An Analysis of Influencing Factors in Collaboration of the Three Industries in Sichuan Province, China

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Abstract

In the past few years, the Chinese government has promulgated in succession seven strategic emerging industries development plans, ten industrial development plans, Chengdu-Chongqing economic zone planning and the outline of the 12th five-year plan. The country has attached more and more importance on the mode of industrial development, the direction of development and path of development. The industries should not be developed rapidly, but should also be developed with health and collaboration. Industrial collaboration is a self requirement of industrial development in the future and is also a long-term target.

This article studies the collaborative development condition of the three industries in Sichuan Province under the above background. Through an analysis on the establishment of indicator system for evaluation on collaboration of the three industries, it is discovered that there are still a lot of problems that are urgent to be adjusted and improved in collaborative development of the three industries in Sichuan Province. Through the Principal Component Analysis, we find out the principal influencing factors for collaborative development of the three industries in Sichuan Province, which includes the three major influencing factors of relevant industries in construction and real estate, tourism industry and great industrial industry. Given the existing problems at present in collaboration of the three industries in Sichuan Province, this article proposes the five policy suggestions of accelerating adjustment of industrial structure, making full use of resource endowment to develop regional economy, boost healthy and orderly development of construction and real estate industry, encouraging rapid development of tourism industry, bringing in steady development of new types of strategic industries and carrying forward industrial transfer and supporting industrial cluster. The aim of these five policy suggestions is to promote collaborative development of the three industries in Sichuan Province, resolve the issue of 1+1>2 and 1+1+1>3, better facilitate industrial promotion in Sichuan Province and lay a foundation and provide conditions for fast and benign development of industries in Sichuan Province.

Keywords: Collaboration of the three industries, Factor analysis, Indicator system, Principal component analysis

1. Introduction

In the past few years, with rapid development of the national economy, the pace of adjustment of economic structure and optimization and upgrading becomes faster and when the country pursues economic development speed, it also attaches more importance to economic structure and economic development efficiency. The country has promulgated several development plans to develop the new types of strategic industries. Economic development plans in relevant function supporting regions are also being prepared and following up closely. As a national plan to develop Sichuan and Chongqing, Chengdu-Chongqing economic zone planning also emerges accordingly under such a background.

However, analysis of the current industrial structure and industrial collaboration in Sichuan Province is the basis and support for follow-up economic development. Study on the status quo of collaborative development of the three industries in Sichuan Province not only has theoretical significance, but also has realistic significance, and the study has materialized and quantified abstract collaboration and realized integration of multiple disciplines. At the same time, the study also has certain realistic significance in that it has well connected Chengdu-Chongqing economic zone planning and has offered reference for development and implementation of Chengdu-Chongqing economic zone planning. The study in this article helps to find out the primary influencing factors in collaboration of the three industries in Sichuan Province and offer a framework for other provinces to study the issue of collaboration of the three industries.

2. Literature Review

Scholars at home and abroad all have been involved in industrial collaboration. Among the foreign academics, the German Physicist Herman Haken was the first who concentrated on industrial collaboration. Haken (1971-1983) published successively "Introduction to Synergetics" and "Advanced Synergetics" with his students and initiated the pioneering work in study on industrial collaboration. Afterwards, study on synergetics became gradually a key research topic by more and more foreign academics. Chinese domestic scholars also have dedicated great enthusiasm in study on industrial collaboration. Among the existing studies, there are some that begin from the perspective of change of industrial structure. Among all the studies, the study by Liu Wei and Li Shaorong (2002) is relatively of great influence who mainly analyze the important role of the tertiary industry in collaboration of three industries. In addition, there are studies from the perspective of industrial organization (yang Jirui, 2003), from the perspective of industrial chain (Gong Qinlin, 2004) and from the perspective of regional space (An Husen, 2005) et al. Domestic scholars have achieved certain achievements in their studies on industrial collaboration. Nonetheless, a general survey at the current studies on collaboration of the three industries, it is found that there have been relatively a large number of qualitative studies and relatively a small number of quantitative studies. This article mainly employs the factor analysis method and principal component analysis to analyze existing problems and influencing factors in collaboration of the three industries in Sichuan province and enrich current studies on industrial collaboration. This has provided more research perspectives and methods for study of industrial collaboration.

3. Establishment of Indicator System and Source of Data

3.1 Principles to Establish Indicator System

Establishment of indicator system should follow the following five principles to make the indicators established more pertinent and more persuasive.

3.1.1 Principle of Comprehensiveness

We ought to select as many as indicators in establishment of the system of evaluation indicators in the hope of attempting to avoid loss of data and enabling any useful indicators to be brought in the indicator system.

3.1.2 Principle of Comparability

Most data about indicators come from different regions. Due to difference in the population base, economic indicators in different regions may differ greatly from each other. Therefore, it is necessary to calculate more frequently on the ratio of these economic indicators with the expectation of achieving comparability of indicators.

3.1.3 Principle of Objectivity

Selection of data is supposed to be more objective and with more operability, so as to try to reduce difficulties in collecting, sorting out and using the data.

3.1.4 Principle of Representativeness

There might be a lot of indicators for measuring collaboration of the three industries. However, in actual establishment of indicator system, it is out of the question to exhaust all indicators. Thus, selection of indicators has to be representative and can well measure and reflect the condition of collaborative development of the three industries.

3.1.5 Principle of Gradation

Under the goal of collaboration of the three industries, we further subdivide the overall indicator of economic development, indicator of collaboration between the three industries and indicator of collaboration within each of the three industries, so as to be distinct and clear.

3.2 Selection of Indicators

In this system, in order to better make evaluation on collaboration of the three industries, this article mainly establishes the indictor system from the five aspects of total economic aggregate indicator, indicator of collaboration within the primary industry, indicator of collaboration within the secondary industry, indicator of collaboration within the tertiary industry and indicator of collaboration between the three industries.

<Insert Table 1 Here>

4. Analysis of Collaboration of the Three Industries and the Result

4.1 Analysis Method

Evaluation on collaboration of the three industries mainly adopts the method of factor analysis method. With the factor analysis method, this article gives a mark on collaboration of the three industries and gets the integrate score of factors in collaboration of the three industries according to the weight of factors. At the same time, the article gets the score of a single item with the factor analysis method. Based on the scores, we can find out the ranking of collaborative development of the three industries in Sichuan Province. Yet, considering the score of a single item, we can also discover differences of all autonomous prefectures in the process of industrial development.

4.2 Analysis Procedure

(1) Collecting and sorting out data about the second class indicators

(2) Nondimensionalization processing of data

(3) Calculating the integrate Score

4.3 Analysis Result of Collaboration of the Three Industries

(1) Collecting of Data

Collecting of data employed in this article mainly refers to the "Sichuan Statistical Yearbook in 2010" and statistical bulletin of all autonomous prefectures in Sichuan Province in 2009. In order to obtain relevant indicators, we might process and total up relevant data.

(2) Modeling

According to the principal component analysis and all known conditions, we set up the following model:

$$X = AF + a_{ij}\varepsilon \tag{1}$$

Where, $X = (X_1 \cdots X_P)$ stands for P original variables, and F stands for m public factor variables, $m \le P$; A stands for the factor loading matrix of $P \times m$; a_{ij} stands for the correlation coefficient of the i th original variable and the j th public factor variable. The larger the value of a_{ij}, the stronger the public variable F_j and the original variable X. ε stands for the special factor, which represents the part of the original variable that can't be explained by the public factor variable and which equals to the residual part in the multiple regression analysis (Note 1).

Calculating through SPSS, we get the total variance explained:

<Insert Table 2 Here>

We take the variance contribution of the principal factor as the weight and substitute it into the model:

$$Y = 61.594\%F_1 + 14.446\%F_2 + 7.547\%F_3 + 4.259\%F_4 + 3.587\%F_5 \tag{2}$$

Then, we substitute the score of factors into the model and get the integrate score of factors, as is shown in the following Table:

<Insert Table 3 Here>

4.4 Summary of Problems Existing in Collaboration of the Three Industries in Sichuan Province

(1) Considering the integrate score, the integrate score of factors in Chengdu, Deyang, Mianyang, Yibin, Leshan and Nanchong has a high ranking, whereas the integrate score of the three autonomous prefectures of Ngawa Tibetan and Qiang Autonomous Prefecture, Bazhong and Kardze Tibetan Autonomous Prefecture has a low ranking.

(2) Considering the total economic aggregate, from the scores of a single factor, we can find that the overall economic strength in Chengdu, Mianyang, Deyang & Nanchong is powerful, whereas the total local economic aggregate in such national minorities as Ngawa Tibetan and Qiang Autonomous Prefecture and Kardze Tibetan Autonomous Prefecture is relatively fragile.

(3) Considering collaboration within the primary industry, good work has been done in Nanchong and Ziyang, whereas Zigong, Ya'an and Panzhihua are still open for further improvement.

(4) Considering collaboration within the second industry, Panzhihua and Deyang are developed in a more collaborative way, whereas Bazhong, Ngawa Tibetan and Qiang Autonomous Prefecture and Kardze Tibetan Autonomous Prefecture have a relatively worse situation.

(5) Considering collaboration within the tertiary industry, the tertiary industry in Chengdu and Zigong has taken the leading role, whereas development speed in Panzhihua and Meishan is relatively slow.

5. An Analysis of Influencing Factors in Collaborative Development of the Three Industries in Sichuan Province

There exist quite a lot of problems in collaborative development of the three industries in Sichuan Province, with low degree of collaboration and obvious regional differences. What are the reasons for existence of these problems and what are the influencing factors? These are major issues to be resolved in this article. Through the indicator system that has been established in Section 4 and by applying the principal component analysis and analysis of relevant factors, we find out the major factors that affect collaboration of the three industries in Sichuan Province and provide evidence on this basis for proposing policies and suggestions in the next section.

5.1 Employment of Analysis Method

There are various categories for analysis methods of influencing factors, such as, econometrics model method, grey correlation analysis method and fuzzy mathematical analysis. The econometrics model method consumes degree of freedom and has great difficulty in collecting and sorting data, while the calculation process of grey correlation analysis method is also complicated. The fuzzy mathematical analysis method is suitable for fuzzy analysis and is mainly used for simple, qualitative and abstract analysis. By contrast, the principal component analysis is easy to handle, able to make an analysis of multiple indicators and extract major influencing factors and propose policies and suggestions according to principal factors.

5.2 Principal Component Analysis and Correlation Analysis of Influencing Factors

The data mainly come from the statistical bulletin and statistical yearbook of all cities and autonomous prefectures in Sichuan Province in 2009 and some data have been processed accordingly.

5.3 Result of Principal Component Analysis and Analysis of Reasons

5.3.1 Result of Principal Component Analysis

We employ SPSS analysis software to make the principal component analysis and correlation analysis and get the following result.

<Insert Table 4 Here>

From the above table, it can be seen that both in the case of initial variance contribution and in the case of rotated variance contribution, the cumulative variance contribution rate of the three factors all achieves 83.587%, which can almost explain a large majority of influencing factors. The eigenvalue of the first factor is 18.423, with a variance contribution rate of 55.827%; the eigenvalue of the second factor is 6.172, with a variance contribution rate of 18.703%; the eigenvalue of the third factor is 2.989, with a variance contribution rate of 9.057%. Hence, we can extract the three principal factors to analyze problems in collaboration of the three industries in Sichuan Province.

<Insert Table 5 Here>

The first factor mainly explains these fifteen variables, which represents the relevant industries of construction and real estate or upstream and downstream industries in construction and real estate. This factor has great influences on

collaboration of the three industries and is the principal influencing factor in collaboration of the three industries in Sichuan Province.

The second factor mainly explains these twelve variables, which represents the tourism industry. The effect of tourism industry on collaborative interaction of the three industries can not be underestimated.

The third factor mainly explains these six variables, which represents large-scale industries or industries that are closely connected with the industry.

5.3.2 Analysis of Reasons

The reason why relevant industries of construction and real estate are the major influencing factors for collaboration of the three industries in Sichuan Province is listed as follows:

(1) Construction and real estate is the major income source for local financial revenue.

(2) There are a great number of upstream and downstream industries that are correlated with construction and real estate industry which have great influences.

(3) The publicity effect of tourism industry is obvious in that it can stimulate regional investment.

(4) The industrial chain of upstream and downstream industries of tourism is long and has great ability to drive development of relevant industries.

(5) The category covered by industry is extensive and has a long industrial chain.

(6) Industrial development is in a transition period and re-positioning of industrial development will bring more influences on collaborative development of the three industries in the future.

6. Policies and Suggestions

6.1 To Speed up Adjustment of Industrial Structure and Make Full Use of Resource Endowment to Develop Regional Economy

We ought to make full use of differences of resource endowment in all regions of Sichuan Province and alternatively develop labor intensive industries, capital intensive industries and technology intensive industries in some regions. We may take advantages of local resource endowment with the help of relevant preferential policies, attract more investors and entrepreneurs to focus on and participate in regional economic development, strengthen confidence and cohesive force of regional economic development, accelerate economic development, improve the overall level of industrial collaboration and better promote collaboration of the three industries in Sichuan Province.

6.2 To Boost Healthy and Orderly Development of Construction and Real Estate Industry

We need to do a good job in the following four aspects in order to standardize development of construction and real estate industry and guarantee healthy and orderly development of real estate industry.

Firstly, it is necessary to clarify the development chaos of construction and real estate industry at present.

Secondly, it is necessary to diminish dependence of local government on land revenue.

Thirdly, it is necessary to carry out a plan ahead of schedule for development of construction and real estate industry.

Fourthly, it is necessary to make a plan about usage and approval of funds in construction and real estate industry.

6.3 To Encourage Rapid Development of Tourism Industry

We need to do a good job in the following three aspects to encourage development of tourism industry.

Firstly, we need to attach importance to development of tourism industry and enhance the influencing power of tourism industry.

Secondly, we need to improve supporting measures for development of tourism industry and improve the service level of tourism.

Thirdly, we need to expand the coverage scope of tourism industry and develop more tourism projects.

6.4 To Bring in New Types of Strategic Industries for Steady Development

The new types of strategic industries have important strategic position in collaborative development of the three industries at a high level. Thus, we need to do a good job in the following two aspects.

On one hand, it is important to attach great importance to the historical position of the new types of strategic industries and recognize the importance of developing new types of strategic industries.

On the other hand, it is important for Sichuan Province to promulgate relevant policies and measures to guarantee development of new types of strategic industries.

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Note

Note 1. Yan, Gang, Xiong, Na & Zhu, Xubin. (2008). Performance Assessment of China's Leading Listed Agricultural Companies by Factor Analysis. *Journal of Jiangxi Agricultural University* (Social Sciences Edition), (9).

Table 1. Indicator system for evaluation on collaborative development of the three industries in Sichuan Province

First class indicator	Second class indicator	Explanation
total economic aggregate indicator	GDP	
	Investment amount of fixed capital	
	Local financial revenue	
	Rural per capita annual net income	
	Urban per capita disposable income	
	Local Financial Expenditure	
indicator of collaboration within the primary industry,	Output value of the primary industry	
	Ratio of plantation	
	Ratio of animal husbandry & fishery	Ratio of totaling of the output value of forestry and fishery
	Ratio of agricultural service	
	Fixed investment of the primary industry	
	Total power of agricultural machinery	
	rural power consumption	
indicator of collaboration within the secondary industry	Output value of the secondary industry	
	Industrial value added	
	Total output value of construction industry	
indicator of collaboration within the tertiary industry	Investment of real estate	
	Amount of sales in commodity housing	
	Finance and insurance	Totaling of bank loan and deposit and premium income and expense
	Traffic Transportation, warehousing and posts and telecommunications	
	Total appropriation expenditure of scientific and technological activities	
	Income of tourism	
	Income of hotels and catering	
	Income of wholesale and retail	Totaling of wholesale and retail
indicator of collaboration between the three industries	Ratio of the primary industry	
	Ratio of the secondary industry	
	Ratio of the tertiary industry	
	Contribution ratio of the primary industry to GDP	
	Contribution ratio of the secondary industry to GDP	
	Contribution ratio of the tertiary industry to GDP	
	Ratio of employment of the primary industry	
	Ratio of employment of the secondary industry	
	Ratio of employment of the tertiary industry	

Table 2. Variance contribution

	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	20.326	61.594	61.594	18.759	56.845	56.845
2	4.767	14.446	76.040	5.265	15.953	72.798
3	2.490	7.547	83.587	2.220	6.727	79.525
4	1.405	4.259	87.845	2.017	6.113	85.637
5	1.184	3.587	91.432	1.912	5.795	91.432

Extraction Method: Principal Component Analysis.

Table 3. Integrate score of factors in all regions in Sichuan Province and the ranking of the score

Name of place	Integrate score	Ranking of integrate score
Chengdu	2.673384	1
Deyang	0.278951	2
Mianyang	0.272916	3
Yibin	0.204804	4
Leshan	0.069118	5
Nanchong	0.012098	6
Dazhou	-0.02474	7
Luzhou	-0.05361	8
Ziyang	-0.06098	9
Meishan	-0.06538	10
Neijiang	-0.09523	11
Zigong	-0.09882	12
Panzhihua	-0.13728	13
Liangshan Yi Autonomous Prefecture	-0.15457	14
Guang'an	-0.16405	15
Suining	-0.18892	16
Ya'an	-0.27477	17
Guangyuan	-0.28639	18
Ngawa Tibetan and Qiang Autonomous Prefecture	-0.34082	19
Bazhong	-0.35414	20
Kardze Tibetan Autonomous Prefecture	-0.46142	21

Table 4. Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	20.326	61.594	61.594	20.326	61.594	61.594	18.423	55.827	55.827
2	4.767	14.446	76.040	4.767	14.446	76.040	6.172	18.703	74.530
3	2.490	7.547	83.587	2.490	7.547	83.587	2.989	9.057	83.587
4	1.405	4.259	87.845						
5	1.184	3.587	91.432						
6	.786	2.382	93.814						
7	.629	1.907	95.721						
8	.328	.993	96.714						
9	.299	.907	97.620						
10	.207	.626	98.247						
11	.151	.457	98.703						
12	.118	.357	99.060						
13	.104	.314	99.374						
14	.092	.280	99.654						
15	.050	.151	99.805						
16	.033	.100	99.905						
17	.018	.053	99.958						
18	.007	.020	99.978						
19	.004	.013	99.991						
20	.003	.009	100.000						
21	8.46E-016	2.56E-015	100.000						
22	5.84E-016	1.77E-015	100.000						
23	4.78E-016	1.45E-015	100.000						
24	3.60E-016	1.09E-015	100.000						
25	1.29E-016	3.90E-016	100.000						
26	-5.67E-017	-1.72E-016	100.000						
27	-1.73E-016	-5.25E-016	100.000						
28	-2.50E-016	-7.58E-016	100.000						
29	-4.14E-016	-1.25E-015	100.000						
30	-5.39E-016	-1.63E-015	100.000						
31	-6.97E-016	-2.11E-015	100.000						
32	-8.72E-016	-2.64E-015	100.000						
33	-1.62E-015	-4.92E-015	100.000						

Extraction Method: Principal Component Analysis.

Table 5. Rotated component matrix(a)

	Component		
	1	2	3
GDP	.973	.223	-.004
Investment amount of fixed capital	.968	.164	.113
Local financial revenue	.958	.232	.119
Rural per capita annual net income	.538	.658	-.444
Urban per capita disposable income	.519	.674	.244
Local Financial Expenditure	.978	.110	.067
Output value of the primary industry	-.119	.788	-.479
Ratio of plantation	.295	.574	-.203
Ratio of animal husbandry & fishery	-.163	-.590	-.145
Ratio of agricultural service	.011	.671	.140
Appreciation of town and township enterprise	.920	.309	-.146
Total power of agricultural machinery	.413	.113	.807
rural power consumption	.136	.276	.888
Output value of the secondary industry	.947	.312	-.014
Industrial value added	-.047	.367	.921
Total output value of construction industry	.966	.190	.097
Investment of real estate	.965	.174	.134
Amount of sales in commodity housing	.967	.172	.134
Finance and insurance	.970	.195	.108
Traffic Transportation, warehousing and posts and telecommunications	.932	.276	-.041
Total appropriation expenditure of scientific and technological activities	.025	.269	.888
Income of tourism	.228	.939	.172
Income of hotels and catering	.206	.976	.014
Income of wholesale and retail	.178	.981	.028
Ratio of the primary industry	-.285	-.890	-.227
Ratio of the secondary industry	-.128	.935	-.174
Ratio of the tertiary industry	.629	-.284	.624
Contribution ratio of the primary industry to GDP	-.019	.039	-.335
Contribution ratio of the secondary industry to GDP	-.012	.681	-.465
Contribution ratio of the tertiary industry to GDP	.789	-.391	0.080
Ratio of employment of the primary industry	.166	-.718	-0.457
Ratio of employment of the secondary industry	.258	0.379	.655
Ratio of employment of the tertiary industry	.606	.542	.251

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.