The Evaluation on the Capacity of Agriculture Logistics Service in Hubei Province Based on PCA and Cluster Analysis

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Abstract: The lag of agriculture logistics service capacity (ALSC) has become a restricted factor for the development of agriculture in Hubei Province of China. This paper analyzed the main impact factors of ALSC, and conducted a primary constituent analysis to compare the level of ALSC of Hubei with other provinces in central region of China, as well the level of ALSC of fifteen districts within Hubei Province. The findings show that the capacity of agricultural logistics services of Hubei Province was dominant in the central region, but obviously imbalanced between the various regions within.
Key words: Agricultural Logistics; agriculture logistics service capacity; PCA; Cluster Analysis

1 Introduction

Hubei Province is a traditional agricultural big province in China, but through the research of agricultural logistics Status quo, we discover that it's still at the extensive development stage. The traditional agricultural logistics is unable to satisfy consumer's diverse and specific demand. Promoting ALSC comprehensively is the best way to overcome contradictions between supply and demand. Promoting ALSC becomes one of the most important questions facing the agricultural further development. Most previous researches on the ALSC focus on the definition of the capabilities and the assessment method. Morash etc. (1996) divided logistics capacity into the demand guidance logistics capacity and supply guidance logistics capacity[1]; Lynch (2000) divided logistics capacity into handling capacity and value increment capacity[2]; Ma Shihua and Chen Xiyong (2004) thought that logistics capacity is composed by logistics essential factor capacity and logistics operation capacity [3]. About the evaluate methods of logistics capacity, Stanley etc. (1997) proposed a conceptual model of logistics capabilities, in which logistics capacity is evaluated based on four indicators of delivery capacity, service quality, cost and flexibility[4]; Wu Nianwei and Ru Yihong (2010) obtained from logistics' connotation, and selected 14 three-level indicators by introduction overlapping mechanism, and then evaluated logistics capacity by data envelopment analysis[5]. So far, there wasn't the widely approved evaluation indicators system and evaluating method about ALSC. This paper carried on some explorations in the aspect, in order to provide some reference for the later research on this domain.

2 Influential Factors of ALSC

ALSC is a complex and dynamic variety system. It constantly changes neither time nor space, as it is affected by many factors mainly from three aspects.[6]

2.1 Internal influential factors

Internal factors mainly include of the situation agricultural logistics supply and demand, the status of infrastructure constructed of agricultural logistics, own localization and target of agricultural logistic development, level of agricultural resources, personal quality of agricultural logistics, level of third-party agriculture logistics development, operation efficiency of agricultural logistics application system, informationization level of agricultural logistics.

2.2 External influential factors

They mainly includes the diversification of global logistic, the development level of agricultural logistic technology, construction of agricultural logistics laws and regulations domestic, the development planning of regional agricultural logistics, the logistic position and development policy of regional agricultural etc.

2.3 Adjective factors

Adjective factors: it is a factor to make influence on agricultural logistic services capacity through internal influence factor or external agency factor. It mainly has economical inertia of agricultural logistic development, economical profit and loss of the factors by optimizing agriculture logistic system,

This paper is supported by logistic development and research centre of main research base of human and scientific of Hubei Province (Project No.: 2010A05 and 2010Z01).

executing validity of regional agricultural logistics polices, etc.

In a word, ALSC is a complex and dynamic system. During the selection of indicators, we should consider the function mechanism of internal, external and adjective factors.

3 Evaluation of Hubei Province ALSC Base on PCA

3.1 The principle of contributing the assessment system

The contribution of the assessment system of ALSC should not only follow the rules of integrity, measurability, comparability and economy, but also be in line with the features of ALSC when designing. Thus, these principles should be additionally included when constructing the assessment system of ALSC:

(1) Layering. What the assessment index system of ALSC measures is the whole logistics capacity of an area, which is an extremely complex system. In order to keep the feasibility and effectiveness of the measure result, there is a necessity to make the entitle agriculture logistics system unfold layered in a certain logic. The specific manifestation is layered structure of the index system.

(2) Service base. Agriculture logistics activity is a kind of social services activity in essence. So in the process of constructing system of ALSC, we should follow the inherent features of agriculture logistics, especially the one of social service.

(3) Stressing the key point. We are supposed to consider different areas and the feature of agriculture logistics in different periods fully during the process of detailing the index system. Selecting representative headline indicators is compulsory when simplifying the index system in order to ensure the system's feasibility and effectiveness meanwhile.

3.2 Index system of ALSC and evaluation

(1) Evaluation model of ALSC

This paper builds the index system of ALSC in three dimensions: agricultural logistics bearing capacity, agricultural logistics competitive power, and agricultural logistics operation capcapacity.

Agricultural logistics bearing capacity is defined as the capacity which resources, ecological, infrastructure, jobs and so on have to support the agriculture logistics. This thesis mainly measures and evaluates the ALSC in five aspects: from A_{11} to A_{15} in table 1.

Agricultural logistics competitive capacity is defined as elements that can acquire and allocate resources, forming and keeping the advantage in agricultural logistics persistently. This thesis evaluates the agricultural logistics competitive power in five aspects: from A_{21} to A_{25} in table 1.

Agricultural logistics operation capcapacity evaluates the results of related activities in regional agricultural logistics, showing a kind of agricultural logistics capacity. The existing national logistics achievements statistics state the operation capcapacity in three aspects: from A_{31} to A_{33} in table 1.

Concluding from some references and following the principle of evaluation on ALSC, this paper chooses 13 indexes in three major categories to build index system of ALSC, details are shown in Table1:

Table 1 The Evaluating System of ALSC

	First-Level Target	Second-Level Target
ALSC	Bearing Capacity A_1	Road Mileage A_{11}
		The Level of Logistics Information A_{12}
		Agricultural Production Value A_{13}
		GDP A_{14}
		The Number of Employees in Logistics A_{15}
	Competitive Capacity A_2	Rate of Logistics Cost A_{21}
		Total Export-Import Volume of Agricultural Products A_{22}
		Investment Level of Agricultural Logistics A_{23}
		Quality of Logistics Talents A_{24}
		Increment Speed of Agricultural Logistics A_{25}
	Operation Capacity A_3	Freight Volume of Agricultural Products A_{31}
		Freight Quantity of Agricultural Products A_{32}
		Logistics Added Value of Agricultural Products A_{33}

(2) Evaluation method

We use the principal component analysis to get integrated principal component index which can judge the agricultural logistics capacity differences between Hubei and other provinces, through the evaluation method of agricultural logistics capacity. The data in the table 1 is from Hubei statistical

yearbook (2009) and Hubei provincial bureau of animal husbandry. Because of the dimensional differences in the 13 indexes, we use standardized treatment before principal component analysis. We input the standardized data into the software SPSS11.5, and use the factor analysis module to get two principal components whose cumulative is 78.273%. Through the principal component analysis, we calculate the level of ALSC of Hubei and other provinces (3)The agricultural logistics comparison between Hubei province and others in central China.

By the software SPSS11.5, we get 2 principal components, and acquire the layered score and comprehensive score of six provinces in central China. Results are shown in Table 2:

According to the table above, the ALSC of the six provinces in the Central region are ranked as below: Hubei, Henan, Hunan, Anhui, Jiangxi, and Shanxi. The service capacity of the Agricultural logistics in Hubei has a priority. As it shows, for Hubei, most of 13 indexes of the service capacity of the Agricultural logistics evaluation index from the specific situation are in a better position than the other five provinces. Only a few of the indexes are at a disadvantage, compared to some of the five other provinces. The disadvantage are mainly in the following aspects: the logistics cost rate is on the high side, logistics information is in a low level, the added value of agricultural logistics score is still low. Relatively speaking, the competition capacity of the agricultural logistics service has more obvious advantage, road mileage, investment of infrastructure, the quality of logistics talents occupy a competitive advantage in the six provinces of central China.

Table 2 ALSC of the six provinces in the Central region

Province	Factor	Number	Factor1	Number	Factor2	Number
Hubei	2.046376	1	0.921415	2	2.012153	1
Henan	1.116327	2	1.863728	1	0.248214	3
Hunan	0.213528	3	0.172416	3	0.872618	2
Anhui	-0.324174	4	-0.254131	4	-0.498234	5
Jiangxi	-1.228756	5	-1.02308	5	-1.758241	6
Shanxi	-1.823301	6	-1.68025	6	-0.87651	4

4 Evaluation of Regional ALSC in Hubei Base on Cluster Analysis

In order to reflect the level of ALSC in Hubei province well, this thesis a deep analysis on the level of ALSC in each regional of Hubei province, based on the agricultural logistics comparison in six province of central China, and details refer to Table 3:

Table 3 ALSC of Internal Region in Hubei

Number	area	Factor	Number	area	Factor
1	Wuhan	1.269427	9	Shiyan	-0.112657
2	Xiangfan	0.432641	10	Xianning	-0.176895
3	Yichang	0.362234	11	Ezhou	-0.249674
4	Huanggang	0.231521	12	Huangshi	-0.342780
5	Jingzhou	0.182341	13	Xiantao	-0.516337
6	Jingmen	0.125583	14	Qianjiang	-0.628164
7	Xiaogan	0.068132	15	Tianmen	-0.772593
8	Suizhou	-0.056476			

Aanalysis results in Table 3 indicated that the development of ALSC was unbalanced in Hubei Province. The ALSC of Wuhan was far ahead of other regions. Overall, it basically presented decreasing trend toward the surrounding area with the centre of Wuhan, Xiangfan and Yichang, which basically conformed to the Hubei status of the development level of economic and agriculture. Through primary constituent analysis of ALSC of internal area of Hubei by table 3, this paper divided Hubei Province into the following three levels according to the region ALSC by Cluster Analysis.

First-level: Wuhan, Xiangfan, Yichang

Second-level: Huanggang, Jingzhou, Jingmen, Xiaogan, Suizhou, Shiyan

Third-level: Xianning, Ezhou, Huangshi, Xiantao, Qianjiang, Tianmen

By the actuality analysis of comprehensive development level of agriculture logistics service capcapacity in Hubei province, we found that at present agriculture logistics service capcapacity in different areas in Hubei province is of unbalanced development objectively, and it can be divided into 3 levels. The analysis results of data showed that currently there are three first cores, namely Wuhan, Xiangfan and Yichang in agriculture logistics service system in Hubei province. Based on the core and edge theory, we take the three core areas as the center, the edge areas and core areas together constitute

the whole architecture of agriculture logistics service in Hubei province.

ALSC of the other interior regions in Hubei basic belong to a low level, except Wuhan, Although Xiangfan and Yichang are in the first level, they are still a little far from Wuhan. Therefore, what can truly comprehensively promote the ALSC of Hubei Province is just taking Wuhan as the center, Yichang and Xiangfan as two wings to promote each region's ALSC.

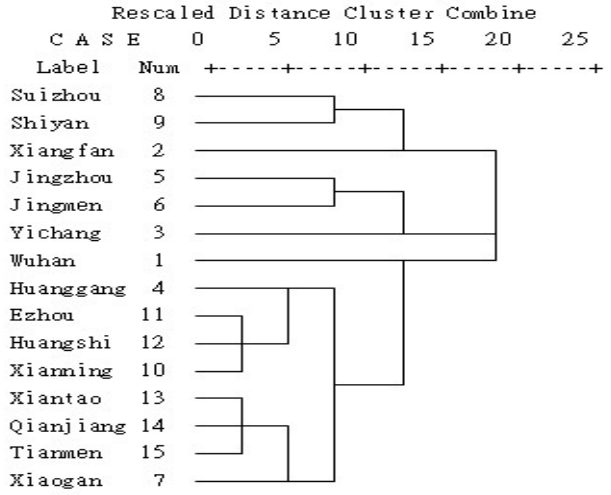

Figure 1 Cluster Map of Region's ALSC in Hubei

5 Conclusion

This paper constructed the evaluating system of ALSC，and employed the primary constituent analysis and Cluster Analysis to analyze the level of ALSC of Hubei province of China. The findings demonstrated that the capacity of agricultural logistics services of Hubei Province is dominant in the central region, and it's obviously imbalanced among the various regions within. The ALSC is determined by each element which constitutes it. So, how to promote Hubei Province's ALSC through optimizing the elements gradually will be the author's aim in the forthcoming research.

Acknowledgements

This paper is supported by logistic development and research centre of main research base of human and scientific of Hubei Province (Project No.: 2010A05 and 2010Z01).

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