditure ratio (X321, positive indicator) Proportion of technical developers (X322, positive indicator) New product development success rate (X323, positive index) New technology, product output rate (X324, positive index) Proportion of strategic products (X325, positive indicator) Comprehensive quality of senior management (X326, positive index)
			Human capital status	Proportion of persons with college degree or above (X331, positive indicator) Per capita profit rate (X332, positive indicator) Comprehensive Index of Staff Conceptual Quality (X333, Positive Index)

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			Management ability	Information technology level of employees (X341, positive index) Organizational outward expansion capability (X342, positive indicator) Effective utilization rate of production capacity (X343, positive index) Cohesion (X344, positive index) Corporate culture construction investment rate (X345, positive indicator)
			Enterprise information technology level	Information technology ownership rate (X351, positive index) Information technology insecurity rate (X352, reverse index) Information technology utilization rate (X353, positive index) Information technology investment return rate (X354, positive indicator) Information technology investment growth rate (X355, positive indicator)

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			External relevance	Coefficient of business power (X361, positive index) Social responsibility cost rate (X362, positive index) Social contribution rate (X363, positive indicator) Social accumulation rate (X364, positive index) The impact of government economic policies on enterprises (X365, positive indicators) Corporate social image (X366, positive index)
		Enterprise resource endowment capacity	Abundance of corporate resources (X41, positive index) Industrial relevance of resource-based enterprise products (X42, positive index) The degree of national control of resource-based enterprises (X43, uncertain index) The scarcity of domestic and foreign resources (X44, positive index) Intensity of international resource competition (X45, reverse index) International resource acquisition threshold (X46, reverse indicator)	

IV. THE EVALUATION METHOD OF RESOURCE-BASED ENTERPRISE COMPETITIVENESS

This article uses factor analysis to evaluate the competitiveness of resource-based enterprises.

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The factor analysis method is to classify complex variables through correlation analysis, and then reduce the dimension according to the variance contribution, so as to simplify the complex things. It is a statistical method for processing dimension reduction in multivariate analysis. The basic purpose of factor analysis is to use a few factors to describe the relationship between many indicators or factors, and to reflect most of the information of the original data with a few factors. Its biggest advantage is that the weight of each comprehensive factor is not subjectively assigned but determined according to their respective variance contribution rates. The larger the variance, the more important the variable is in the evaluation, and thus the greater the weight. Therefore, the factor analysis method avoids the arbitrariness of artificially determining the weight, making the evaluation result relatively objective and reasonable.

4.1. Factor Analysis Model

Generally, factor analysis is used to deal with the problem of component correlation of multidimensional random variables under linear transformation. It obtains the independent main factors that concentrate the main information of the original random variables by finding the eigenvalues and eigenvectors of the covariance matrix or the correlation coefficient matrix, according to the specified contribution rate.

The model is as follows:

Suppose there are$n$ samples, and each sample has p observation variables, which are represented by X_1, $X_2, X_3 \ldots\ldots X_p$. F_1, $F_2, F_3 \ldots\ldots F_m$ represent m factor variables respectively, then the mathematical expression of factor analysis is:

$$\begin{cases} X_1 = a_{11}F_1 + a_{12}F_2 + \cdots \ldots a_{1m}F_m + \varepsilon_1 \\ X_2 = a_{21}F_1 + a_{22}F_2 + \cdots \ldots a_{2m}F_m + \varepsilon_2 \\ X_3 = a_{31}F_1 + a_{32}F_2 + \cdots \ldots a_{3m}F_m + \varepsilon_3 \\ \qquad\qquad \ldots \\ X_p = a_{p1}F_1 + a_{p2}F_2 + \ldots\ldots a_{pm}F_m + \varepsilon_p \end{cases} \quad (1)$$

Abbreviated as:

And meet the following conditions:

(1) $m < p$

(2) $Cov(F, \varepsilon) = O$, *that is,* F *and* ε *are not related*

(3)

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$$D(F) = \begin{bmatrix} 1 & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & 1 \end{bmatrix} = I_m \quad (2)$$

That is, F_1, F_2,F_3……..F_m are uncorrelated, and the variance is 1.

(4)

$$D(\varepsilon) = \begin{bmatrix} \sigma_1^2 & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & \sigma_p^2 \end{bmatrix} \quad (3)$$

That is, ε is uncorrelated and has different variances.

Among them, $X = (X_1, X_2, X_3 \ldots \ldots X_p)$ is a measurable p-dimensional random vector, and $F = (F_1, F_2, F_3 \ldots \ldots F_m)$ is an unobservable vector. F is a common factor or latent factor of X, which can be understood is the m coordinate axes perpendicular to each other in the high-dimensional space; a_{ij} is called the factor load, which is the load of the i-th variable on the j-th common factor. If the variable X_j is regarded as a vector in the m-dimensional factor space, thena_{ij} represents the projection of X_j on the coordinate axis F_j, and the matrix A is called the factor loading matrix;ε is called the special factor of X. Usually the covariance matrix of ε is theoretically required to be a diagonal matrix, and ε includes random errors.

4.2. Steps of Factor Analysis

In simple terms, the steps of factor analysis can be composed of the following aspects: (1) standardize the original variable data and analyze the correlation between the variables; (2) factor rotation. The initial factor loading matrix obtained from the eigenvector matrix is likely to have little correlation with the factor loading. This makes it difficult to interpret the factors. Therefore, in order to make the main factor have a clear meaning, the initial loading matrix must be positive Rotate alternately to make the load on the principal factor of each original variable differentiate between 0 and 1. (3) Principal component solution. By solving the characteristic equation, k eigenvalues and the corresponding k unit eigenvectors are obtained. They respectively represent the variance of the observed variables explained by the k principal components. The principal components are the linear combination of the observed variables, and the weight of the linear combination is the element in the corresponding unit feature vector.

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(4)Determination of the number of factors. The purpose of factor analysis is to simplify data, so common factors that can reflect all indicator data information are taken to represent the main information. (5) Establish factor loading and name and explain the factors. In order to make the main factor have a clear meaning, the initial load matrix should be orthogonally rotated, and then the actual meaning of each main factor should be determined according to the comprehensive meaning of several indexes with larger weights in the linear combination. (6)Factor score and analysis.

V. APPLICATION OF COMPREHENSIVE COMPETITIVENESS EVALUATION SYSTEM OF RESOURCE-BASED ENTERPRISES

5.1 Processing of Sample Data

This article collected a large amount of monthly data on China's resources industry from 2013 to 2018. Among them, the ratio of technology developers, the ratio of R&D funding, the total funding of scientific and technological activities, the funding for technological transformation, the funding for technology introduction, the number of new product development projects, the per capita expenditure on information and communication technology, and the penetration rate of microcomputers come from the "China Science and Technology Statistical Yearbook." Since the "China Science and Technology Statistical Yearbook" only counts the annual data of the above indicators, and the monthly data is used in this article, we use the data with the growth rate of industrial output value as the weight and correct the original data. International resource acquisition threshold and international resource competition intensity data are given by considering the global resource environment and combining reality and virtual reality. These two indicators are dummy variables. Taking into account the substitutability between indicators and the availability of indicator data, 30 indicators in the indicator system are selected for simulation application. The specific indicator set is shown in TABLE II.

The original data of other indicators are from the Information Network of the Development Research Center of the State Council of China. Since the industrial statistical data part of the Information Network of the Development Research Center of the State Council of China is calculated on a monthly basis, foreign trade uses a decreasing method to restore these data to the current month's data and calculate the required index data.

5.2 Factor Analysis

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According to the calculation steps of factor analysis, this article uses SPSS software to obtain the sample standardized data matrix, calculates the correlation coefficient matrix and the characteristic root, selects the maximum variance for orthogonal rotation, and extracts the common factors with the characteristic root greater than 1 as the comprehensive evaluation index. By maximizing the orthogonal rotation of the variance, calculating factor scores, this article finally synthesize the comprehensive competitiveness index of Chinese resource-based enterprises, which can be used to analyze and evaluate the comprehensive competitiveness of Chinese resource-based enterprises.

5.2.1 Correlation Coefficient Matrix and KMO Test

From the correlation matrix of the variables, it can be known that the correlation coefficient of most variables is greater than 0.3, which has a strong correlation. Through the KMO test degree and the Bartlett sphere test, the KMO test value is 0.774, and the results show that the factor analysis method can be used.

5.2.2 Contribution Rate

Through calculation, this article finds that the variable correlation coefficient matrix has six characteristic roots, namely: 14.678, 2.739, 2.588, 2.485, 2.307, and 2.160. These six characteristic roots explain 87.87% of the comprehensive competitiveness of Chinese resource-based enterprises. It can be seen that most of the information of the original data can be reflected by the first 6 factors. Therefore, it is appropriate to extract 6 common factors.

TABLE II. Total variance explained

Ingredients	**Initial eigenvalue**			**Extract the sum of squares and load**			**Rotate the sum of squares loading**		
	total	% Of variance	Cumulative %	total	% Of variance	Cumulative %	total	% Of variance	Cumulative %
1	16.597	55.325	55.325	16.597	55.325	55.325	14.678	48.926	48.926

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2	3.336	11.120	66.445	3.336	11.120	66.445	2.739	9.129	58.055
3	2.387	7.955	74.400	2.387	7.955	74.400	2.588	8.627	66.682
4	2.001	6.669	81.069	2.001	6.669	81.069	2.485	8.283	74.965
5	1.566	5.221	86.290	1.566	5.221	86.290	2.307	7.690	82.655
6	1.070	3.566	89.856	1.070	3.566	89.856	2.160	7.201	89.856
7	0.627	2.089	91.945						
8	0.554	1.846	93.791						
9	0.429	1.428	95.219						
10	0.316	1.054	96.274						
11	0.299	0.996	97.270						
12	0.210	0.701	97.971						
13	0.172	0.574	98.545						
14	0.143	0.478	99.023						
15	0.094	0.314	99.337						
16	0.082	0.274	99.611						
17	0.043	0.143	99.754						
18	0.028	0.094	99.848						
19	0.015	0.051	99.900						
20	0.012	0.040	99.940						
21	0.006	0.022	99.961						
22	0.004	0.014	99.975						
23	0.003	0.010	99.985						
24	0.002	0.008	99.993						

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25	0.001	0.003	99.996						
26	0.001	0.002	99.998						
27	0.000	0.001	99.999						
28	0.000	0.001	100.00						
29	0.000	0.000	100.00						
30	0.000	0.000	100.00						
Extraction method: principal component analysis.									

5.2.3 Extract Common Factors

SPSS18.0 software can give the initial results of factor analysis in tabular form. The initial results show that after the factor analysis of the original indicator variables, the variance explained by 26 factor variables is above 0.8, indicating that the extracted factors contain most of the information of the original variables, which can fully meet the needs of statistical analysis.

Establish the original factor loading matrix for the extracted 6 common factors F1, F2, F3, F4, F5, F6, and rotate the original factor loading to obtain the orthogonal rotation matrix with the largest variance, see TABLE III.

TABLE III. Rotation factor loading matrixes

	Ingredients					
	1	2	3	4	5	6
X351	.985	-.012	.041	-.031	.098	.045
X151	.973	.039	.074	.009	.020	.082
X312	.972	.006	.131	.068	-.006	.092
X355	.952	.168	.124	.074	.136	.099

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X26	-.945	-.122	-.212	-.088	-.070	-.109
X46	.023	.150	.191	.126	.944	.116
X45	.015	-.069	-.130	-.222	.942	-.066
X326	.930	.086	.186	.019	-.176	.158
X21	-.923	.086	-.088	-.150	-.013	.028
X153	.253	.072	.904	.042	-.060	.269
X311	.903	.042	.161	.150	.153	.126
X341	.879	.119	.206	.157	-.263	.214
X27	.857	.012	.041	.132	-.070	.220
X25	.807	.473	-.009	.234	.124	.158
X323	.758	.224	.295	.062	-.446	.189
X143	-.661	-.206	-.535	-.207	-.214	-.052
X363	-.309	.261	.532	.107	.651	.276
X133	.395	.392	.372	.255	-.001	.557
X321	-.069	.947	.026	.061	.017	.003
X28	.177	.925	.054	.032	.050	.051
X121	-.162	.146	-.331	.003	.007	-.778
X112	.380	.308	.678	-.018	.152	.389
X144	.124	.091	.155	.958	-.040	.069
X145	.180	.059	.142	.957	.038	.048
X364	.138	.069	.122	.097	.781	-.009
X113	.364	.070	.628	-.363	-.136	.235
X322	.516	-.617	.379	.076	.320	.199

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X111	-.494	.242	.606	.115	.416	.079
X132	.070	-.097	.871	.143	-.015	.041
X134	.249	.178	.761	-.072	.053	.125
Extraction method: main component. Rotation method: Orthogonal rotation method with Kaiser standardization.						

5.2.4 Factor Naming

According to the factor orthogonal rotation matrix, the index is divided into six common factors and named.

The first common factor has a large load on X143, X151, X311, X312, X323, X355, X351, X25, X27, X26, X21, X326, X341 (market expansion capacity, per capita technical equipment level, number of people in the mining industry), Total assets, number of new product development projects, per capita investment in information and communication technology, information technology ownership rate, the proportion of the number of multinational resource companies in the world, the proportion of foreign investment in the total asset value, the value of imports and exports, the comprehensive quality of senior management personnel, Information technology level of employees). These 13 indicators mainly include the corporate development potential indicators of Chinese resource-based enterprises, the indicators of corporate internationalization management capabilities, and corporate resource endowment capabilities, as well as some corporate financial capability indicators. It mainly reflects the sustainable development ability of the enterprise, so it can be called the sustainable development factor.

The second common factor has a large load on X322, X321, and X28 (the ratio of technical developers, the ratio of R&D expenses, and the proportion of overseas employees of resource-based enterprises). These three indicators reflect the human capital capability of the enterprise, so the second factor can be named the enterprise human capital factor.

The third factor has a large load on X111, X113, X112, X134, X132, X153, (main business profit rate, return on net assets, return on total assets, turnover rate of current assets, inventory turnover rate, labor productivity). These six indicators mainly reflect corporate profitability, so the third factor can be named the corporate profitability factor.

The fourth factor has a greater load on the two indicators of X144 and X145, namely product capability and marketing capability. These two indicators reflect the management ability of the

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enterprise, so the fourth factor can be named the enterprise management ability factor.

The fifth factor has a larger load on the four indicators of X364, X363, X45, and X46. These four indicators are social contribution rate, social accumulation rate, international resource acquisition threshold, and international resource competition intensity, which reflect the operating environment of the enterprise. Therefore, the fifth factor can be named the enterprise environmental factor.

The sixth factor has a large load on the two indicators X121 and X133. These two indicators are asset-liability ratio and accounts receivable turnover rate, which reflect the risk control of the enterprise. Therefore, the sixth factor can be seen Named as the corporate risk control factor.

5.2.5 Factor Score

The factor score coefficient matrix of Chinese resource-based enterprises calculated by regression method is used to calculate the scores of the six factors, and the comprehensive competitiveness factor of Chinese resource-based enterprises is calculated according to the information contribution rate of each factor as the weight to achieve the purpose of reduction dimension.

Expressed by the formula:

$$\begin{cases} F_1 = -0.081X_{111} - 0.043X_{112} + 0.039X_{121} + \cdots + 0.068X_{42} \\ F_2 = 0.050X_{111} + 0.022X_{112} + 0.162X_{121} + \cdots + 0.011X_{42} \\ F_3 = 0.235X_{111} + 0.335X_{112} - 0.468X_{121} + \cdots - 0.002X_{42} \\ F_4 = -0.016X_{111} - 0.150X_{112} - 0.006X_{121} + \cdots + 0.016X_{42} \\ F_5 = 0.252X_{111} + 0.061X_{112} - 0.009X_{121} + \cdots + 0.025X_{42} \\ F_6 = -0.007X_{111} + 0.083X_{112} + 0.137X_{121} + \cdots - 0.034X_{42} \end{cases} \quad (4)$$

From this we can get the time series of 6 factors. Based on the naming of the 6 factors above, we will analyze the time trend graphs of the 6 factors here in order to discover the factors and their strengths influencing the comprehensive competitiveness of Chinese resource-based enterprises, as shown in Fig 1-6.

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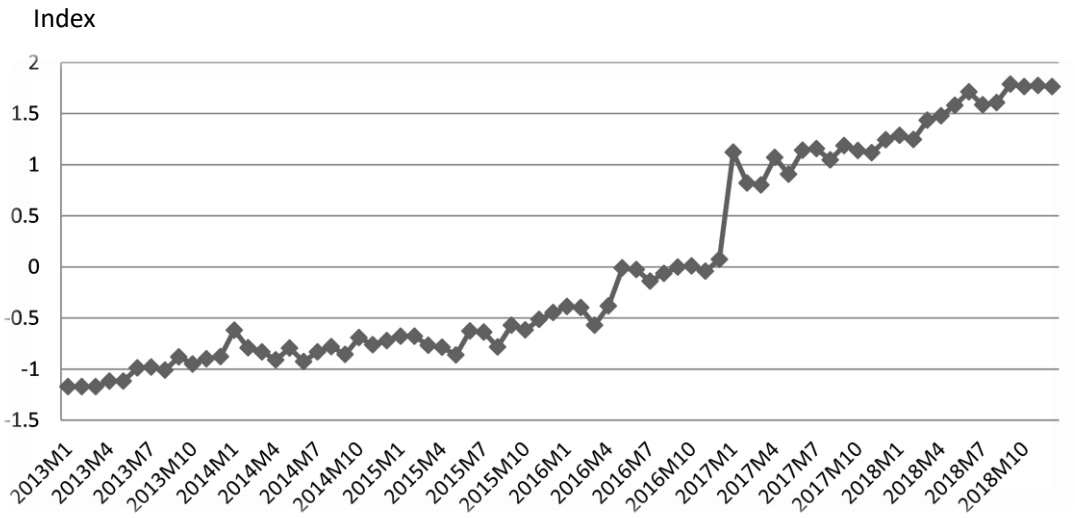

Fig1:The sustainable competition factor

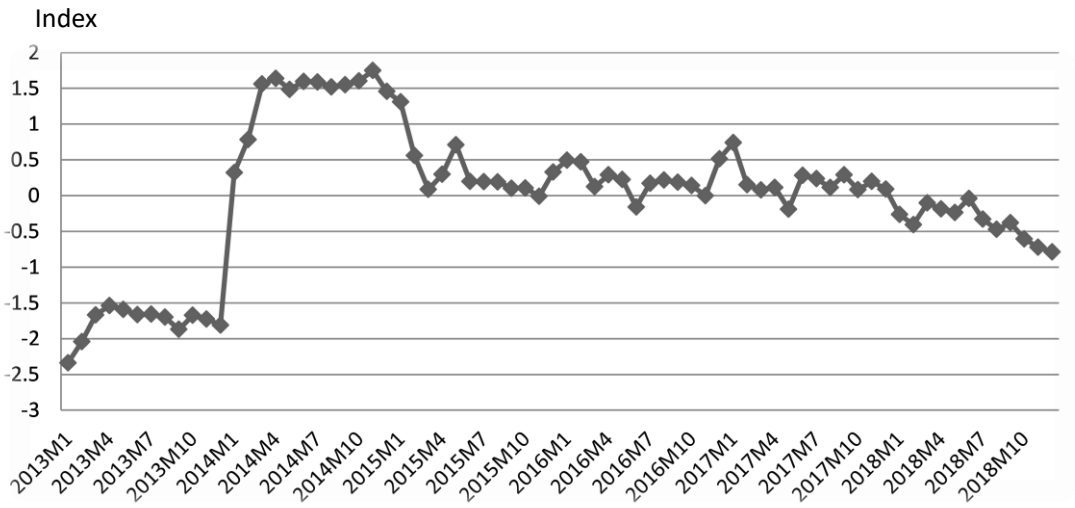

Fig2:The human capital factor

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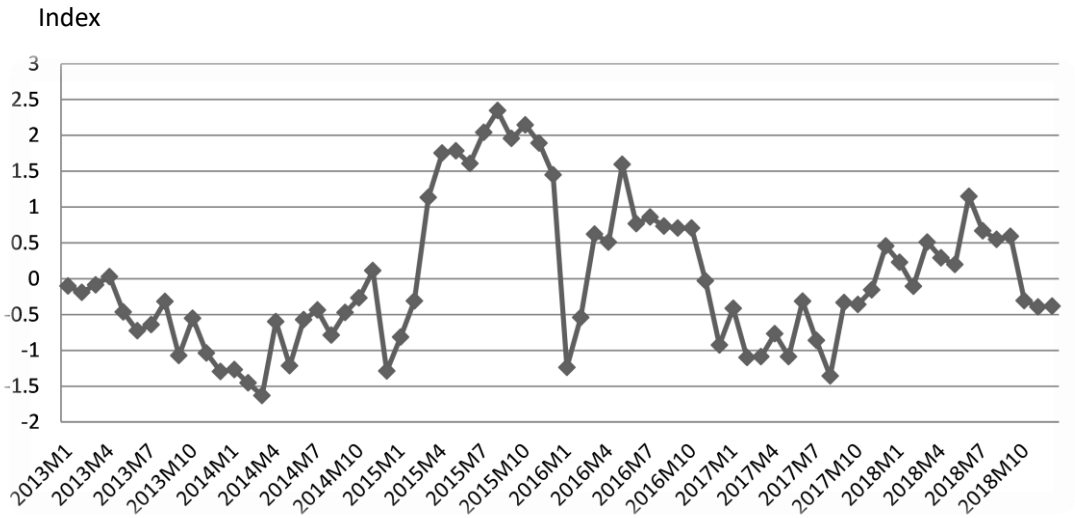

Fig3: The corporate profitability factor

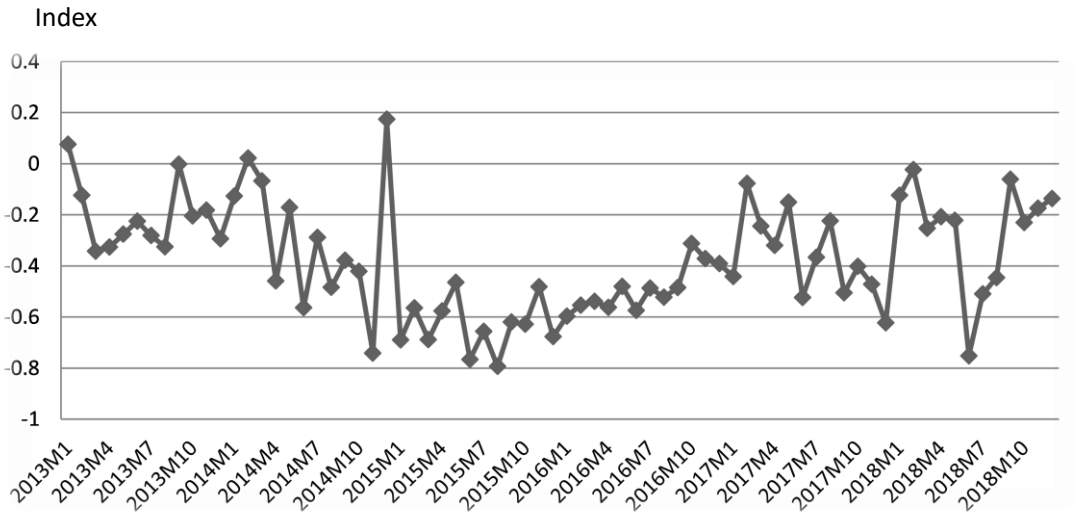

Fig 4: The enterprise management capability factor

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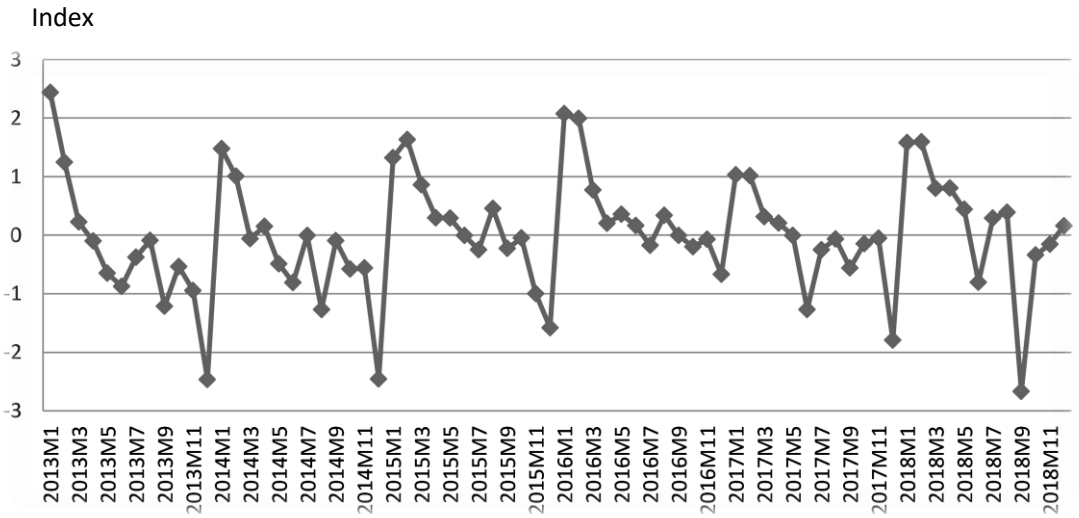

Fig 5:The business environment factor

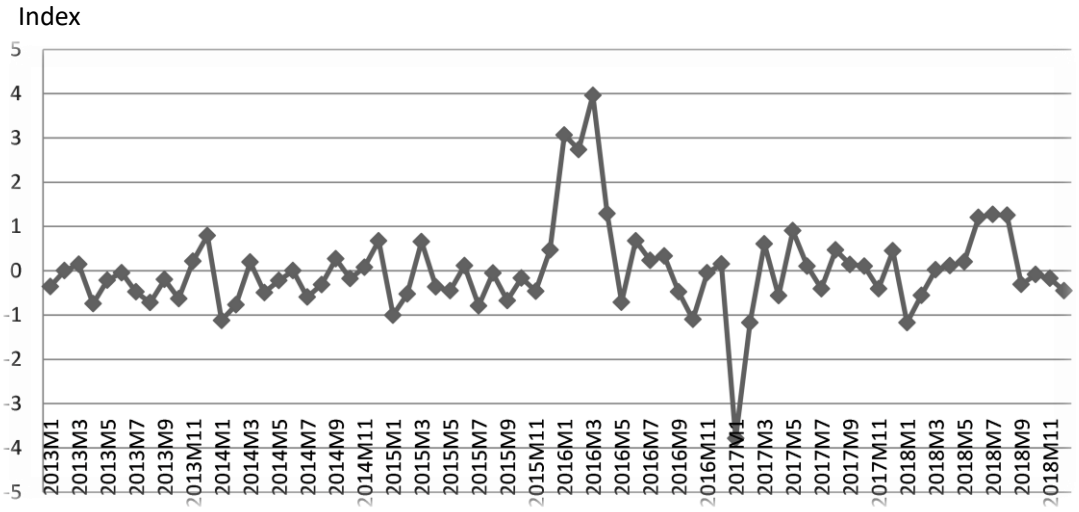

Fig 6:The corporate risk control factor

From the trend chart, we can intuitively find that the sustainable development factor has been on an upward trend among the factors affecting the competitiveness of Chinese resource-based enterprises. With the same influence weight, the sustainability factor is an important factor in enhancing the comprehensive competitiveness of Chinese resource-based enterprises. The corporate profitability factor and corporate management capability factor have basically maintained a stable trend (except for abnormal points in individual years). However, Chinese

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resource-based companies do not seem to be doing well enough in terms of human capital factors and risk control. From 2013 to 2017, the company's risk control capabilities remained basically stable. By 2017 to 2018, corporate risk control factors showed a downward trend, which was not conducive to the improvement of corporate risk control and comprehensive competitiveness. The human capital factor of enterprises shows the same development trend. It is worth mentioning that the business environment factors of enterprises have experienced violent fluctuations, but they have not formed an obvious upward or downward trend. This is the result of the multi-party power game faced by Chinese resource-based enterprises in the international and domestic environment.

Finally, we can use the information contribution rate of each factor as the weight to calculate the factor comprehensive score of China's resource-based enterprises, the formula is as follows:

$$Y = \frac{48.926F_1 + 9.129F_2 + 8.627F_3 + 8.283F_4 + 7.690F_5 + 7.201F_6}{89.856} \quad (5)$$

According to the above formula, we can easily get the trend chart of Chinese resource-based enterprises' comprehensive competitiveness index, as shown in Figure 7.

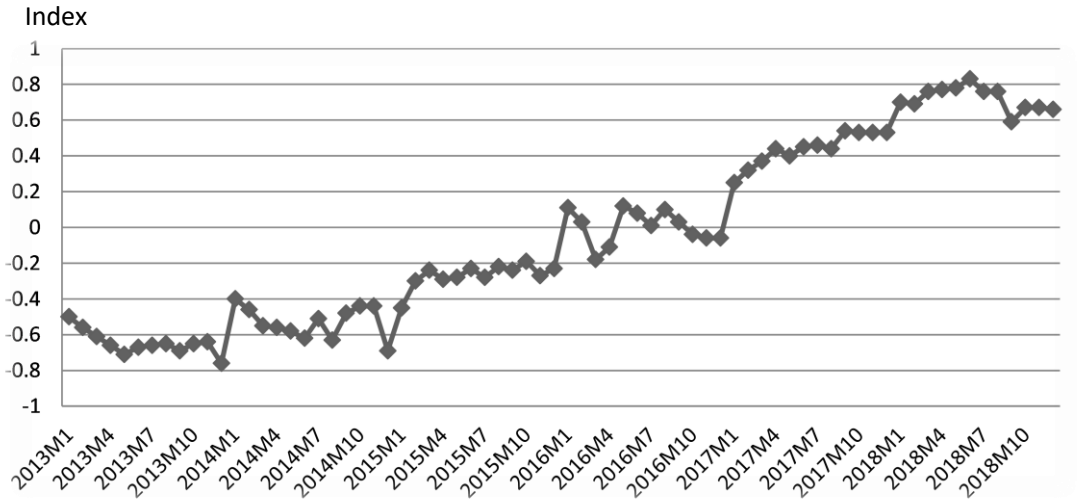

Fig7:The comprehensive competitiveness index of Chinese resource-based enterprises

VI. CONCLUSION AND DISCUSSION

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The competitiveness of resource-based enterprises has dynamic attributes, which means that the comprehensive competitiveness of resource-based enterprises should be constantly changing and cannot be judged with constant standards and perspectives. The financial results and other indicators shown by the comprehensive competitiveness of resource-based enterprises are only static results at this stage. They can reflect the competitiveness of enterprises, but they cannot fully reflect all the competitiveness of enterprises. The construction of the competitiveness index system of resource-based enterprises must consider dynamic factors and static factors, and the two are related to each other and promote each other. At the same time, the evaluation of the comprehensive competitiveness of resource-based enterprises must include the general competitiveness of the enterprise as an index, as well as the special aspects of resource-based enterprises. In view of this, this article designs a multi-layer evaluation index system reflecting the competitiveness of resource-based companies from the four dimensions of resource-based companies' financial management, development strategy, international operating capabilities, and resource abundance, and uses factor analysis to evaluate Chinese resource-based companies. An empirical evaluation study was conducted on the comprehensive competitiveness of enterprises. Research shows that the comprehensive competitiveness evaluation index system of resource-based enterprises composed of financial capabilities, development potential, international operating capabilities, and resource endowment capabilities is feasible, and the evaluation method based on factor analysis is scientific.

In addition, this research is only a useful exploration of the competitiveness evaluation of resource-based enterprises, but from the depth of the research, the evaluation index system needs to be further optimized, especially the integrated analysis of evaluation methods requires further systematic and in-depth special research. In addition, this article has not made an in-depth study on the early warning mechanism of resource-based enterprises' competitiveness. How to design an early warning information system, how to give early warning to the decline in competitiveness, and how to respond will become important directions for future research.

ACKNOWLEDGEMENTS

Guizhou Provincial Education Department Youth Science and Technology talent Growth Project 'Research on structured Measure of Knowledge Elements under open conditions' & 'Study on the Operating efficiency of Guizhou inland Open Economy'.

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