Construction and Evaluation of the Theoretical Model of Citrus Cooperative Organization

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Abstract　Based on the general overview of cooperative economic organizations of citrus industry at home and abroad, theoretical model of the modernization, industrialization and marketization of Citrus Cooperative Organization is established. After selecting the indices, such as the scale of production, the scale of management, the rate of encouraged farmers, and the market competitiveness, quantitative evaluation index system for modernization, industrialization and marketization is established. Then, Citrus Cooperative Organization is divided into three stages, such as primary stage, intermediate stage and senior stage. After evaluating the modernization, industrialization and marketization of citrus industry in the United States, Spain and South Africa, it is pointed out that the Citrus Cooperative Organization in China at present is at the primary stage. Finally, policy direction of the development of Citrus Cooperative Organization in China is pointed out.
Key words　Citrus industry, Cooperative economic organization, Theoretical model, China

In recent years, organization degree of citrus industry in China has been increasingly strengthened and the industrial chain has been extended. On July 1st, 2007, *Law of the People's Republic of China on Farmers' Professional Cooperatives* was implemented, which lays the foundation for the development of cooperative economic organization of citrus industry in China. However, there are some outstanding impediments in citrus industry in China, such as low commercialization rate and weak market exploitation ability. Cooperative economic organization is still at the primary stage in China, having the problems of non-standard operation, weak economic strength, and imperfect operating mechanism. Therefore, cooperative economic organization in China has not yet exerted its function[1]. Starting from the aspects of industrialization, modernization, marketization and cooperative organization, theoretical model and quantitative evaluation index system for the cooperative economic organization of citrus industry are established and the related analysis framework is set up, so as to analyze the cooperative economic organization.

1 Theoretical model construction of Citrus Cooperative Organization

1.1 Theoretical discussion on the industrialization, modernization, marketization and cooperative organization

The aim of the theoretical discussion on the industrialization, modernization, marketization and cooperative organization is to find out the relationship between Citrus Cooperative Organization and related problems.

Industrialization of citrus industry is an important content of the development of world agricultural industrialization. And de-velopment of cooperative economic organization is an important step to promote the industrialization of citrus industry. Marketization uses market mechanism to develop agriculture, optimizes agricultural structure, produces market-oriented products, and allocates resources according to market mechanism under the framework of market economy. Development of cooperative economic organization can effectively improve the competitiveness of citrus industry and promote the improvement of market mechanism. Modernization of citrus industry includes the modernization of the means of production, the modernization of production technology, the modernization of farmers and the modernization of organization and administration. On the one hand, realization of agricultural modernization offers conditions for the emergence of a new cooperative economic organization. And development of peasants' cooperative economic organization can promote the modernization process. On the other hand, it is an inevitable choice for agricultural modernization to develop peasants' cooperative economic organization, to promote the agricultural cooperation, and to realize the agricultural modernization[2].

1.2 Construction of the theoretical model of "3 +1" cooperative economic organization

Theoretical analysis shows that cooperative economic organization of citrus industry takes a prominent position in the industrialization, marketization and modernization process of citrus industry. And the reform of cooperative organization model of citrus industry can not be separated from the historical category of the industrialization, marketization and modernization development of citrus industry. Thus, its function can be described by correlation model. Fig. 1 illustrates the relationship among industrialization, marketization, modernization and cooperative organization of citrus industry.

The "3 +1" cooperative economic organization mode is a theoretical model we try to establish in this paper. By using the related index evaluation system, this model differentiates the

development stage and concrete mode of cooperative economic organization, in order to provide a theoretical basis for the establishment of mathematical model of quantitative analysis.
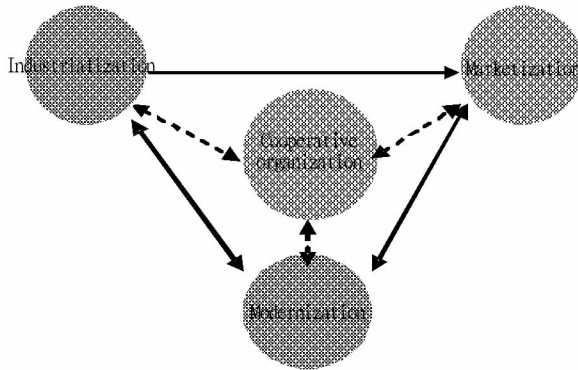

Fig.1   Theoretical model of the "3 +1" Citrus Cooperative Organization

1.3   Mathematical derivation of the theoretical model of "3 +1" Citrus Cooperative Organization

1.3.1   Highlights and significance of modeling. Firstly, the purpose of modeling is to explicate the goal of this study, which is the concrete relationship between Citrus Cooperative Organization and related problems, hoping to summarize the necessities of establishing Citrus Cooperative Organization according to the practical problems. Secondly, "non-strict" mathematics is used to analyze, compare and summarize the problems, and the appropriate discipline language is adopted to express it. Thirdly, through modeling, we hope to summarize the inherent laws of Citrus Cooperative Organization and the industrialization, marketization and modernization of citrus industry according to the mathematical derivation and the obtained mathematical conclusion.

1.3.2   Concrete modeling. According to the analysis motioned above, we have the following model:

$$R = \sum (O + P + M + I) \qquad (1)$$

where R is the total revenue, O is the cooperative organization, P is the level of modernization, M is the level of marketization, and I is the level of industrialization.

Industrialization, marketization and modernization of citrus industry affect the total revenue through the cooperative organization of citrus industry, that is:

$$O \to P, M, I \qquad (2)$$

Hence, the mathematical function is

$$P = af(O), M = bf(O), I = cf(O) \qquad (3)$$

where a, b and c are different constants.

Equation(3) is denoted by $P = f_1, M = f_2, I = f_3$. Hence, we have:

$$O = af(P), O = bf(M), O = cf(I), \qquad (4)$$

and $R = \sum (af(O) + bf(O) + cf(O) + af(O)) \qquad (5)$

Assuming $2a + b + c = d$, d is also a constant, since a, b and c are different constants.

Hence, we have

Original equation = $\sum [(2a + b + c) f(O)] = \sum [df(O)]$

Assuming $2a + b + c = d$, d must be a constant.

Therefore, it can be concluded that levels of industrializa-

tion, marketization and modernization of citrus industry vary in different countries. And the different processes of industrialization, marketization and modernization lead to the different modes of cooperative economic organization in different countries. At the same time, Citrus Cooperative Organization plays a critical and core role in the economic development of citrus industry, and determines the development trend and process of industrialization, marketization and modernization of citrus industry in a certain country.

2   Evaluation system of Citrus Cooperative Organization based on the model

2.1   Index selection of industrialization, marketization and modernization of citrus industry   According to the analysis, evaluation index system of citrus industry management is studied mainly from the large-scale production and management (the scale of labor force L, the scale of citrus output Y, the scale of citrus base J and so on), the rate of encouraged farmers D, and the market competitiveness (the market share M_1, the cost-benefit ratio C and so on). Market-oriented management mainly starts from the commodity rate F and the marketization of production structure Q. Modernization is a product of social and economic development at a certain stage, having its scientific connotation and accepted standards. Index includes the labor productivity index A, the land productivity index T and the farmland standardization index V. Table 1 reports the measurement index and weight distribution of the industrialization, marketization and modernization of citrus industry.

Table 1   Measurement index and weight distribution of the industrialization, marketization and modernization of citrus industry

Item	Total weight	Subindex	Sub-weight
Industrialization level	52	Scale of labor force	8
		Scale of output value	9
		Scale of commodity base	10
		Rate of encouraged farmers	8
		Market share	9
		Cost-benefit ratio	8
Marketization level	23	Marketization rate of production structure	9
		Commodity rate	11
Modernization level	25	Labor productivity	8
		Land productivity	9
		Standardized rate of farmland	8

2.2   Evaluation index of Citrus Cooperative Organization
According to the weight and value range of index in agricultural industrialization management obtained by Delphi investigation, index evaluation system of the industrialization, marketization and modernization of citrus industry is established in Table 2.

3   Evaluation of the Citrus Cooperative Organization

3.1   Evaluation of the foreign Citrus Cooperative Organization   According to the related literatures, the model and in-

dex evaluation system of established Citrus Cooperative Organization, and the development status of Citrus Cooperative Organizations in different countries, Table 3 reports the evaluation results of the industrialization, modernization and marketization of citrus industry in the United States, Spain and South Africa.

Table 2 Index evaluation system of the industrialization, modernization and marketization of citrus industry %

Index	Primary stage	Intermediate stage	Senior stage
Scale of labor force (L)	$15{\leqslant}L{\leqslant}35$	$35{\leqslant}L{\leqslant}75$	$75{\leqslant}L{\leqslant}85$
Scale of output value (Y)	$10{\leqslant}Y{\leqslant}30$	$30{\leqslant}Y{\leqslant}60$	$60{\leqslant}Y{\leqslant}80$
Scale of commodity base (J)	$10{\leqslant}J{\leqslant}40$	$40{\leqslant}J{\leqslant}60$	$60{\leqslant}J{\leqslant}80$
Rate of encouraged farmers (D)	$5{\leqslant}D{\leqslant}25$	$25{\leqslant}D{\leqslant}40$	$40{\leqslant}D{\leqslant}70$
Market share (M_1)	$5{\leqslant}M{\leqslant}30$	$30{\leqslant}M{\leqslant}50$	$50{\leqslant}M{\leqslant}80$
Cost-benefit ratio (C)	$2{\leqslant}C{\leqslant}5$	$5{\leqslant}C{\leqslant}8$	$8{\leqslant}C{\leqslant}15$
Marketization rate of production structure (Q)	$10{\leqslant}J{\leqslant}40$	$40{\leqslant}J{\leqslant}60$	$60{\leqslant}J{\leqslant}80$
Commodity rate (F)	$10{\leqslant}J{\leqslant}35$	$35{\leqslant}J{\leqslant}65$	$65{\leqslant}J{\leqslant}85$
Labor productivity (A)	$10{\leqslant}J{\leqslant}40$	$40{\leqslant}J{\leqslant}60$	$60{\leqslant}J{\leqslant}80$
Land productivity (T)	$4{\leqslant}C{\leqslant}8$	$8{\leqslant}C{\leqslant}12$	$12{\leqslant}C{\leqslant}20$
Standardized rate of farmland (V)	$10{\leqslant}J{\leqslant}40$	$40{\leqslant}J{\leqslant}60$	$60{\leqslant}J{\leqslant}80$

Table 3 Evaluation results of the industrialization, modernization and marketization of citrus industry in the United States, Spain and South Africa %

Index	The United States	Spain	South Africa
Scale of labor force (L)	83	94	About 37
Scale of output value (Y)	78.7	Above 85	Above 40
Scale of commodity base (J)	Above 70	Above 70	About 45
Rate of encouraged farmers (D)	Above 90	97.5	About 30
Market share (M_1)	Above 85	93	36
Cost-benefit ratio (C)	Above 10	12	8
Marketization rate of production structure (Q)	Above 80	Above 85	About 45
Commodity rate (F)	About 70	86	About 65
Labor productivity (A)	–	–	–
Land productivity (T)	About 17	About 16	About 9
Standardized rate of farmland (V)	Above 90	Above 90	45

Note: Data are from http://www.nass.usda.gov/ and http://tzswj.mofcom.gov.cn/aarticle/e/200911/20091106641789.html.

Table 4 shows the evaluation results after data treatment and estimation of industrialization, modernization and marketization of citrus industry in the United States, Spain and South Africa. In general, development level of citrus industry in the three countries shows a certain gradient. Citrus industries in developed countries of Europe and America are at a relatively high level of industrialization, modernization and marketization; while developing countries, such as South Africa, are relatively backward. Under their own management levels, the United States, Spain and South Africa have different stage characteristics of Citrus Cooperative Organizations. And there are also differences in the development mode and trend.

Table 4 Management evaluation stages of industrialization, modernization and marketization of citrus industry in the United States, Spain and South Africa

Level of industrialization, modernization and marketization	Index	The United States	Spain	South Africa
Level of industrialization	Scale of labor force (L)	High	High	Medium
	Scale of output value (Y)	High	High	Medium
	Scale of commodity base (J)	High	High	Medium
	Rate of encouraged farmers (D)	High	High	High
	Market share (M_1)	High	High	Medium
	Cost-benefit ratio (C)	Low	Low	Low
	Overall evaluation	High	High	Medium
Level of marketization	Marketization rate of production structure (Q)	High	High	Medium
	Commodity rate (F)	High	High	Medium
	Overall evaluation	High	High	Medium
Level of modernization	Labor productivity (A)	–	–	–
	Land productivity (T)	High	High	Medium
	Standardized rate of farmland (V)	High	Medium	Low
	Overall evaluation	High	High	Medium

3.2 Evaluation of Citrus Cooperative Organization in China Based on the data arrangement and filed investigation in Yichang City, Hubei Province, China, evaluation results of in- dustrialization, modernization and marketization of citrus indus- try in China and South Africa are obtained (Table 5).

Table 5 Comparison of the evaluation results of industrialization, modernization and marketization of citrus industries between China and South Africa
%

Country	Scale of labor force	Scale of comm- odity base	Market share	Marketization rate	Commodity rate	Land productivity	Standardized rate
South Africa	Medium	About 45	36	About 45.0	About 65	About 9	35
China	Low	37	27	27.5	20	About 7	20

Note: Indices of industrialization, modernization and marketization are obtained by the relevant scholars according to their investigation results of Yichang City, Hubei Province, China.

According to the definition standard of the development stage of Citrus Cooperative Organization, the development sta- tus of cooperative organization are summarized, as well as the indices of industrialization, modernization and marketization of citrus industries in both China and South Africa. Generally speaking, Citrus Cooperative Organization in China is still at the primary stage with weak economic strength, small production scale, poor ability to take risks, low rate of encouraged farm- ers, and limited market share. On the one hand, this situation is caused by the low industrialization, modernization and mar- ketization of citrus industry, which hinders the development of Citrus Cooperative Organization in China to a certain degree. On the other hand, some indices of industrialization, moderni- zation and marketization of citrus industry in China are close to those of South Africa; but the development stage of Citrus Co- operative Organization in China lags behind that in South Afri- ca. Moreover, Citrus Cooperative Organization in China is now facing with the problems of the low organization level, poor reg- ulation, and low contribution rate of science and technology, which used to bewilder the Citrus Cooperative Organization in South Africa[3].

4 Conclusion

Citrus Cooperative Organization in China has many similar characteristics with that in South Africa in both development stage and mode. Thus, development road of Citrus Coopera- tive Organization in South Africa is an important reference for China. According to the development stage of Citrus Coopera- tive Organization in China, cooperative economic organization mode suitable for China is discussed. From the aspects of the industrialization, modernization and marketization levels, corre- sponding policy ideas are put forward for the definition of devel- opment stage of Citrus Cooperative Organization, which pro- vides references for the relevant policy formulation.

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Government should take the establishment of production base as the breakthrough point of enhancing the competitiveness of leading enterprises, so and to help enterprises to establish bases. On the one hand, government should introduce direc- tional input, service and purchase, establish a relatively rea- sonable mechanism for the distribution of benefits, help lead- ing enterprises to treat the relationship with peasant house- holds, actively develop the modes of company + peasant household, company + base + peasant household, and oth- er industrial management mode integrating trade, industry and agriculture, form a development relationship body between peasant household and enterprise with economic interest as a link, help leading enterprises to increase the income of farm- ers, and make farmers offer high-quality raw materials for en- terprises[5]. For instance, Sino-Japanese joint venture of Tia- nyi Food Co., Ltd. in Huai'an area once were unable to com- plete the export contracts, because few of the farmers broke the contract and sold agricultural products to other parties without permission. On the other hand, government should en- courage enterprises to invest in bases through the forms of subsi- dies and so on, improve infrastructures and production conditions in bases, promote the structural adjustment and technical train- ing, and strengthen the production management of base and the quality control of products.

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