Advances in Research on Modern Agricultural Development in Grain Production Core Area of China

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Abstract Grain production core area is key region of modern agricultural development in China. Through summarizing related literature about grain production area and modern agricultural development researches both at home and abroad, it obtained characteristics and existing problems in the modern agricultural development of the grain production core area. It is found that there are many research perspectives in modern agricultural development of the grain production core area. On the basis of analyzing the grain production core area and connotation, mode and evaluation of the modern agricultural development, it is concluded that further study should be carried out for adopting which development mode and how to make evaluation, so as to provide theoretical guidance for balanced development of modern agriculture in grain production core area of different regions.

Key words Characteristics of core area, Modern agriculture, Mode of modern agriculture

1 Introduction

The Twelfth Five-Year Guideline period is a key period for China transforming traditional agriculture and taking the road of agricultural modernization with Chinese characteristics. With the technological, economic and social progress, modern agriculture presents with different connotations and development goals, which are manifested in different development modes. At present, there are more and more researches about modern agricultural development in China, but different countries and scholars have not reached uniform conclusion. Numerous scholars and institutions have made extensive researches on existing problems, development modes and evaluation system of modern agriculture.

With acceleration of modern agricultural construction, China always takes grain security as top priority of national agricultural development for guaranteeing people's livelihood. However, there are few in-depth researches about grain production core area and even less researches about evaluation of modern agricultural modes in grain production core area.

Focusing on grain production core area, modern agriculture, modern agriculture of grain production core area, and modern agricultural development modes, as well as different levels of modern agricultural development evaluation, we made an overview for research literature about modern agricultural development in grain production core area, to find out new study perspective and promote in-depth research in this field, and so as to provide theoretical guidance for balanced development of modern agriculture in different regions of China.

2 Researches about grain production core area

Now, research about the construction of grain production core area is a new project. There are few in-depth researches about this and there is still no perfect research system framework. Except few developed countries like the United States, few countries specially research the issue of grain production core area. In the world, the grain production core area is called agricultural area construction or agricultural regional distribution. Wang Jingying[1] stated that regional distribution, specialized production and industrialized operation are general rules of agricultural development in the world, which are also inevitable requirements and results of lifting market competitiveness of agricultural products.

Resource conditions and economic development level of different countries are different. In the agricultural regionalization and specialization, different countries break administrative limit of states or provinces in accordance with agricultural production environment of different regions, divide regions with county or region as administrative unit, and closely connect with agricultural regionalization and specialization, to promote interactive development of agriculture, countryside and farmers. Starting from strengthening construction of agricultural infrastructure in different regions, we found that agricultural infrastructure construction in the agricultural development of all countries generally includes: agricultural product circulation infrastructure construction, farmland water conservancy works construction, commodity grain and cotton production base construction, and forestry production base and protection forest construction[2-3]. Roberto[4] studied reclamation of wasteland, selection of fine seed, transformation of agricultural infrastructure, increase of irrigated area, improvement of grain processing and storage capacity, and improvement of grain market circulation, and encouragement of application of new science and technology in agricultural production, and made clear orientation of agricultural sci-tech investment.

Since the 1980s, China has introduced regional development concepts such as major grain production area, centralized grain production area, and industrial belt of advantageous agricultural

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products. In China, the grain production core area is a new concept put forward through several decades of practice. There are few researches about the grain production core area. Most researches conduct simple analysis at macroscopic and microscopic level.

2.1 Researches about problems related to grain production core area From macroscopic level, Tan Yan[5] analyzed background of policies for grain production core area construction and conflict of interested parties, elaborated plight in construction of grain production core area in China, and came up with pertinent recommendations. Yang Bangjie *et al*[6] surveyed in northeast area and posed imagination of building national grain production core area. Taking Heilongjiang Province as an example, they analyzed existing construction of grain production core area and found that low standard of land consolidation and slow increase of farmers' income retard the process of Heilongjiang becoming a national grain production core area. Taking Henan Province as an example, at the background of the No. 1 document of central government proposing policy of the grain production core area, Wang Jingying[1] studied division and construction of the grain production core area in Henan Province, established division indicator system, determined indicator weight using analytic hierarchy process (AHP), pointed out unreasonable parts in division of grain production core area in Henan Province, and came up with corresponding recommendations.

2.2 Researches about modern agricultural development in major grain production area Yang Chun *et al*[7] summed up innovative grain production technologies of Hebei Province and obtained practical experience in increasing grain yield, which are of great realistic significance for high yield of modern agriculture in major grain production area. Ping Zuoyan[8] analyzed input in major grain production area and proposed establishing benefit safeguarding mechanism, so as to promote stable growth of agricultural production and stabilize modern agricultural development of grain production core area. Zhao Chunyu[9], using production concentration degree and gravity center evolution path methods, summarized characteristics and rules of production area from provinces, three regions and eight grain production areas, analyzed influence factors, and came up with pertinent policy recommendations. Using panel data, Luo Wanchun *et al*[10] established theoretical model and econometric model, analyzed pattern of grain production area and influence factors, and concluded that farmland per capita, per unit area yield, and non-agricultural income are major factors. Wu Shanlin[11] described change characteristics of grain production area in central and western areas using composite index of grain production, concluded that farmland per capita and non-agricultural employment relay are major influence factors through empirical analysis, and put forward related policy recommendations.

Cai Wenzhu[12] analyzed basic characteristics of agricultural development in major grain production area and came up with agricultural development modes of different regions based on foreign typical modern agricultural development. Cui Kai[13] analyzed and evaluated agricultural modernization of major grain production area by AHP and compared agricultural modernization level of different periods and regions, which are positively significant for development of agricultural modernization in major grain production area. Jiang Heping *et al*[14] established evaluation indicator system and evaluated modern agricultural development level of the whole country, eastern, central and western areas, and reached the conclusion that the modern agricultural development level takes on rising trend and there is a great gap between eastern, central and western areas in modern agricultural development level. Jiang Heping *et al*[15] and Cui Kai *et al*[16] made quantitative evaluation on China's agricultural modernization development level and compared overall and regional development level by multi-indicator comprehensive analysis method.

3 Researches about modern agriculture

3.1 onnotation, characteristics and theoretical basis of modern agriculture According to No. 1 document of central government, different scholars extended connotation of the modern agriculture on the basis of their understanding of definition of modern agriculture and combining with their respective research field, and believed that modern agriculture should be developed at the same time of considering ecological and social environment. Opinions of Bai Zhenzhong[17], Kong Xiangzhi[18], Tao Wuxian[19], Liu Yanhua[20], and Dai Xiaofeng *et al*[21] can be summarized as: the modern agricultural development is revolution of production mode and productivity, and input of new elements of modern agriculture, not the change of development goals, industrial functions, value orientation, and operation mode, but gradually realization of commercial, specialized, industrialized, market-oriented and socialized agriculture.

Since China's agricultural development is backward, the modern agricultural development is faced with some problems. Zhang Jianhua[22] summed up different modes of agricultural development in developed countries and stated that China should select suitable modern agricultural development path with Chinese regional characteristics. Ma Xiaohe[23] held that modern agricultural development has such problems as low sci-tech level, insufficient input, weak infrastructure, and imperfect management mechanism, which seriously retard modern agricultural development. Wang Bifeng[24] believed that resource restriction of agriculture, low industrialization level, low quality of farmers, low sci-tech innovation ability and poor infrastructure condition are key factors restricting agricultural development and lead to low agricultural resource utilization efficiency, labor productivity, and slow sci-tech extension.

Liu Xibo *et al*[25] analyzed theoretical basis system of modern agricultural development both at home and abroad and stated that the system consists of agricultural economy, agricultural development and agricultural ecology theories. Zhu Huajun *et al*[26] analyzed factors influencing agricultural development using the Barrel

Theory (short plate theory) and concluded that the agricultural development and mode of a country is directly determined by natural and production factors, and the level of modern agricultural development is mostly influenced by resources. Yang Lan'gen[27] held that per capita land resource is the short plate and determines land output rate and agricultural product quality, is important means for China's modern agricultural development, strengthening international competitiveness of agricultural products, and constantly increasing farmers' income. Cao Chengzhong *et al*[28] pointed out that institution basis is the key factor for building modern agriculture and made clear development direction of modern agriculture. Yin Chengjie[29] and Jiang Heping[30] discussed development approaches, basic ideas and development modes of modern agriculture in China and held that the construction of modern agriculture should focus on key construction points, improve long-term mechanism in accordance actual national conditions, so as to ensure sustainable and stable development of modern agriculture.

3.2 Modern agricultural development modes

3.2.1 Modern agricultural development modes in developed countries.

According to leading types of modern agricultural development, Bai Zhenzhong[19] summed up three modern agricultural modes in developed countries. According to different natural resources and external environmental conditions, Li Zirui *et al*[31] summed up three representative modern agricultural modes in the United States, Japan and the Netherlands respectively. For construction of modern agriculture in developed countries, Sun Haoran[32], Xiang Renxue[33], and Meng Lei[34] obtained three modes: (i) resource saving and capital and technology intensive mode; (ii) large-scale, mechanized and high technological mode; (iii) composite mode of production intensive combined with machinery technology. Jiang Heping and Song Lili[35-36] introduced contents, characteristics and existing problems of agricultural construction in Brazil and Japan on the basis of basic conditions of both countries, in the hope of providing reference for China's construction of modern agriculture.

3.2.2 Modern agricultural development modes in China.

In recent years, combining with national conditions, from the perspective of regional development, many scholars have found approaches and modes of modern agricultural construction in different regions using the method of combining theories and practical experience on the basis of a lot of construction cases. According to location condition and economic development level, Xu Kailu[37] proposed differentiated, regional and characteristic agricultural development road to realize interactive development of agricultural industrialization, rural urbanization and farmers' education. Cui Kai *et al* surveyed and analyzed schemes and summarized and concluded four major modes from the perspective of factors promoting modern agricultural development. Kong Xiangzhi *et al*[38] divided China's modern agricultural development into four modern agricultural modes on the basis of economic development and regional environment. Li Hongshan[39] and Song Zaiqin[40] proposed industrial cluster in central region and improving land scale at moderate level in northeast to develop their modern agriculture respectively. Zhao Huilong[41] evaluated modern agricultural development of all provinces of China using the indicator evaluation method and divided China's modern agriculture into urban modern agriculture, high-efficient export-oriented modern agriculture, advantageous and characteristic industry leading modern agriculture, large-scale operating modern agriculture, and modern agriculture with ecological characteristic. Zhu Ming[42] divided China's modern agricultural construction into highly developed, developed, developing, underdeveloped, and undeveloped types. In developed modern agriculture, the rural net income per capita is higher than 6 000 yuan, there are lots of township enterprises, and the urban and rural integration level is high; in developing modern agriculture, the rural net income per capita is 2 500 – 4 000 yuan, the urban and rural gap is still large, and township enterprises have certain development but are not fully developed; in undeveloped modern agriculture, many rural areas still remain poverty or just get rid of starvation, and rural net income per capita is lower than 1 500 yuan.

3.3 Evaluation of modern agricultural development

Modern agricultural evaluation system is a systematic project. Different stages of modern agricultural development show different characteristics. The Agricultural Research Center of the Ministry of Agriculture, Du Huazhang[43] and Ma Qiufang[44] made a comprehensive evaluation on current situation of modern agricultural development by case study method. They worked out stage indicators and built an indicator system theoretical system for modern agriculture, reflecting that different areas have regional difference, providing important theoretical guidance for accelerating regional modern agricultural development.

Using expert evaluation method and AHP, Xin Ling *et al*[45] established calculation model for evaluation of comprehensive level of China's agricultural modernization, made quantitative calculation of China's agricultural modernization, and obtained that China's agricultural modernization takes on general rising trend and there is significant gap between central, western and eastern regions in modern agricultural development, and accordingly came up with recommendations for speeding up China's agricultural modernization. Luo Qiyou[46] made an evaluation on regional division and coordination of China's agricultural development and discussed orientation of leading functions of institutional change direction of different agricultural regions through establishing mechanism model and evaluation method for coordinated development of agricultural regions.

3.4 Research methods of modern agricultural development

On the basis of review of cluster development of modern agriculture, Hong Yan *et al*[47] made a strategic SWOT analysis on cluster development of China's modern agriculture and came up with specialized strategy of building and extending industrial chain for cluster development of modern agriculture. Taking competitiveness of agricultural mechanization as starting point, Yang Weimin[48]

studied the modern agricultural industrial competitiveness of a country or region. Using SWOT method, he made comprehensive evaluation on competition of agricultural mechanized development and came up with pertinent recommendations for improving competitiveness of modern agriculture. Yan Chaode *et al*[49] made a gray correlation calculation and analysis on variable and integrated agricultural productivity using the gray correlation analysis method, determined influence of variables on integrated agricultural productivity, and summarized factors influencing integrated agricultural productivity of Henan Province. Dong Yan *et al*[50] made comparison of advantages in crops, economic crops, animal husbandry, and aquatic products industry of regions in China, which is of great theoretical significance for promoting regional modern agriculture and coordinated development of rural economy.

4 Conclusions

Extensive studies show that researches on modern agricultural development in grain production core area of China still remain at starting stage. Studies on agricultural industrialization in major grain production area are deep, while there are few empirical researches about modern agricultural development in grain production core area and evaluation on modern agricultural development modes. Most researches are carried out from two aspects: one is simple qualitative analysis focusing on current situations, existing problems, and development modes of modern agriculture and the other focuses on indicator evaluation system of agricultural modernization, making evaluation of agricultural modernization indicators for different regions and different industries of China from both quantitative and qualitative perspective, and judging integrated agricultural development level and stages of China's modern agriculture according to integrated development index of the modern agriculture.

In conclusion, there are still problems to be further studied: including how to develop modern agriculture in the grain production core area, the modern agriculture of different regions of grain production core area adopting which development mode, and major influencing factors for modern agricultural development modes of the grain production core area in different regions. These should have further evaluation and in-depth study. Therefore, taking the modern agricultural development mode of grain production core area as starting point, making comparative analysis from both vertical and horizontal perspective, and analyzing stage characteristics, influencing factors and development modes will have great significance for correctly grasping actual regional difference in the grain production core area of China.

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capacity and level of cooperation, and the distribution of benefits is more equitable.

3 Conclusions

The benefit distribution mechanism of agricultural industrial chain is an important factor affecting the stability of industrial chain. For common interest, the players interact and collaborate and enter into a strategic alliance, ultimately forming a complete chain. The fundamental goal of players' participation in agricultural industrial chain is to rely on cooperation to create greater overall benefits while seeking to maximize their own interests. The nature of members' maximization of their own interests will be bound to make them concerned about the mutual distribution of benefits, and if the distribution of benefits is unreasonable, it will affect the enthusiasm of players for participating in cooperation, thereby affecting the overall interests of the entire chain, or even breaking the industrial chain. Therefore, the reasonable distribution of benefits can ensure the stable operation of agricultural industrial chain. In the cooperative game relationship, Shapley value method provides a reasonable allocation strategy for the distribution of benefits between cooperative members. On the basis of Shapley value, this paper considers the risk factors, technological innovation capacity and level of cooperation faced by the players in agricultural industrial chain, and corrects the Shapley model to make the benefit distribution strategy lay equal emphasis on efficiency and fairness. In short, Shapley value method can provide a theoretically and practically feasible benefit distribution program for the distribution of benefits among players in agricultural industrial chain, reduce the irrational factors in the distribution of benefits, and lay a solid foundation for the stable and continuous cooperation.

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