

Analysis on the Factors and Research on the Countermeasures for Economic Benefit of Salt Making Industry

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Abstract: By means of the basic principles of the analysis on the factors, this paper establishes the mathematic model for evaluating the economic benefit of salt making industry in China, surveys the basic situation of economic benefit, analyzes the factors influencing economic benefit and discusses the main ways to increase the economic benefit.

Keywords: Salt making, economic benefit, factor analysis, managerial proposals

1. PREFACE

1.1 basic ideas of factor analysis

Factor analysis is a statistical analysis method in socio-economic field that simplifies a number of variables to a few comprehensive factors. The basic idea is to group the original variables based on the degree of relevance, which makes the degree of relevance is high within the group and vice versa. Each variable represents a basic structure, and it is denoted by a unknown variable, which is called the "public factor."

Factor analysis is a statistical analysis method that evaluates the potential variable by means of the known variables, which evaluates the abstract factors by means of specific indicators. Usually we find some major influential variables from complex economic phenomena, each of which represents a certain economic relation. Grasping of these key factors, it will help us to analysis and explain complex economic problems.

1726

1.2 Mathematical model of factor analysis

1.2.1 Expression of original variables

Each various in factor analysis can be expressed as:

$$X_i = a_{i1}F_1 + a_{i2}F_2 + \dots + a_{im}F_m + e_i \quad i=1,2,3,\dots, p \quad (1)$$

Where F_1, F_2, \dots, F_m are the public factor, e_i is the special factor of X_i . a_{ij} is referred as the "load factor", which is load of the m th factor of variable i . After standardization, X_i and a_{ij} are the correlation coefficients of X_i and F_j .

The model is expressed by matrix as :

$$x = AF + e \quad (2)$$

Where $F = (F_1, F_2, \dots, F_m)$ is the public factor of X , $A = (a_{ij})_{p \times m}$ ($m < p$) is the load matrix.

1.2.2 Expression of factor scores

Factor score is the ultimate manifestation of factor analysis. When the factor loading matrix is determined, we can calculate the

specific value of each factor in each sample ,which is known as the factor score and can be expressed as follows:

$$F_j = \beta_{j1}X_1 + \beta_{j2}X_2 + \dots + \beta_{jp}X_p, j = 1, 2, \dots, m$$

where X_i is the original variable after standardization, β_{ji} is the factor score coefficient, F_j is the factor score.

1.3 Steps of factor analysis

Factor Analysis should include the following steps: ①Selecting the original variables according to the problem ②Standardization of the original variables and the related matrix, and analyzing correlation between variables: ③ solving initial public factor and factor load matrix; ④ factor transformation, it will explains more clearly about the economic meaning of the main factor, which is conducive to name factor; ⑤ factor score; ⑥further analysis of factor score based on the factor score.

2. FACTOR ANALYSIS OF ECONOMIC EFFICIENCY IN SALT MAKING INDUSTRY.

2.1 Choosing the indicators

In accordance with the industrial enterprises economic evaluation index system

promulgated by the National Bureau of Statistics in 1998 and in 2008 relative requirements for central business promulgated by State-owned Assets Supervision and Administration Commission of the state council in 2008, combining the specific situation of the salt industry , we select eight indicators of the return rate of total assets (X1) and tax on sales profit (X2), the cost margins (X3), industrial added value(X4), asset-liability ratio (X5), current ratio (X6), current fund turnover days (X7), labor productivity (X8) for evaluating the economic situation of salt industry. These indicators basically cover the capability of company's profitability, credit, growth.

2.2 Date collecting

The data is collated in accordance with the "National statistic of salt industry" compiled by China National Salt Industry Corporation. We choose the 17 salt making industry as the observation sample, and calculate the major economic indicators of salt making industry in 2007 as shown in Table 1.

Table 1 Major economic indicators of salt making industry in 200

company	X1	X2	X3	X4	X5	X6	X7	X8
Yingkou	9.38	33.99	19.76	35.44	54.61	186.57	227	12.87
Dadi	4.82	16.68	10.70	46.47	100.00	95.80	279	74.51
Cangzhou	2.99	15.96	7.78	75.14	68.44	56.88	379	7.49
Changlu	0.77	14.67	3.91	55.65	69.88	148.19	844	12.41
Jintan	4.58	16.95	10.16	31.39	68.40	34.02	89	122.78
Lantian	0.14	8.21	0.55	41.43	79.45	57.84	258	19.65
Changjiang	2.26	17.82	6.26	31.49	22.74	150.42	211	21.28
728	-6.87	-5.00	-11.59	46.37	108.41	24.81	177	10.79
Huayuan	0.16	3.19	1.73	43.28	58.06	60.20	249	14.17
Hongbo	0.05	7.60	0.14	29.29	74.71	57.15	228	24.16
Zaoyang	6.85	16.64	0.51	41.13	62.55	69.24	159	20.08
Xiangfeng	1.62	10.87	3.08	43.37	49.23	84.52	121	23.55
Jiangxi	2.08	15.89	6.97	68.21	33.92	88.69	173	25.44
Dongxing	0.63	9.15	4.73	33.70	86.00	61.64	173	36.94
Suote	0.04	4.57	0.18	32.69	71.91	32.48	276	26.86
Hebang	7.14	39.78	24.10	42.71	52.63	141.03	704	8.70
Haolong	1.19	13.46	2.55	60.20	71.93	77.05	239	2073

2.3 Establishment of factor analysis model

Various economic indicators have different values. In order to get rid of the influence of different dimensions, we have to

normalized the original data, which is used as the National Salt Industry statistics indicators as shown Table 2.

Table 2 National Salt Industry statistics indicators

No.	X1	X2	X3	X4	X5	X6	X7	X8
1	2.06849	1.99959	1.87846	-0.5693	-0.2375	2.34494	-0.0199	-0.4954
2	0.78136	0.32585	0.69052	0.2524	1.57415	0.27556	0.06923	1.7576
3	0.25759	0.25623	0.30765	2.38833	0.25192	-0.6117	0.58507	-0.6921
4	-0.3778	0.1315	-0.1998	0.93631	0.31225	1.46995	2.98371	-0.5122
5	0.71267	0.35196	0.61971	-0.8711	0.25025	-1.1329	-0.9109	3.52194
6	-0.5581	-0.4931	-0.6404	-0.1231	0.71319	-0.5899	-0.0391	-0.2476
7	0.04866	0.43608	0.10835	-0.8636	-1.6627	-1.52079	-0.2815	-0.188
8	-0.3435	-14.0539	-0.4647	-1.365	-1.8282	-0.1271	-0.9418	-0.4212
9	-0.2862	-0.3152	-0.4725	-0.5395	-1.1721	0.0494	-0.4569	-0.4267
10	-0.6125	-0.5521	-0.6941	-1.0275	0.51461	-0.6056	-0.1939	-0.0828
11	1.36237	0.32198	0.40337	-0.1454	0.00516	-0.33	-0.5498	-0.2319
12	-0.1345	-0.2359	-0.3086	0.02145	-0.5529	0.01839	-0.7458	-0.1051
13	-0.0029	0.24946	0.20144	1.87204	-1.1943	0.11346	-0.4776	-0.036
14	-0.4179	-0.4022	-0.0923	-0.699	0.98761	-0.5032	-0.4776	0.01885
15	-0.5867	-0.8451	-0.6889	-0.7742	0.3973	-1.168	0.05376	0.01593
16	1.44538	2.55943	2.44752	-0.0277	-0.4104	1.30671	2.26154	-0.6479
17	-0.2576	0.0145	-0.3781	1.27529	0.39814	-0.1519	-0.1371	-0.2081

2.3.1 Correlation test of the original data

Factor analysis selects some representative variable form the original variables ,which requires the original variables have strong correlation. The relevance of the original variables There are two main methods for testing of correlation of the original variables: Bartlett, test of sphericity test and KMO (Kaiser-Meyer-Olkin) test. After calculation, the ball Bartlett test statistic is 102.854, with significant level of 0.000, which indicates that the correlation coefficient matrix and unit matrix were significantly different. At the same time, KMO statistic is $0.667 > 0.6$, which notes the data in this article are suitable for factor analysis.

2.3.2 Solving for the factor load matrix, factor score coefficients

Using SPSS software, We processed the

data in Table 2 with the method of Factor Analysis and done orthogonal rotation (Varimax) to the primary load factor matrix (Componet Matrix). The factor variance contribution rate and the load factor matrix as well as the factor score coefficient matrix after transformation are shown in Table 3-5.

It can be seen from Table 3 that the variance accumulation contribution is 82.438%, which indicates that the three factor basically contain the original information. We choose the three public factor and denote them as Y1, Y2, Y3, in accordance with the characteristics of characteristic value is larger than 1 and the variance accumulation contribution is greater than 80%.

Table 3 Factor variance accumulation contribution

Factor Item	Initial eigenvalue		
	total	variance	accumulated variance
X1	3.678	45.969	45.969
X2	1.626	20.324	66.293
X3	1.292	16.145	82.438
X4	0.696	8.695	91.133
X5	0.371	4.643	95.776
X6	0.239	2.986	98.762
X7	0.076	0.952	99.714
X8	0.023	0.286	100

Table 4 Factor load matrix

Factor Item	Factor		
	1	2	3
X3	0.977	0.070	-0.032
X2	0.951	0.201	-0.104
X1	0.950	-0.084	0.001
X6	0.693	0.180	-0.543
X7	0.301	0.784	-0.174
X4	-0.035	0.766	0.043
X8	0.257	-0.386	0.795
X5	-0.274	0.426	0.732

Table 5 Factor score coefficient

Factor Item	Factor		
	1	2	3
X1	0.297	-0.094	0.096
X2	0.274	0.008	0.044
X3	0.295	0.001	0.088
X4	-0.038	0.493	0.086
X5	-0.024	0.339	0.527
X6	0.148	0.043	-0.300
X7	0.041	0.473	-0.032
X8	0.181	-0.196	-0.566

It can be seen from Table 4 that: the economic meaning of each main factor is represented clearly: The main factor F1 has large load value in the X3, X2 and X1, all of these factors are more than 90%, which explains the profitability of enterprises, it can be named as the profitability factor. The main factor Y2 has large load value in the X7 and X4, all of these factors are more than 75%, which explains the operating capacity of enterprises, it can be named operating capacity factor. The main factor Y3 has large load value in the X8 and X5, all of these factors are more than 70%, which explains the human resources and credit of enterprises, it can be

named human resources and credit factor.

At the same time, the Table 4 also explain the linear relation of the variable X_i and the factor of Y_1 , Y_2 and Y_3 , for example:

$$X1 = 0.950Y1 - 0.084Y2 + 0.001Y3$$

$$X2 = 0.951Y1 + 0.201Y2 - 0.104Y3, \text{ and etc.}$$

The Table 5 calculates the coefficients of factor score, which is very important to the following problems.

2.4 Mathematical model of the comprehensive score of the economic benefit

We can propose mathematical model of the factor score based on the data in Table 5:

$$F1 = 0.297X1 + 0.274X2 + \dots + 0.181X8 \quad (3)$$

$$F2 = -0.094X1 + 0.008X2 + \dots - 0.196X8 \quad (4)$$

$$F3 = 0.096X1 + 0.044X2 + \dots + 0.566X8 \quad (5)$$

Based on the above model, the mathematical model of the comprehensive score of the economic benefit can be

established taking the proportion of each variance contribution to the total as follows:

$$F=(0.45969F_1+0.20324F_2+0.16145F_3)/0.82438 \quad (6)$$

substituting the X into the equations of (3), (4) and (5), each factor can be obtained. Further we can calculate and sort the

comprehensive factor based on the equation 6 in Table 6

Table 6 Evaluation of economic efficiency

company	F1		F2		F3		F(Total)	
	score	rank	score	rank	score	rank	score	rank
Hebang	2.03	1	1.17	3	-0.58	14	1.31	1
Dadi	0.84	4	0.31	7	1.91	2	0.92	2
Yingkou	2.00	2	-0.32	12	-0.75	16	0.89	3
Jintan	0.95	3	-1.55	18	2.56	1	0.65	4
Changlu	0.07	8	2.19	1	-0.63	15	0.45	5
Cangzhou	-0.05	9	1.65	2	0.17	9	0.41	6
Zaoyang	0.50	5	-0.40	13	0.16	10	0.21	7
Haolong	-0.31	11	0.76	4	0.20	7	0.05	8
Jiangxi	0.08	7	0.32	6	-0.48	13	0.03	9
Dongxing	-0.35	12	-0.25	10	0.57	4	-0.15	10
Lantian	-0.64	16	0.20	8	0.257	6	-0.25	11
Changjiang	0.42	6	-0.99	17	-1.47	19	-0.30	12
Xiangfeng	-0.23	10	-0.51	15	-0.38	12	-0.33	13
Hongbo	-0.62	15	-0.42	14	0.18	8	-0.42	14
Suote	-0.76	18	-0.29	11	0.35	5	-0.43	15
Huayuan	-0.74	17	-0.06	9	-0.32	11	-0.49	16
728	-2.28	19	0.71	5	0.61	3	-0.98	18

3 EVALUATION ON ECONOMIC EFFICIENCY

The main factor scores and overall score in Table 6 is quantitative description of economic efficiency of salt making enterprises. We can conclude from different points of view based on the data.

From the point of view of scoring and ranking, the development of the 17 salt making enterprises are very uneven, nine of which are above the average level, the other 8 is below. Among them, Hebang salt industry in Sichuan ranks the first, which have advantages in profitability and operating

capacity. Dadi salt industry Co., Ltd in Shandong ranks the second, which have advantages in profitability and operating capacity and human resources and credit. Yingkou Salt Co., Ltd of China National Salt Industry Corporation ranks the third, which has advantages in profitability. Hubei 728 Salt Co., Ltd ranks the last, which has advantages in operating capacity and human resources and credit, but its profitability is far behind the average level. From the point of view of economic efficiency, the variance contribution of the first three major factor are 46%, 20%, 16%, respectively, which indicated that the profitability is the determining factor of

economic efficiency (Hubei 728 salt Co., Ltd. is a good validation of the judge). The operating capacity and human resource and credit has different influence on the economic efficiency. From the point of view of production distribution, four of the top five is sea salt production, which indicates that the sea salt enterprises are better than other salt enterprises. In addition, from the point of view of ownership, six of the top nine are subsidiary company of China National Salt Industry Corporation (CNSIC), which indicates

that the economic efficiency of CNSIC is better than local salt companies.

4 MAJOR INFLUENTIAL FACTORS ON ECONOMIC EFFICIENCY

Factor score data of the sample enterprises are listed in Table 6 (positive value indicates higher than the average level, while a negative value indicates lower than average level), from which we can identify the main factors of economic efficiency.

Table 7 Factors influencing economic efficiency

Company	Disadvantage
Xiangfeng, Huayuan	Profitability, Operation, HR, Credit
Dongxing, Hongbo, Suote	Profitability, Operation
Yingkou, Changjiang	Profitability, HR, Credit
Cangzhou, Haolong, Lantian, 728	Operation
Jintan, Zaoyang	Profitability
Hebang, Changlu, Jiangxi	HR, Credit

5 PROPOSALS ON IMPROVING THE ECONOMIC EFFICIENCY

5.1 Enhancing business management and improving the core competitiveness.

Management is enterprise core competitiveness. Only by strengthening business, excellent core competitiveness can be cultivated, sound economic efficiency can be obtained, long life of company can be assured. Strengthening the business management, we should begin from rules and regulations, technology, quality standards, production quotas, and other basic rules. We also have to learn the philosophy and methods of contemporary lean management, to integrate advanced information technologies, and to improve the management of the basic work. we have to buildup a management system of standardization, systematization, and standardization in order to achieve safe, qualified, and efficient management of the salt production.

5.2 Mining the internal potential, controlling production costs

Controlling and reducing costs is an effective way to increase revenue and reduce expenditure. Firstly, we have to establish a strict cost-accounting system and to implement of cost management accountability. Secondly, we have to allocate important resources and purchase important resources and services, even more, we have to intensify the management of procurement, transportation and utilization. Thirdly, we have to learn from advanced enterprises internationally and vigorously carry out standardization management. Average energy consumption of vacuum salt is 164.54 kilograms (standard coal) in 2007, the highest is Chongqing (206 kg) and the lowest is Anhui (132 kg) with a gap of 74 kilograms, which indicate the potential of energy saving is great. We have to control energy consumption in order to reduce the cost of production, targeting at the advanced enterprise and comparing the cost management. We have to

optimize the economic indicators and continue to improve reform, enhancing the revenue and reducing the cost.

5.3 Strengthening financial management and improving the operational efficiency of assets

Financial management is the core of industry operation and development. The company has to carry out overall budget management and allocate asset properly in order to utilization quality of funds. It also has to promote the concentration of financial accounting and to strengthen the cash flow management, innovating financial planning in order to broaden channels of financing for long-term dynamic balance of the funds. The company also has to perfect storage management by reduce the capital occupied by production and activating precipitated funds. It may need to tighten the debt in order to speed up the liquidity of funds. The company has to strengthen early warning and monitoring to guard against financial risks. It also has to establish risk monitoring system to watch out the upstream and downstream industry, monitoring and evaluating the credit capability of important customers. The company has to monitor the financial situation of the insurance company and establish emergency planning against financial risks.

5.4 Speeding up technological progress, and promoting energy-saving and emission reduction

Technological progress is the determining factor in promoting economic growth. We have to speed up technological progress and focus on clean production and energy-saving production. Sea salt production area has promoted comprehensive utilization of brine, biotechnology applications and comprehensive utilization of marine chemical resources, which gradually realize "zero emission". We have to protect the environment of the salt lake and improve the comprehensive utilization of brine. Enterprises in the well and rock district is necessary to

speed up the introduction and absorption of coproduction of salt and sodium and sulfate, promoting brine purification, multi-effective pre-heating, energy-saving technologies in order to speed up the reformation and upgrade of vacuum salt cooling system, evaporation pot and gas pipelines, which will save energy and decrease environmental pollution, improving the energy consumption efficiency. It also has to strengthen the treatment of "three wastes", establishing pollution monitoring system to ensure the emission of waste meet the requirement, which will improve the development and recovery of resources utilization. It will make overall mineral resources planning and resource exploitation, paying attention to the symbiotic, associated mineral resources development and utilization and protective development.

5.5 Strengthening the human resources management and creating a high-quality workforce

Human resource is the only initiative and creative main factor. The quality of human resources is of vital importance to maintain the advantage and competitiveness. We should vigorously develop human resources and intensify education and training investment to improve the overall quality of human resources; to vigorously adjust and optimize the structure of human resources. We have to adjust and optimize the human resources structures, strengthening the cultivation of salt and salt chemical engineering personnel, management personnel and research talent. The company has to train inter-disciplinary talents, who should know the professional knowledge and management and marketing. The company also has to set up the correct orientation of human resources, establishing a fair competition mechanism. Firstly, the company has to establish a sound and fair evaluation system for human resources and evaluation mechanisms for the scientific management of human resources. Secondly, it is necessary to build the management system and competition mechanism based on personal

capability, which will provide a stage for the talents. Thirdly, it is necessary to establish a scientific allocation and incentive mechanism to promote internal fair competition and external competitiveness. s

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Reference

- Zhu Jianping, Yin Duanfei. Application of SPSS in statistic analysis [M]. Tsinghua university press Jan 2007.
- He Xiaoqun. Modern statistic methods and application(2nd Edition)[M]. China Renmin University Press. 2007.