

Study on the Evaluation System of Information Potential of Regional Circulation Industry

From the Perspective of Potential Science*

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Abstract—The circulation industry has an information potential, which can be divided into explicit potential and implicit potential. The explicit potential includes the scale potential, technical potential and benefits potential of the circulation industry; the implicit potential include the institutional potential, correlation potential and innovation potential of the circulation industry. The article establishes the evaluation index system of the information potential in regional circulation industry, and evaluates the information potential of circulation industry in 31 provinces and municipalities in China by use of factor analysis method. The results show that the circulation information potential in the eastern coastal areas of China is the strongest, and that in the western and northeastern regions is relatively weak. In order to enhance the circulation information potential of the region, it is necessary to expand the scale of the circulation industry, improve the technical level and circulation benefits of the circulation industry, increase the regional openness, and promote the innovation capability of the circulation industry.

Keywords—*information potential of circulation industry; evaluation of regional circulation development; factor analysis*

I. INTRODUCTION

Circulation, an important link between production and consumption, as a basic industry and a leading industry of the national economy, plays a very important role in the healthy operation of the national economy. The development of circulation in a region has the same impact on the development of the regional economy. How to evaluate the circulation development of a region? This paper intends to use the circulation information potential to evaluate the development of regional circulation from the perspective of potential science, in order to provide new ideas for the evaluation of China's circulation industry.

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II. LITERATURE REVIEW

At present, the concept of the competitiveness of the circulation industry is generally adopted in the evaluation of regional circulation development status. The competitiveness of the circulation industry refers to the overall competitiveness of the circulation industry of a country or region, that is, the ability of the circulation industry to occupy and expand the market based on the original scale of strength, and to obtain certain economic benefits, compared with other countries or regions. (Yang Yaping, Wang Xianqing, 2005). In the selection of competitiveness evaluation indicators for circulation industry, Song Ze (2003) proposed to establish a modernization evaluation index system for circulation industry from 11 aspects including the scale, contribution, efficiency, environment, benefit, organization degree, structure, talents, informationization, method and cost of circulation; Wang Juan (2014) constructed from the relationship between the scale, foundation, benefits and growth of circulation industry and its competitiveness, the evaluation index system for the circulation industry based on the above four dimensions; Jiang Weihua (2016) studied the competitiveness of Shanghai's circulation industry from five perspectives: circulation contribution competitiveness, circulation efficiency competitiveness, circulation scale competitiveness, advanced productivity of circulation, and circulation benefit competitiveness; Zheng Shuli (2014) established the rating index system of the circulation industry competitiveness from four aspects: the production factor, demand conditions, related and supportive, horizontal competition and industrial organization degree; Liu Y. (2017) used the statistical data from 2011 to 2015 to analyze the efficiency increasing of the circulation industry and its cost declining. Wang Lei (2017) studied the circulation competitiveness of 45 cities in the world in terms of circulation scale and contribution rate, circulation innovation and efficiency, circulation energy consumption, circulation infrastructure, as well as circulation structure and environment.

Most scholars have chosen factor analysis in the selection of the methods of circulation competitiveness evaluation. Liu Genrong and Fu Yu (2012) empirically studied the competitiveness of the circulation industry in different provinces of China by use of factor analysis, and concluded

that places like Guangdong, Shanghai, Beijing, Zhejiang and Jiangsu are regions that have competitive circulation industry. Wang Yongpei and Xuan Ye (2008) used factor analysis to analyze the competitiveness of China's circulation industries, and considered that Beijing, Shanghai and Tianjin are at the first level of China's circulation competitiveness; Chen Ming (2010) made an ordination analysis for the circulation industry competitiveness of the 28 cities by use of factor analysis. Du Jiesi (2016) selected 11 provinces and cities in the Yangtze River Economic Belt, and used the economic data of the statistical yearbooks of each province and city in 2013 to objectively evaluate the competitiveness level of Chongqing's commercial and trade circulation industry, by use of the principal component analysis method in the factor analysis method. Some scholars have adopted other analytical methods. Yang Jian and Song Dongmei (2016) used the analytic hierarchy process to study the development of the competitiveness of the circulation industry in Hebei Province; Gu Xiao (2009) used the subjective weight method to study the competitiveness of the circulation industry in Zhejiang Province.

The literature on the competitiveness of the circulation industry from the perspective of potential science is very few currently. Using the principles of the potential science to analyze the development of the entire industry is more common. Li Dechang (2011) proposed that the fundamental path for the development of strategic emerging industries is to produce the largest amount of economic information and create strong economic information potential. Zhang Xiangyang and Zhang Hongli (2015) believe that the agglomeration model of network emerging industry represented by IT technology, e-commerce and cloud intelligence is in line with the "potential gain" driving mechanism; they constructed the factor model of the network emerging industry agglomeration in a society of information man by extracting six key elements of attraction, management, innovation, transformation, capital and radiation. Relying on the "clustering" principle of the potential science, they analyzed the development path of "park gathering" of the network emerging industries evolving into digitization, networking and cloud intelligence. Chen Hao (2017) analyzed the international competitiveness of Chinese enterprises with Huawei as an example using the principle of information potential; Ding Yuehua and Wu Jie (2014) analyzed the competitive advantage of modern enterprises and divided these advantages of modern enterprises into explicit potential and implicit potential; Hui Shupeng (2015) used the stickiness principle of information potential and analyzed that only the institutional strength can achieve the transfer of industries from coastal to central and western regions of China.

It can be seen from the above analysis that the industrial competitiveness is the main indicator in the evaluation of the level of the regional circulation industry by experts and scholars, but there is still no consensus on the evaluation index system of the competitiveness of the circulation industry; Factor analysis is the main method to evaluate the competitiveness of the circulation industry, while other methods are used less. There is plenty of analysis of the

competitive advantages of strategic industries, network emerging industries, and enterprises by use of the principle of potential science, but few analysis and application of potential science in the circulation industry, let alone empirical research. The author intends to use the information potential theory of the potential science to analyze and evaluate the development level of the regional circulation industry from the perspective of potential, in order to provide a new reference for the evaluation of the development level of regional circulation industry in China.

III. POTENTIAL AND THE INFORMATION POTENTIAL IN CIRCULATION INDUSTRY

Everything in the world has its potential. It is understood as an influence in Chinese culture. The presence of potential can be represented in idioms like "the situation is like splitting a bamboo"(meaning "with overwhelming force"), "have power and influence", "taking advantage of the situation and guide it to a favorable direction", "gaining momentum", in which the "overwhelming force", "influence", "situation" and "momentum" all have the meaning of "potential" to some extent. Sun Tzu said that "the rush of water is able to wash away stones because of its potential"; Lao Tzu said that "The Tao generates everything, and morality raises everything. Although everything is in various forms, the momentum has made everything grow". They all illustrate the role of the potential. The potential in physics is often associated with energy and work that is creating a potential field provides conditions for doing work. For a system, creating strong information potential is an internal impetus for system development and an important condition for external competition. Based on the above contents, Professor Li Dechang (2008) of Xi'an Jiaotong University put forward the theory of potential science, pointing out that potential = difference \times connection, potential is information, slope and derivative. The growth, development and evolution of individual, organization, society, and the universe are driven by the potential of all levels. He believes that the difference between things is objective, and the connections of things that differ greatly form a potential. The science of potential is the discipline that studies the mechanisms of difference and linkage of things.

There are three basic laws in the science of potential: (1) the law of the operating mechanism of the potential. The operational mechanism of the potential is that the difference promotes the connection and the connection expands the difference, so the trend tends to be constant and the universe accelerates expansion and the society accelerates development; (2) the law of the evolution of the potential. When the steady growth of the potential reaches a certain critical value, non-equilibrium phase transition and nonlinear bifurcation will occur in the system, which will lead to various qualities, innovations and risks; (3) the symmetry principle of potential. The growth limit of the potential at a certain level produces symmetry which forms a group, and the undamped material potential acts to form a mass group. The non-interfering information potential acts to form a quality group, an organization group and a social group so

can quality harmony, organizational harmony, and social harmony can be produced.

From the perspective of the potential science, everything in the world has its own quality. Material has the quality of material and human the quality of human. Similarly, the circulation industry, as an important industry for economic operations, also has its own quality. The quality of the circulation industry refers to the quality of the elements (scale, benefit, technology, system, correlation, innovation) that constitute the circulation industry and the essential characteristics of their interaction, that is, the order degree of the elements of the circulation industry. According to the principle of the potential science, orderly message is information. The information potential of the circulation industry is the resource integration capability that is better than that of other regions in terms of the development of the circulation industry in a certain region. The more orderly the circulation industry in a region is, the more favorable is the quality and ability of the circulation industry in the region in the combination of circulation factors. The quality of the circulation industry in different regions ranges from low to high, and the higher quality of the circulation industry in all aspects is the competitive advantage of the circulation industry. That is, the orderliness of the circulation industry. According to the theory of potential science, orderliness is equivalent to the derivative in mathematics. Therefore, the competitive advantage of the circulation industry can be expressed by the first derivative of the quality of the circulation industry and the second derivative of the elements. Its value is: the difference among the elements of the circulation industry \times correlation among them. Therefore, the differences and correlations among the elements of the circulation industry determine the strength of the competitive advantage of the circulation industry. When the symmetrical structure is formed among the various elements that constitute the circulation industry (that is when the difference and the correlation is in the maximum), the circulation industry information potential is the strongest, so to enhance the information potential of the circulation industry is to promote the symmetry of the circulation industry elements.

In the theory of potential science, "explicit potential" and "implicit potential" constitute the symmetrical structure of the quality of information man. "Monetary information, power information and knowledge information" is what is called "explicit potential" while "emotional information, art information, and virtual abstract information which is intangible and less measurable, is called "implicit potential". The organic combination of "explicit potential" and "implicit potential" constitutes the quality of information man. The circulation industry is a special and systematic self-organization process realized by the "virtual and real" dual mechanism. As far as the circulation industry is concerned, it is because of the dual interaction between "explicit potential" and "implicit potential" that the quality of the circulation industry is improved, thus enhancing the orderliness of the circulation industry.

The circulation industry information potential can also be divided into explicit potential and implicit potential. The explicit potential of the information potential in the

circulation industry is the explicit orderly information that can be observed through intuitive data. The added value, the sales volume and the profit-taxation rate of the circulation industry are all examples. According to the views of Yang Yaping, Wang Xianqing (2005), Liu Genrong, and Fu Yu (2012), the explicit potential of the information potential in the circulation industry can be divided into three types: the scale potential of the circulation industry, the technical potential of the circulation industry, and the benefit potential of the circulation industry. The explicit potential of the information potential in the circulation industry first shows up as the its scale potential. The scale potential means that the development of the circulation industry should first be based on a certain scale. Only with a certain scale can information damping be generated. If F indicates the competitiveness of the distribution industry, M indicates information damping, a indicates the circulation industry information potential, and f indicates the risk coefficient of the competitiveness of circulation industry, then: $F = f \times M \times a$. M is the scale of the circulation industry. The larger M is, the larger the F is. It is obvious that there is no competition in the circulation industry without a certain scale. A larger the scale of the circulation industry shows a better state of the past development of the circulation industry, indicating that the potential energy is greater in the circulation industry. At present, the ranking of circulation enterprises in the world is mainly based on scale-sales revenue. For example, Deloitte released the 2018 Global Retailers' Power Report (Global Powers of Retailing 2018) based on the data released by major retailers around the world in fiscal year 2016 (the fiscal year up to June 2017). The report was made according to sales revenue (see "Table I" for specific list).

The technology potential of the circulation industry reflects its technological development capability. With the development of science and technology and the Internet, the circulation industry needs to be further integrated with modern technology. Only with the close integration with modern technology, can the circulation industry have vitality, and better serve our production and life. The reason why Internet circulation companies such as Alibaba and Jingdong can win consumers' favor is mainly that they realized the combination of modern science and technology with circulation earlier, which saved consumers a lot of transaction costs and enable the company to gain a larger Potential. Modern circulation enterprises such as Wal-Mart and Costco have also used communication satellites for logistics distribution, commodity sorting and out-of-stock management very early, so they have maintained large information potential. Therefore, the circulation industry must make better use of modern technology, to maintain a high level of technology and obtain a large technical information potential.

TABLE I. TOP 10 GLOBAL RETAILERS IN 2018

Ranking	Company Name	Founding Nation	Retail revenue for fiscal year 2016	Total revenue	Category	Number of countries/regions to open stores
1	Wal-Mart Stores, Inc.	The US	485.873 billion	485.873 billion	Big box/big shopping center/big supermarket	29
2	Costco Wholesale Corporation	The US	118.719 billion	118.719 billion	Cash-and-carry/warehouse club	10
3	The Kroger Co.	The US	115.337 billion	115.337 billion	Supermarket	1
4	Schwarz Group	Germany	99.256 billion	99.256 billion	Discount Store	27
5	Walgreens Boots Alliance, Inc.	The US	97.058 billion	117.351 billion	Pharmacy	10
6	Amazon. Com. Inc.	The US	94.665 billion	135.987 billion	No physical stores	14
7	The Home Depot, Inc.	The US	94.595 billion	94.595 billion	Home improvement	4
8	Aldi Group	Germany	84.923 billion	84.923 billion	Discount Store	17
9	Carrefour S.A.	France	84.131 billion	87.139 billion	Big box/big shopping center/big supermarket	34
10	CVS Health Corporation	The US	81.1 billion	177.526 billion	Pharmacy	3

The benefit potential of the circulation industry is the economic benefit embodied in the circulation industry, or the information potential of currency in the circulation industry. The circulation industry must generate economic benefits to make compensation for input costs. If the circulation industry cannot create large economic benefits, it will not be able to give full play to its advantages. the economic benefits of the circulation industry, from the macro perspective, is that it must provide more value-added for national production; from a micro perspective, is that the circulation industry must obtain certain profits and maintain a reasonable profit rate.

The above three types of potential belong to explicit potential, that is, these elements can be directly observed from the statistics of the circulation industry. The explicit potential constitutes the basis of the information potential of the circulation industry. Correspondingly, the circulation industry information potential also includes implicit potential. The implicit potential of the information potential in the circulation industry is the orderly information hidden in the circulation industry and needs to be found through analysis and calculation. This information needs to be detected through in-depth observation. For example, it can take the form of the policy system in the region where the circulation industry is located, and the innovation ability in the development of the circulation industry. The implicit

potential can be divided into the system potential, correlation potential, and innovation potential of the circulation industry.

The system potential of the circulation industry is the influence of the development institution of a regional circulation industry on its development. The more sound and complete is the regional circulation institution, the greater development advantage will the circulation industry in the region have. For example, since Hainan has been approved as a free trade port from May 1st, 2018, residents of 59 countries and regions abroad will be allowed to enter the island after a visa interview. This superior circulation institution has created strong information potential for the development of circulation industry in Hainan. Similarly, the developed circulation industry in Shanghai's has a close relationship with the early approval of the Shanghai Free Trade Area and the granting of Shanghai's greater autonomy in opening and circulation.

The correlation potential of the circulation industry refers to its interrelationship with other industries. The greater the impact the circulation industry has on other industries, the greater is the advantage of it. The correlation of circulation industry is usually expressed by the proportion of the circulation industry to GDP. The greater is the proportion of the circulation industry to GDP, the greater is the influence of the circulation industry on other industries.

The innovation potential of the circulation industry is the innovation capacity of the circulation industry. The future development of the circulation industry depends on its level of innovation potential. The innovation potential of the circulation industry is reflected in the systematization level of the circulation industry and its capacity of innovation in the use of modernization methods. For example, the proportional relation of chain management to the entire retail operation reflects the level of operation using modern organization in the circulation industry.

The “explicit potential” and “implicit potential” together constitute the “complex potential”, the measure of which must be carried out in the conjugate complex space, namely:

$$|P| = \sqrt{(X + iQ)(X - iQ)} = \sqrt{X^2 + Q^2}$$

In the formula, $|P|$ is “complex potential”, meaning the total information potential produced by the coupling of the “explicit potential” and “implicit potential” in the circulation industry. X is “explicit potential”, which represents the explicit ability and quality that is visible, tangible, and measurable of the circulation industry. It consists of the three-dimensional components: “circulation industry scale, circulation industry technology, and circulation industry benefits”. $\pm iQ$ is the “implicit potential”, which represents the implicit ability and quality that is invisible and intangible of the circulation industry. It consists of the three-dimensional components: “circulation industry institution, circulation industry correlation, and circulation industry innovation”. It can be seen from the above formula that the “explicit potential” and “implicit potential” of the circulation industry are a set of symmetrical relationships. At the same time, since $+iQ$ and $-iQ$ are symmetrical, the “explicit potential” and “implicit potential” must also be symmetrical. At this time, the complex potential $|P|$ is the largest, which satisfies the basic characteristics of the conjugate complex potential. The greater the “complex potential” of the enterprise in circulation industry is, the stronger will its quality be, and the more obvious will the competitive advantage be. Therefore, to build a competitive advantage in the circulation industry is to use the method of symmetry to create “explicit potential” and “implicit potential”.

IV. CONSTRUCTION OF EVALUATION INDEX SYSTEM FOR THE INFORMATION POTENTIAL IN REGIONAL CIRCULATION INDUSTRY

This paper will follow the design principles of objectivity, systematicness and comprehensiveness, according to the elements included in the explicit potential and implicit potential in the circulation industry information potential, so as to establish a set of evaluation index system for information potential in circulation industry that is practical, objective and effective. The factor analysis was used to objectively evaluate the circulation information potential of 31 provinces and municipalities in China. The data were all derived from the data of China Statistical Yearbook 2017.

According to the content contained in the information potential in circulation industry, the indicators of the

information potential in regional circulation industry can be set in six aspects. See “Table II” for details.

TABLE II. INDICATORS OF THE INFORMATION POTENTIAL IN REGIONAL CIRCULATION INDUSTRY

Feature	First-level indicators	Number	Secondary indicators
Explicit potential	Circulation scale potential	X1	Added value in circulation industry
		X2	Sales revenue in circulation industry
		X3	Average balance of fixed assets in circulation industry
	Circulation technology potential	X4	Number of mobile internet users
		X5	Number of Internet port access
	Circulation benefit potential	X6	Profit-taxation rate of circulation industry
		X7	Labor productivity of circulating industry
		X8	Capital productivity of circulation industry
Implicit potential	Circulation institution potential	X9	The area of the circulation market of commodities above 100 million Yuan
		X10	Market openness
		X11	Highway mileage
		X12	Annual freight volume
	Circulation correlation potential	X13	Proportion of circulation industry to the share of GDP
		X14	The proportion of the number of employees in the circulation industry to number of employees in the whole society
		X15	proportion of Fixed assets investment in circulation industry to the investment of the whole society
	Circulation innovation potential	X16	catenation degree in Circulation industry
		X17	online sales of Circulation industry

A. Circulation Scale Potential

To evaluate the scale potential of the circulation industry, three indicators has been selected, namely, the added value of the circulation industry, the sales income of the circulation industry, and the average balance of fixed assets in the circulation industry. The added value of the circulation industry reflects the scale of the net output provided by the circulation industry for society; the sales income of the circulation industry reflects the overall operation scale of the circulation industry, usually expressed by the sales of the retail enterprises above designated size; the average balance of the fixed assets of the circulation industry reflects the scale of ongoing operations of existing assets in the circulation industry.

B. Circulation Technology Potential

The circulation technology potential mainly considers the ability of the circulation industry to use modern Internet technology. Based on the availability of data, the penetration rate of Internet in various regions and the number of Internet

port accesses are used as the main indicators for evaluating the ability of the circulation industry to apply the Internet.

C. Circulation Benefit Potential

The circulation benefit potential is mainly considered to be the benefits created by the circulation industry for the whole society. The profit-taxation rate of the circulation industry is an important evaluation index that reflects the profits created by the circulation industry for the industry itself and the tax revenue created for the society. The labor productivity and capital productivity of the circulation industry reflect the production efficiency of labor and capital of the circulation industry. They reflect the output efficiency of the circulation industry from the perspective of investment.

D. Circulation Institution Potential

The circulation institution potential reflects the impact of regional circulation development policies on circulation development. Simple comparison of the circulation system documents of each region is not statistically significant, so this paper uses four specific indicators to reflect the specific implementation of the circulation policy of a regional. That is, the area of circulation market of commodity worth more than 100 million Yuan, market openness, highway mileage, and annual freight volume. The larger the market area of commodity circulation above 100 million Yuan shows the greater support for the circulation development the region can provide and it can attract the entry of large-scale market; the degree of openness is indicated by the total investment of foreign-funded enterprises/the total investment in the region; Larger mileage and annual volume of freight traffic reflect the more attention of this region paid to the development of the circulation industry which will have more institutional advantages.

E. Circulation Correlation Potential

The circulation correlation potential reflects the impact of the circulation industry on other industries. The greater the proportion of the circulation industry is to GDP, the greater the impact of the circulation industry on other industries is. The greater the proportion of employees in the circulation industry to the total number of employees, the greater the impact of the circulation industry on other industries; the greater the proportion of fixed assets investment in the circulation industry, the greater the correlation between the circulation industry and other industries.

F. Circulation Innovation Potential

The innovation of the circulation industry can be examined from the proportion of chain management to all circulation enterprises. The greater the innovation of the circulation industry is, the better the modern circulation management methods can be used. In addition, the liquidity turnover rate of the circulation industry is also an important indicator for evaluating the innovation of the circulation industry. The higher the turnover rate of current assets reflects the stronger the innovation capacity of the circulation industry.

V. EMPIRICAL ANALYSIS OF REGIONAL CIRCULATION INFORMATION POTENTIAL

According to the evaluation index system of regional circulation industry information potential mentioned above, the situation of the circulation industry information potential of 31 provinces and cities in China has been empirically studied with the specific statistical data by use of SPSS software in factor analysis method. At the same time, cluster analysis of the development of the circulation industry in 31 provinces and municipalities in China and the comparison of the provinces and regions with similar information potential on the circulation industry have been conducted, thus a comprehensive evaluation of the information potential status in different regions of China can be made.

A. KMO and Bartlett Test for Statistical Data

Factor analysis is to find a few random variables that can synthesize all variables through studying the internal dependencies of the correlation coefficient matrix between multiple variables. These variables are not measurable and are usually called factors. Then the variables are grouped according to the size of the correlation, so that the correlation between the variables in the same group is large, and the correlation between the variables in the different groups is small. Finally, the total score is calculated based on the common factor score and its corresponding variance contribution rate.

According to the requirements of the factor analysis method, the data is first tested by KMO and Bartlett test (see in "Table III"), the purpose of which is to see if the data is suitable for factor analysis.

TABLE III. KMO AND BARTLETT TEST

KMO and Bartlett Test		
KMO sampling suitable measure.		.741
Bartlett test for sphericity	Approximate chi square	613.318
	Degree of freedom	136
	Significant	.000

After the test, the KMO index of the data is detected as $0.741 > 0.5$, indicating that the partial correlation of the data is strong. The data of the Bartlett spherical test is 613.318, and the degree of freedom is 136, which means that there are common factors in the matricial matrix, and between the variables there is a correlation so it is suitable for factor analysis.

B. Analysis of the Total Variance of the Synthetic Data Explaining Original Data

From analysis of the total variance of the synthetic data explaining original data, the eigenvalue, variance contribution rate and accumulation contribution rate calculated from the correlation coefficient matrix R, it can be found that the eigenvalues of the first four factors are all greater than 1, having a significant explanatory power. The cumulative contribution rate reached 87.37% (as shown in "Table IV"), so the first four factors were selected as

common factors, so that the information potential level of the

circulation industry in the region can be better described.

TABLE IV. EIGENVALUE AND CUMULATIVE CONTRIBUTION RATES OF COMMON FACTORS

Ingredient	Total	Percentage of initial eigenvalue variance	Accumulation %	Total	Percentage of Sum of squared rotated loadings variance	Accumulation %
1	8.471	49.828	49.828	7.767	45.689	45.689
2	2.692	15.836	65.664	2.542	14.951	60.640
3	1.608	9.457	75.121	1.772	10.424	71.064
4	1.011	5.947	81.068	1.701	10.004	81.068

C. Analysis of the Meaning of the Synthesized Factor

Factor load matrix can be obtained through calculating the correlation between the original index and the synthesized factor. But in the factor load matrix, the original variable contributes to all the factors, so it is not easy to determine to which of the original indicators a certain factor corresponds. Therefore, we need to make an orthogonal rotation of the factor load matrix with the largest variance. The squared value of each column or row in the rotated factor load matrix is polarized to 0 and 1 (as shown in “Table V”) so that the original index is concentrated on the load of a certain synthesized factor, forming a high load. And then the meaning of the comprehensive factor can be analyzed.

TABLE V. ROTATED FACTOR LOAD MATRIX

Rotated factor load matrix				
	Ingredient			
	1	2	3	4
X1	.920	.191	.168	.190
X2	.875	.337	.256	.060
X3	.862	.206	.093	.180
X4	.965	.003	.081	-.010
X5	.965	.017	.042	.048
X6	.098	.072	.854	.113
X7	-.003	.806	-.048	.299
X8	-.133	-.153	.144	-.839
X9	.839	.105	-.105	.144
X10	.677	.406	.489	-.076
X11	.590	-.487	-.398	-.008
X12	.849	-.270	-.049	.003
X13	.063	.063	.271	.844
X14	-.197	-.867	-.182	-.009
X15	-.506	.225	-.202	-.233
X16	.757	.390	.440	-.155
X17	.648	.475	.398	-.052

As can be seen from “Table V”, the common factor F1 has large loads on indicators X1, X2, X3, X4, X5, X9, X10, X11, X12, X16, and X17, which embody the circulation scale and the level of technological innovation. Therefore, it can be called scale and technological innovation factor; the common factor F2 has a large load on X7 and X14 which embody the circulation efficiency and the associated level, so it can be called the efficiency correlation factor; the common factor F3 has a large load on indicators X6, X10, which embody the level of circulation benefit and market openness, so it can be called the benefit and institutional factor. The

common factor F4 has a large load on X8 and X13, which embody the level of capital productivity and GDP of the circulation industry, therefore it can be called the capital factor.

D. Factor Score and Comprehensive Ranking

Calculate the comprehensive score of each region using variance contribution rate of each common factor as the weight.

$$\text{Overall ratings } F = 0.56 * \text{FAC1_1} + 0.18 * \text{FAC2_1} + 0.13 * \text{FAC3_1} + 0.13 \text{FAC4_1}$$

The results are in “Table VI”:

TABLE VI. TABLE OF OVERALL RATINGS OF EACH REGION

Region	Overall ratings	Ranking	Region	Overall ratings	Ranking
Guangdong	1.58	1	Inner Mongolia	-0.16	17
Jiangsu	1.32	2	Jiangxi	-0.27	18
Shandong	1.17	3	Shanxi	-0.28	19
Zhejiang	1.09	4	Shaanxi	-0.28	20
Shanghai	0.48	5	Heilongjiang	-0.29	21
Beijing	0.34	6	Jilin	-0.33	22
Henan	0.28	7	Yunnan	-0.33	23
Hubei	0.27	8	Guizhou	-0.34	24
Hebei	0.23	9	Guangxi	-0.41	25
Sichuan	0.18	10	Xinjiang	-0.42	26
Liaoning	0.11	11	Hainan	-0.52	27
Hunan	0.07	12	Gansu	-0.7	28
Fujian	-0.03	13	Ningxia	-0.8	29
Anhui	-0.03	14	Qinghai	-0.85	30
Tianjin	-0.06	15	Tibet	-0.91	31
Chongqing	-0.1	16			

E. Cluster Analysis

According to the basic principle of the cluster analysis, the information potential of the circulation industry in each region is classified (as can be seen in Table VII”).

TABLE VII. THE INFORMATION POTENTIAL OF THE CIRCULATION INDUSTRY IN EACH REGION

Information potential level	Region
First floor	Guangdong Jiangsu Shandong Zhejiang Shanghai Beijing
Second floor	Henan Hubei Hebei Sichuan Liaoning Hunan
Third floor	Fujian Anhui Tianjin Chongqing Inner Mongolia
Fourth floor	Jiangxi Shanxi Shaanxi Heilongjiang Jilin Yunnan Guizhou
Fifth floor	Guangxi Xinjiang Hainan Gansu Ningxia Qinghai Tibet

VI. COMPARISON OF THE INFORMATION POTENTIAL OF THE CIRCULATION INDUSTRY IN VARIOUS REGIONS

It can be seen from the above analysis that the eastern coastal areas are at the first floor of the information potential of circulation industry. It includes Guangdong, Jiangsu, Shandong, Zhejiang, Shanghai, and Beijing respectively. The main reason is that these regions generally have a high level of economic development, and their scale of circulation and circulation efficiency are among the highest in the country; they have relatively high level of circulation technology and circulation innovation capacity. Taking Guangdong as an example, F1 score of Guangdong is as high as 2.58 points, indicating that Guangdong's circulation scale, technical level and innovation capacity are very high; this can be related to Guangdong's long-term openness to the outside world, strong economic foundation, and strong applying ability of technical research and development. Jiangsu, Shandong and Zhejiang, as major economic provinces in the coastal areas, have relatively good circulation infrastructure, sound circulation system, and strong applying ability of modern technology and innovation ability of the circulation industry, and their E-commerce sales and Internet ports are among the highest in the country. For example, Zhejiang's F1 reached 1.31 points and F4 reached 1.86 points, indicating that Zhejiang's circulation scale and technological innovation ability are strong, and the market is very open; it is also true in its real life in that the unmanned supermarket first started from Hangzhou, Zhejiang. As the economic and political center of China, Shanghai and Beijing have a high starting point of circulation, obvious advantages in circulation technology and innovation, so it is natural to be in the first floor. Take Shanghai as an example, the common factor F3 is as high as 3.5478, which indicates that Shanghai has very open market and good circulation benefits.

The second and third floors are areas where the circulation industry information potential is at a medium level. Among the provinces, Henan, Hubei, Hebei, Sichuan, Liaoning, and Hunan are in the middle of the upper level. Especially in Henan, Hubei, the overall ratings reached 0.28 and 0.27 points respectively, close to the level of the first level. The main reason is that Henan and Hubei are located in the central part of China, with Zhengzhou and Wuhan being important transportation hubs in China, and the circulation infrastructure is in good condition. The scale and correlation of circulation are relatively high. The F1 of

Henan is as high as 0.90 points and F3 0.29 points, indicating that Henan has a large circulation scale, which is closely related to the geographical location of Henan in the central region. At the same time, Henan has taken advantage of its traffic location to improve its openness to the outside world, so the circulation information potential is at a relatively high level.

The circulation information potential of Fujian, Anhui, Tianjin, Chongqing and Inner Mongolia is down the middle of the ranking. Although Fujian is in the coastal area, Fujian's F1 score is -0.18 and F3 is -0.23, indicating that although Fujian is on the coast, the scale of circulation and technological innovation are still insufficient, and its openness needs to be further improved. This shows that Fujian must seize the advantages of its coastal location and further increase its openness. Otherwise, the advantages of along the coast cannot be effectively utilized. Chongqing's F2 is as high as 2.36 points and F4 1.39 points. It should be considered that it is already very good to have high circulation efficiency and circulating capital output like this in the southwest region. This may be related to Chongqing's status as a municipality, and its strategic positioning designated by the country of building Chongqing into the economic center and trade circulation center in the upper reaches of the Yangtze River. The economic center has a greater relationship with the strategic positioning of the trade and circulation center. However, its F1 is only 1.0 and F3 only -0.8, indicating that Chongqing's circulation scale and technological innovation capability need to be further promoted, and the degree of openness needs to be further improved.

There are 14 provinces on the 4th and 5th floors. These provinces are either in the western region or in the northeast region. The economic aggregates are small, with incomplete circulation infrastructure, generally low circulation modernization level, backward circulation technology level, and low circulation innovation ability. They are mainly Jiangxi, Shanxi, Shaanxi, Heilongjiang, Jilin, Yunnan, Guizhou, Guangxi, Xinjiang, Hainan, Gansu, Ningxia, Qinghai, Tibet and other provinces. Taking Guizhou as an example, its F1 score is only -0.59 points. F3 scored -0.82 points, indicating that Guizhou's circulation scale is relatively weak, technology and circulation innovation ability is poor, and it needs to be opened up more widely.

VII. CONCLUSION

This paper studies the information potential in the circulation industry. The information potential of the circulation industry consists of explicit potential and implicit potential. The explicit potential includes the scale potential of the circulation industry, the technical potential of the circulation industry and the benefit potential of the circulation industry; the implicit potential includes the institution potential of the circulation industry, the correlation potential and the innovation potential. Through empirical research, it is found that the information potential of the circulation industry in different regions of China is quite different. The circulation information in the western

and northeastern regions is relatively low in particular. Therefore, it is necessary to further increase investment in the circulation industrial facilities in the western and northeastern regions, improve the circulation technology level in these regions, further increase the level of opening up to these regions. These regions need to realize the innovation of the circulation industry as soon as possible and form higher circulation information potential.

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