

Research on the status of high-quality development of Chinese agriculture and countermeasures in the context of digital transformation

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Keywords: Digital transformation, high quality agricultural development, entropy weight TOPSIS method

Abstract: This study constructed an evaluation index system for high-quality development of agriculture from the perspective of the new development concept against the background of digital transformation. The entropy weight TOPSIS method was used to measure the level of high-quality development of agriculture in 30 provinces in China from 2015 to 2020, and its spatial distribution characteristics were analyzed through the Moran index. The results of the study show that the level of high-quality development of agriculture in China shows a slow upward trend. In terms of dimension, agricultural high-quality development pays more attention to the level of agricultural digitalization and scientific and technological innovation. In terms of regional development, there are significant differences in the level of high-quality development of agriculture in different regions, showing a spatial pattern of "strong in the east, flat in the middle and weak in the west".

1. Introduction

The concept of high-quality development originates from the major change of the main contradiction in Chinese society. The historic change in the stage of China's economic development has made "resolving the major social contradictions and promoting high-quality development" a priority of the present era. Under the main tone of the era of economic development, the academic community focuses on how to promote agriculture to achieve high-quality development. High-quality development of agriculture not only covers the improvement of product quality, industrial efficiency, production efficiency, operational efficiency, operator quality, international competitiveness and farmers' income, but also needs to consider the good ecological environment and perfect production and management system [1-3]. Scholars agree that the high-quality development of agriculture should be compatible with the needs of the main social contradictions, and realize the transformation of agriculture from production-increasing orientation to quality-improving orientation by continuously optimizing the agricultural supply system in order to satisfy the people's demand for high-quality agricultural products [4-5].

Academic research on agricultural high-quality development mainly focuses on the construction of influencing factors and evaluation system. In terms of influencing factors, scholars pay attention

to the fields of digital economy, digital technology, digital inclusive finance, etc., and study the effect of their promotion on agricultural quality development^[6-7]. In terms of measuring the level of agricultural quality development, scholars used to construct the evaluation index system of agricultural quality development mainly from the theoretical level, with a relatively narrow perspective^[8]. However, with the implementation of the new development concept and related policies, the evaluation index system of agricultural quality development based on the five development concepts of innovation, coordination, greenness, openness, and sharing has begun to receive extensive attention and research^[9-10]. The advancement of digital transformation has also prompted some scholars, such as Wu Guoyong, to begin to study the level of agricultural modernization and make new explorations on the index system of agricultural high-quality development level^[11].

Overall, academics have conducted more qualitative research on agricultural high-quality development, but quantitative research is relatively scarce, especially in the context of digital transformation, the construction of the evaluation index system of agricultural high-quality development level is relatively insufficient. Therefore, the purpose of this paper is to thoroughly study the connotation and characteristics of agricultural high-quality development in the context of digital transformation, and further improve the evaluation index system of agricultural high-quality development.

2. Measuring the level of high-quality development of Chinese agriculture

2.1 Indicator construction

The construction of the indicator system in this paper is based on the current status of previous research, while fully drawing on the policy documents issued by China, taking the new development concept as the guiding principle and establishing high-quality development as the core objective. Following the principles of data comprehensiveness, scientificity, completeness and comparability, this paper constructs an indicator system containing five primary indicators and 24 secondary indicators.

2.2 Data sources

This study takes full account of the completeness and availability of data, and selects data from 30 provinces, autonomous regions and municipalities (excluding Hong Kong, Macao and Taiwan) for the period 2015-2020. These data were mainly obtained from China Rural Statistical Yearbook, China Statistical Yearbook, China Science and Technology Statistical Yearbook, statistical yearbooks of provinces, autonomous regions and municipalities, reports of Ali Research Institute, and the official website of the National Bureau of Statistics. For the missing values of the indicators in some provinces, we used the linear interpolation method to interpolate.

2.3 Measurement methods

The entropy weight TOSIS method integrates the advantages of the entropy weight method and the TOPSIS method, which is applicable to multi-objective decision-making, aims at eliminating the influence of subjective factors, and is commonly used in the measurement of the level of high-quality development. Its basic principle is to objectively assign weights to each indicator through the entropy weight method, and then use the TOSIS method to calculate the distance between the evaluation object and the ideal value, and complete the ranking. In this study, this method was chosen for the measurement of the high quality development level of agriculture.

2.4 Measurement results

The entropy weight TOSIS method was used to process the panel data of 30 provinces from 2015 to 2020 to derive the level of high-quality development of agriculture and the composite index of each dimension. Then the comprehensive index of the level of high-quality development of agriculture in 30 provinces was analyzed to form the regional high-quality development of agriculture.

Table 1: Composite index of the level of high-quality development of agriculture and its components.

particular year	High-quality level of development	Level of digitization of agriculture	Agricultural science, technology and innovation	Agricultural economic benefits	Social security in agriculture	Agricultural greening
2015	0.127	0.026	0.046	0.027	0.018	0.011
2016	0.132	0.032	0.043	0.025	0.021	0.011
2017	0.132	0.032	0.043	0.025	0.021	0.011
2018	0.159	0.049	0.046	0.026	0.026	0.012
2019	0.178	0.058	0.049	0.030	0.031	0.010
2020	0.194	0.065	0.054	0.033	0.032	0.010
annual rate of growth	7.286%	16.323%	2.965%	3.439%	10.115%	-0.813%

2.4.1 Comprehensive analysis of China's high-quality agricultural development

In recent years, the level of high-quality agricultural development in China has steadily increased from 0.127 in 2015 to 0.194 in 2020, a cumulative increase of 0.067, with an average annual growth rate of 7.286%. Among them, the growth was slower in 2016-2018, and the growth was most obvious in 2017-2018. The differences in the dimensions are obvious, with digitization being the most positive and agricultural green ecology lagging behind. The level of agricultural digitization index increases from 0.026 in 2015 to 0.065 in 2020, with an average annual growth rate of 16.323%. The index of agricultural science and technology innovation grows slowly, from 0.046 in 2015 to 0.054 in 2020, with an average annual growth rate of 2.965%. The index and growth rate of agricultural economic efficiency is in the middle, indicating that the development of agriculture is not sufficient, and there is a need to promote the deep integration of primary, secondary and tertiary industries, and enhance the comprehensive economic strength of agriculture. The agricultural social security index rose from 0.018 in 2015 to 0.032 in 2020, with an average annual growth rate of 10.115%, especially the fastest growth in 2018-2019, reaching 20.769%.

2.4.2 Analysis of regional differences in high-quality agricultural development

By analyzing the differences in regional agricultural high-quality development, it is found that the overall trend of China's agricultural high-quality development level and the significant differences between regions, specifically now in the eastern region (0.219) > central region (0.132) > western region (0.115).

Table 1 reflects the overall trend of China's agricultural high-quality development level and the significant differences between regions, specifically now in the eastern region (0.219) > central region (0.132) > western region (0.115).

The level of high-quality agricultural development in the eastern region continues to grow steadily from 0.164 in 2015 to 0.274 in 2020, with an average annual growth rate of 8.315%. Within the eastern provinces, Beijing is the most outstanding performer at 0.369, while Hainan lags behind at 0.105. Seven provinces have consistently ranked among the top ten in the country, accounting for 63.636% of the number of provinces in the eastern region. Beijing has consistently ranked first in the country in terms of high-quality agricultural development, while Zhejiang has seen the most rapid development during this period. The ranking of other provinces fluctuates greatly, with Hainan and Liaoning having a level of high-quality agricultural development below the national average.

The level of high-quality agricultural development in the central region rises from 0.114 in 2015 to 0.160 in 2020, with an average annual growth rate of 5.795%. Henan has the most outstanding performance in the region, with a level of 0.173, while Shanxi has the lowest at 0.092. Henan has consistently ranked among the top 10 in the country, while other provinces have relatively low rankings and fluctuate greatly.

The level of high-quality agricultural development in the western region rose from 0.100 in 2015 to 0.115 in 2020, with an average annual growth rate of 5.730 percent. Shaanxi has the best performance in the region with a level of 0.172, while Hainan has the lowest at 0.085. Except for Shaanxi, other provinces in the region have annual averages lower than the national annual average (0.155), accounting for 90.909% of the number of provinces in the west. The ranking of the provinces fluctuates greatly, with Shaanxi ranking seventh in the country in 2020.

In order to deeply analyze the regional differences in the level of high-quality agricultural development in China, the 30 provinces were divided into four categories (Category 1: 0.397, Category 2: 0.251-0.296, Category 3: 0.136-0.167, and Category 4: 0.086-0.116). The results of the division are shown in Table 2.

Table 2 shows that the level of high-quality development of Chinese agriculture shows obvious regional differences among provinces, generally characterized by "strong in the east, flat in the middle and weak in the west". The number of high-level provinces is relatively small, while the number of low-level provinces is relatively large, forming a "pyramid-shaped" distribution. Specifically, the first and second categories of provinces are mainly located in the eastern region, accounting for 54.545% of the number of provinces in that region, while the fourth category of provinces is mainly located in the western region, accounting for 81.818% of the number of provinces in the west. This indicates that the eastern region is leading overall, while the western region is lagging behind.

Table 2: Classification of regional levels of high-quality development in agriculture.

Category/area	eastern part	Central Region	western region
Category I (high level)	Beijing, capital of People's Republic of China	-	-
Category II (medium-high level)	Shanghai, Guangdong, Jiangsu, Zhejiang, Shandong	-	-
Category III (low to medium level)	Tianjin, Hebei, Fujian	Heilongjiang, Anhui, Hebei, Hubei, Hunan	Sichuan, Shaanxi
Category IV (low level)	Hainan, Liaoning	Shanxi, Jilin, Jiangxi	Chongqing, Guizhou, Yunnan, Gansu, Qinghai, Ningxia, Inner Mongolia, Guangxi

3. Research findings and policy recommendations

3.1 Conclusions of the study

The level of high-quality development of Chinese agriculture is on a slow upward trend, but the overall level has yet to be improved. Under the digital transformation, the high-quality development of agriculture focuses more on the level of agricultural digitization and innovation capacity. Despite the medium economic efficiency of agriculture, the relatively low level of agricultural social security and green ecology constrains high-quality agricultural development.

3.2 Policy recommendations

3.2.1 Strengthening the foundations for digital transformation in agriculture

Firstly, the imperative lies in the comprehensive implementation of a strategy dedicated to the digital transformation of agriculture. This strategy encompasses strengthening the top-level design and ensuring that comprehensive planning is tailored to local conditions. Secondly, there is a fundamental necessity to upgrade rural network infrastructure comprehensively. This involves expanding the coverage of '5G base stations' and increasing the utilization rate of high-quality networks in rural areas. Concurrently, our efforts are directed towards facilitating the deep integration of digital technology within the agricultural sector. This includes the establishment of digital agricultural parks and the creation of integrated platforms for the fusion and sharing of agricultural big data. Such initiatives aim to break through existing barriers in agricultural information and promote the high-quality development of agricultural production. In parallel, there is an active endeavor to improve the digital monitoring system for agricultural production capacity. By leveraging modern information technology, this system enables real-time monitoring of agricultural production processes. This not only enhances the quality and efficiency of agricultural products but also aims to minimize resource wastage.

3.2.2 Differentiated exploration of regional agricultural development strategies

The eastern region has strengthened agricultural cooperation and exchanges, shared with the central and western regions new models for the integration of the digital economy and agriculture, and created a demonstration zone for high-quality agricultural development. Secondly, the central and western regions are giving full play to their agricultural characteristics and advantages, complementing resources with the eastern regions and narrowing the gap between their agricultural development and that of the east.

3.2.3 Fostering agricultural science, technology and innovation capacity

This study investigates the initiative aimed at fostering the deep integration of digital technology within the agricultural sector. Key components of this initiative include the establishment of digital agricultural parks, the creation of integrated platforms for the amalgamation and dissemination of agricultural big data, and the overcoming of informational barriers to foster the high-quality development of agricultural production. Concurrently, this research underscores the significant enhancements made to the digital monitoring systems of agricultural production capacities. Through the adoption of modern information technology, this initiative facilitates the real-time monitoring of agricultural production processes. It significantly improves the quality and efficiency of agricultural products and endeavors to minimize the wastage of resources.

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