

On the Selection of the Leading Industry of Agricultural Products Processing in Anhui Province of China

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Abstract Based on the leading industry selection theory, an index system has been built in this article on how to choose leading industry according to the characteristics of Anhui agricultural products processing. Also the AHP method is used to empirically analyze leading industry selection of Anhui's agricultural products processing industry in the article. The author argues that Anhui province of China should choose those industries, which use grain, oil, cotton, bamboo, wood as raw materials, as the leading industries. Furthermore, the industry of textiles, garments and wood products processing industry are also can be the leading industry. As for this, the most important thing to do is to accelerate the development of agricultural products processing industry in Anhui Province of China sequentially.

Key words Agricultural product processing; Selection of leading industry; AHP

1 The Significance of Selecting Leading Industry in Anhui's Agricultural Products Processing Industry

Anhui Province is located in central China. It has a population of 67 million, which includes 40 million are farmers. There are 6561100 hectares cultivated lands. All these let Anhui be famous for a traditional agricultural province. Since the reform and opening, the agriculture and rural economy of Anhui have developed rapidly. By the end of 2009, the GDP of Anhui province reached 887.4 billion Yuan, of which 181.4 billion Yuan was attributed to agriculture. Anhui's agricultural product processing industry involves 12 industries, namely food processing, textiles, beverage manufacturing, tobacco processing, rubber products, food manufacturing, paper and paper products, wood and bamboo processing, leather and furs processing, garment manufacturing, printing and furniture manufacturing. However, Anhui agricultural product processing industry (AAPPI) is still in a relatively backward position. The ratio of AAPPI's output and agricultural output is a very important index which shows the agricultural product processing industry's development of a nation or an area. This ratio is 1.54 in Anhui, 2.99 in China, about 3.5 in the developed countries in 2008. Therefore, it is important to accelerate the development of agricultural processing industries in order to raise the farmer's income, promote the development of rural economy and other social undertakings. Due to scarce resources and entrepreneurship associated with the unbalanced growth, countries, especially the developing countries, should concentrate their limited capital resources on the development of some important industries, and thus gradually increase investment in other industries as to promote the overall development of the whole industry. The government should take the initiative to increase the imbalance of supply and demand, invest more capital on the key industry and promote the development of related industries. Furthermore it can also promote the development of industry as a whole. Therefore, if the government wants to accelerate the development of agricultural processing industries in Anhui Province, the first thing which should be done is to choose some right leading industries on agricultural products processing in conjunction with Anhui's actual situation, And then providing some guidance and support in capital, technology, policy and so on.

2 Factors Affecting the Selection of Leading Industry and Indicator System

2.1 Review on the selection of leading industry

In 1960s, Austrian-American economist Rostow studied the differences of economic development efficiency among various countries and found that there exists a dominant sector in the process of economic growth. He argued that there still exists some sectors which can promote other sectors' development in each stage, even in an advanced stage of development. Rostow called these sectors as the leading sectors. He also pointed out that the economic development was due to the rapid expanding of the leading sectors. The expanding role is realized by the spread effect of the leading sector including the backward effect, the lateral effect and the proceeding effect. In his book "Strategy of Economic Development", American famous economist Albert Hirschman also studied the Leading industry and proposed the Correlation Effect^[2]. In 1950s, Japanese economists Shinohara proposed

the selection criteria for leading industry for the first time in his book "On the industrial structure," that is, the benchmark of income elasticity of demand and productivity upward. Thereafter, environmental benchmark and labor content benchmark were proposed^[3]. In the latest more than 10 years Chinese scholars also studied the problems of the choice of leading industries. They proposed the benchmark of comparative advantage, factor endowment differences based on David Ricardo's theory of comparative advantage and Heckscher Ohlin's theory of factor endowment differences. In the context of China's industrial policies adjustment and the worldwide economic and social development, the benchmark of sustainable development, benefit analysis, employment and technological progress are also proposed.

2.2 The construction of selection index system on leading agricultural products processing industry in Anhui province

Considering the close relationship between agriculture industry and processing of agricultural products, the author selected and modified the selection index system of leading industry proposed by Chinese and overseas scholars, and added new material natural resources index. In accordance with objectivity, feasibility, comparability, regional principle, selection factors the leading agricultural products processing industry in Anhui are layered at different levels about five benchmarks, eight indicators. As is shown in Figure 1:

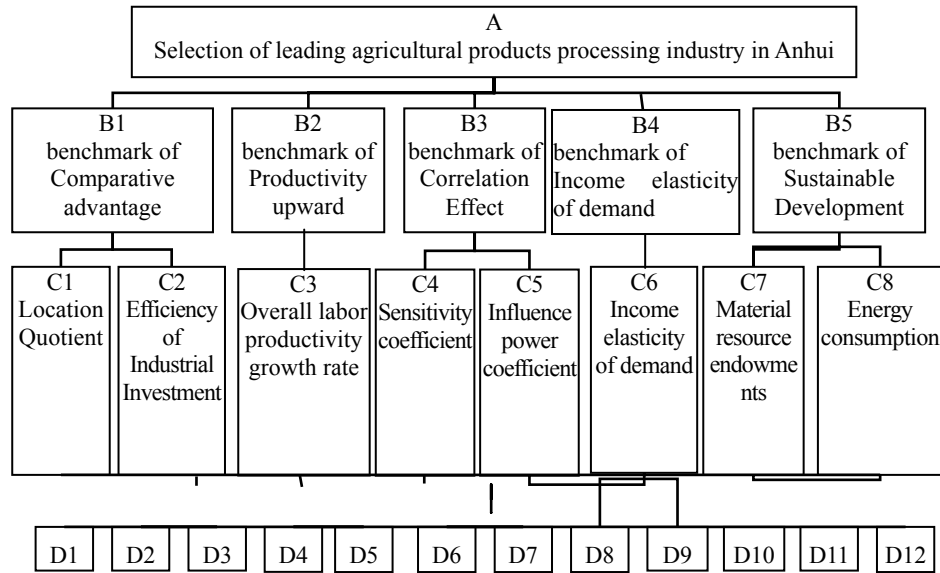


Figure 1 Selection of Leading Agricultural Products Processing Industry in Anhui

In figure 1, D1 represents the agro-food processing industry, D2 represents the food industry, D3 represents the beverage manufacturing industry, D4 represents the tobacco industry, D5 represents the textile industry, D6 represent that textile garments, shoes and caps, D7 represents leather, fur and feather (down) manufacturing industry, D8 represents rattan palm wood and straw industry, D9 represents furniture manufacturing, D10 that paper making industry, D11 represents printing and reproduction of recording media, D12 represents Rubber Industry.

(1) benchmark of comparative advantage (B1)

C1: Location quotient, namely the regional concentrated degree of production, means the ratio of some region's A sector's output value(or total product, number of employment fixed asserts, etc.) and some region's output value divided by the ratio of the whole country's A sector's output value and the whole country's output value.

$$\text{Location quotient (LQ)} = \frac{\text{some region's A sector's output} / \text{some region's output value}}{\text{the whole country's A sector's output} / \text{the whole country's output}}$$

LQ>1, the sector's specialization in the region is above the national average level

LQ=1, the sector's specialization in the region is equal to the national average level

LQ<1, the sector's specialization in the region is lower than the national average level

C2: Efficiency of Industrial Investment, as Industry Investment profit and tax rate, on one hand, business investment profit is the most primitive force of enterprise development, on the other hand, the regional government revenue is the source and basis of public finance, the focus of regional government policy support and protection.

$$\text{Industry Investment profit and tax rate} = \frac{\text{An industry total profits and taxes}}{\text{An industry total investment net assets}} \times 100\%$$

(2) benchmark of growth rate of Productivity (B2)

(3)C3: Overall labor productivity growth rate is the output input ratio. Input factors include capital, technology, labor, management. It represents the Characteristic of Rapid technological progress in leading industries and technology-intensive elements. If the productivity growth rate of an industry is rapid its production costs are decreasing fast. The advantage of this industry in the economy as a whole is getting more and more obvious.

$$\text{Overall labor productivity growth rate} = \left(\frac{\text{Labor productivity in Reporting year}}{\text{Labor productivity in base year}} - 1 \right) \times 100\% \text{ [4]}$$

(4) benchmark of Correlation Effect (B3)

It is mainly used to calculate forward linkages(eg. Responsive degree coefficient) and backward linkages(eg. Influential power coefficient) based on input-output table and to analyze selecting leading industries . That is,

C4: responsive degree coefficient =mean of a line's coefficients of an industry in Leontief inverse matrix / mean of all industries' line's coefficient's mean in Leontief inverse matrix

C5: influential power coefficient = mean of a column's coefficients of an industry in Leontief inverse matrix / mean of all industries' column's coefficient's mean in Leontief inverse matrix

If responsive degree coefficient is greater than 1, it reflects that certain industry sectors' response level higher than the average level of social. Greater response coefficient represents greater demand for the industry in the process of economic development.

If influence coefficient is greater than 1, it reflects that the impact of an industry is higher than the average impact of social. Greater influence coefficients represent stronger degree of backward linkages, which promote economic development and other industries more strongly.

The industry with greater influence coefficient response coefficient is an important industry in the national economy development, or is the Leading industry.

During a given period, if the industry's influence coefficients and response coefficient in a country or region are increasing, this will show that the industry's width and depth of backward and forward linkages are to be strengthened. Also the industry's position and role are upward, therefore it may become the leading industry in the new coming period.

(5) C6: Income elasticity of demand indicates the percentage change in quantity demanded divided by percentage change in national income. We can use the of coefficient the income elasticity of demand (E) to measure the market demand:

$$Ed = \frac{\Delta Q / Q}{\Delta r / r}$$

ΔQ represents incremental social quantity demanded in a given period; Q represents the quantity demanded of society; $\Delta r/r$ —percentage change in national income. Industries' products with larger income elasticity of demand (eg. $Ed > 1$) will create greater market demand as an increase in income level. Therefore, these products can obtained greater power from society, occupy larger market share, and promote the development of related industries.

(6) Benchmark of Sustainable Development (B5)

C7: Material resource endowments, agricultural products processing's main target are primary products of planting, breeding production. Natural conditions are important restraining factor of Agriculture. As the most basic features of agricultural production is the process of economic reproduction consistent with the natural reproduction process, thus light, heat, water, soil, topography and other natural factors affecting plants and animals have become important resource condition of

agricultural production and development. Its temporal and spatial distribution and composition directly impact agricultural production distribution and inter-regional division of labor in agricultural production. As technology continues to progress, it has been greatly reduced than before that natural resources' constraint effect to the formation of regional agricultural products 'comparative advantage and further competitive advantage. But natural resources is still the basis of the distribution of traditional agriculture, often plays a very important influence in agricultural products processing industry. Based on these considerations, it can be regarded that the type and quantity of raw materials of agricultural products to provided regional agricultural is constrained by natural conditions, so Material resource endowments is important screening factor for selecting leading industries of agricultural products.

$$\text{Material resource endowment} = \frac{\text{Regional raw material output of an agriculture product processing}}{\text{National raw material output of an agriculture product processing}} \cdot 100\%$$

C8: energy consumption

$$\text{Hundred RMB output energy consumption} = \frac{\text{Regional energy consumption of an agriculture product processing}}{\text{Regional total value of an agriculture product processing}} \cdot 100\%$$

3 Selecting Leading Industry of Agricultural Products Processing in Anhui of China Based on the Analytic Hierarchy Process

Table 1 the relevant economic indicators

Industry Classification	C1	C2	C3	C4	C5	C6	C7	C8
D1	0.97	37.42%	37.9%	3.69	6.478	3.145	0.0512	-0.000804
D2	0.82	20.83%	28.82%	1.83	4.421	-0.01	0.0396	-0.00793
D3	0.97	51.06%	15.64%	0.95	1.715	1.245	0.0261	-0.0024
D4	1.32	107.99%	11.77%	0.41	0.728	0.975	0.0089	-0.000497
D5	0.46	25.13%	21.91%	3.38	5.697	1.43	0.0441	-0.00302
D6	0.38	39.61%	12.78%	0.76	1.134	2.92	0.0492	-0.00084
D7	0.49	47.88%	53.37%	0.61	1.166	1.625	0.031	-0.000816
D8	1.04	38.67%	26.81%	0.98	1.022	2.205	0.05	-0.00305
D9	0.26	39.59%	30.96%	0.46	1.097	2.565	0.05	-0.00078
D10	0.51	28.9%	14.24%	1.94	1.091	1.635	0.05	-0.01012
D11	0.85	26.87%	48.66%	0.69	1.156	2.045	0.05	-0.001447
D12	0.96	28.7%	13.65%	0.78	1.155	1.07	0	-0.002985

3.1 Analytical hierarchy process evaluation model

Analytical Hierarchy Process is a qualitative and quantitative method of decision analysis proposed by American operational research expert A.L. Saaty in 1970s. It is a modeling, quantitative process of policy makers' thought process as making decision in complex system. By this method, decision-makers can come to different weights and provide the basis for selecting the best programs through decomposing a complex problem into several levels and factors, comparisons and calculations between various factors.

The basic steps of AHP:

- (1) To establish a hierarchical model
- (2) Pair wise comparison matrix structure
- (3) Calculate the weight vector and a consistency test
- (4) Calculate the right combination of vector and do mix consistency test

3.2 Empirical analysis

3.2.1 The actual index about Anhui agricultural products processing industry related statistics

According to "China Statistical Yearbook" (2007-2009), "Statistical Yearbook of Anhui Province" (2007-2009) calculated the relevant economic indicators are as follows Table 1.

3.2.2 Construction and calculation of comparison matrix

(1) Comparison scale: (Meaning of scale 1~9)

Table 2 Comparison scale

Scale	Two elements with the same importance of an attribute
1	Comparing two elements, one element is Somewhat more important than the other
3	Comparing two elements, one element is Obviously more important than the other
5	Comparing two elements, one element is much more important than the other
7	Comparing two elements, one element is extremely more important than the other
9	Expressing the need of compromise between the two standards
2,4,6,8	the anti-Comparison of the two elements
1/bij	

(2) According to figure 1、table1、table2, respectively construct comparison matrix **AB,BC** as follows:

① comparison matrix **AB**

$$A-B = \begin{bmatrix} 1 & 2 & 3 & 2 & 2 \\ 1/2 & 1 & 2 & 2 & 2 \\ 1/3 & 1/2 & 1 & 1/2 & 1 \\ 1/2 & 1/2 & 2 & 1 & 3 \\ 1/2 & 1/2 & 1 & 1/3 & 1 \end{bmatrix} \quad W_1 = (0.3410 \ 0.3409 \ 0.1066 \ 0.2004 \ 0.1111)^T$$

$CI = (\lambda_{max} - n) / (n - 1) = (5.1787 - 5) / (5 - 1) = 0.044675$, Then consistency index $RI = 1.12$ (as table1), Consistency ratio $CR = CI / RI = 0.0399 < 0.1$ 。

② comparison matrix **BC**

$$B_1-C = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix} \quad W_2 = (0.5 \ 0.5)^T \quad B_3-C = \begin{bmatrix} 1 & 1/2 \\ 2 & 1 \end{bmatrix} \quad W_3 = (0.3333 \ 0.6667)^T$$

$$B_5-C = \begin{bmatrix} 1 & 3 \\ 1/3 & 1 \end{bmatrix} \quad W_4 = (0.75 \ 0.25)^T$$

③ the index weights

With above data, final index weights can be got as following table:

Table 3 Final Index Weight

index	C1	C2	C3	C4	C5	C6	C7	C8
weight	0.1705	0.1705	0.2409	0.0355	0.0711	0.2044	0.0833	0.0278

④ calculating Sort results

The results after adjusting the relevant weight of indicators as the following table:

Table 4 The Results after Adjusting the Relevant Weight of Indicators

Industry Classification	C1	C2	C3	C4	C5	C6	C7	C8	Total
D1	0.16539	0.06380	0.09130	0.13100	0.46059	0.64284	0.00426	-0.00002	1.55916
D2	0.13981	0.03552	0.06943	0.06497	0.31433	-0.00204	0.00330	-0.00022	0.62510
D3	0.16539	0.08706	0.03768	0.03373	0.12194	0.25448	0.00217	-0.00007	0.70238
D4	0.22506	0.18412	0.02835	0.01456	0.05176	0.19929	0.00074	-0.00001	0.70387
D5	0.07843	0.04285	0.05278	0.11999	0.40506	0.29229	0.00367	-0.00008	0.99499
D6	0.06479	0.06754	0.03079	0.02698	0.08063	0.59685	0.00410	-0.00002	0.87166
D7	0.08355	0.08164	0.12857	0.02166	0.08290	0.33215	0.00258	-0.00002	0.73303
D8	0.17732	0.06593	0.06459	0.03479	0.07266	0.45070	0.00417	-0.00008	0.87008
D9	0.04433	0.06750	0.07458	0.01633	0.07800	0.52429	0.00417	-0.00002	0.80918
D10	0.08696	0.04927	0.03430	0.06887	0.07757	0.33419	0.00417	-0.00028	0.65505
D11	0.14493	0.04581	0.11722	0.02450	0.08219	0.41800	0.00417	-0.00004	0.83678
D12	0.16368	0.04893	0.03288	0.02769	0.08212	0.21871	0.00000	-0.00008	0.57393

From the above analysis results, it can be inferred that in Agricultural products processing industry in Anhui province, Agro-food processing industry ranked first, followed by the textile industry, textile, footwear and cap manufacturing, timber processing and straw products, printing and record medium reproduction, tobacco products, and paper, paper products industry, food manufacturing, rubber products ranked the last three. Anhui is one of the country's 13 major grain-producing provinces. According to 2006 statistics, grain, annual outputs of oil, cotton, fresh water product rank No. 6, No. 4 and No. 6 in the main 16 agricultural products. Anhui Province is also a large proportion of forestry provinces, belonging to one of the key Southern Collective Forest provinces of the country. The province's forest land 4,403,500 hectares, accounting for 31.7% of total land area, is close to arable land. With grain, oil, cotton, bamboo and wood as raw materials, agricultural product processing, textiles, garments and cap, wood and bamboo processing industry have wealthy source of raw material, but also traditional industries in Anhui Province. Firmly grasping the leading industries, adjusting policies, good planning, Concentration of capital, technology and management, and speeding up the development of these industries play an active and effective role in promoting the rural economy and social development in Anhui.

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