The Realization Path of "Four Modernizations Synchronized" to Promote Common Prosperity in the Huaihe River Ecological Economic Belt

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Abstract

In recent years, the theory of synchronous development of the "four modernizations" has attracted widespread attention from scholars from all walks of life and gradually achieved some research results. The article constructs an evaluation model for the synchronous development of "four modernizations" in 25 provinces and cities under the Huaihe River Ecological Economic Belt, and comprehensively measures the dynamic development level of "four modernizations" in each province and city from 2018 to 2020 using the entropy method, coupling degree and coordination model, and grey correlation degree. The results indicate that the synchronous development level of the "four modernizations" in the Huaihe River Ecological Economic Belt is constantly increasing, and the coordinated development level and coupling degree of the "four modernizations" are showing a stable growth trend, showing a spatial distribution characteristic of "high in the east and low in the west" as a whole.

Keywords

Huaihe River Ecological Economic Belt; Coupling coordination degree; Four modernizations synchronization.

1. Introduction

Since the reform and opening up, the Central Committee of the Communist Party of China has repeatedly proposed the concept of continuously promoting the synchronous development of the four modernizations, emphasizing the importance of promoting benign interaction between regions and dynamic economic balance. This has become a major strategic deployment for China to accelerate the realization of a comprehensive well-off society and move towards the comprehensive construction of a socialist modern society. Faced with the requirement of synchronous normalization of the four modernizations, the Huaihe River Basin, as an important strategic block for achieving transformation and development in the eastern coastal areas of China, has significant research value and has risen to become the fourth largest growth pole after the Yangtze River Delta, Pearl River Delta, and Bohai Rim, and has become a strong support force for promoting reform and opening up economic development. At the same time, the existing strategic layout of the Huaihe River Ecological Economic Belt rarely involves industrial cooperation and interaction between economic zones, especially the coordinated development of industry and spatial layout. Therefore, it is necessary and urgent to conduct a quantitative analysis of the synchronous development level of the Huaihe River Ecological Economic Belt, pay attention to the evolution of the four modernizations and regional differences of the Huaihe River Ecological Economic Belt, and deeply explore its high-quality economic and social development path.

2. Literature Review

The research on the synchronous development of the "four modernizations" in foreign countries is mostly focused on the interactive level of the "two modernizations", and mainly focuses on the role of industry, employment, structure, and urbanization, industrialization, agricultural modernization, and informatization in the single position. However, overall, there is little analysis of the synchronous coordination and interaction mechanism of the four modernizations. Schultz (1964) first analyzed the impact of agricultural economic development on industrialization and urbanization, and believed that modern agriculture is the foundation and key to promoting industrialization and urbanization. Then Lewis put forward the dual economic model for the first time, and constructed a simple economic development model based on urbanization and industrialization; Yujiro Hayami (2005) proposed from the perspective of agricultural modernization that the scientific and technological factors in agricultural modernization are important factors in the synchronous interaction between industrialization and urbanization. Therefore, the development of agricultural modernization cannot be separated from the development and transformation of industrialization.

Since the 18th National Congress of the Communist Party of China proposed the theory of synchronous coordination of the "Four Modernizations", domestic scholars have conducted active and beneficial explorations around the issue of synchronous development of the "Four Modernizations", forming fruitful research results. In terms of theory, the gap in the theoretical understanding of the laws of the synchronous development process of China's four modernizations has been further supplemented. Liu Wenyao and Cai Tao (2020) proposed an evaluation and measurement system for the development of "four modernizations synchronization" based on their analysis of the theoretical connotation and essential characteristics. They also pointed out the need to strengthen institutional system design, accelerate institutional construction, and establish a scientific statistical system and scientific evaluation mechanism. Guo Junhua and Xu Jiayu (2017) constructed a coordinated indicator system and used a coordinated development evaluation measurement model to analyze the current situation of coordinated development of the "four modernizations" in Shaanxi, and proposed corresponding countermeasures. Li Erchao and Han Jie (2018) pointed out that in order to promote the synchronous development of the "four modernizations", it is necessary to deeply understand the essential connotation of the "four modernizations" synchronization, and demand that the "four modernizations" concept be deeply rooted in people's hearts and reach the participation of the whole people in the "four modernizations" construction. They proposed numerous policies and suggestions.

In terms of empirical research, domestic studies have conducted more detailed observation and excavation verification on synchronous samples of the four modernizations, such as the coastal areas of Jiangsu, Anhui Province, the Yellow River Basin, Henan Province, etc. Tan Xu (2016) constructed an evaluation model for the "four modernizations synchronization" development and used EDSA to analyze its spatial differences. Based on this, the development path of the "four modernizations synchronization" in Hubei Province was summarized and summarized. Li Gang (2019) used coupling coordination theory and obstacle degree theory to evaluate the "Four Modernizations" situation in Qinghai from 2006 to 2016, and concluded that the level of agricultural services was the primary obstacle factor affecting the synchronous coordination of the "Four Modernizations" in Qinghai. Liu Wenyao, Cai Tao (2017) and others proposed to establish four primary and 42 secondary evaluation index systems based on the four evaluation levels of agricultural modernization and informatization. They used entropy method and coupling model to empirically analyze the synchronous development level of "four modernizations" in 31 provinces and cities across the country.

The above research results have laid a rich theoretical foundation and empirical experience for this article to explore the synchronization of the "four modernizations" in the Huaihe River Ecological Economic Belt. Due to the complexity and diversity of regional data and situations, the evaluation of the development level of the "four modernizations" between regions requires breaking away from the traditional economic framework and using more rigorous professional knowledge and analytical structures to carry out multi-dimensional rational observation. Therefore, referring to the existing "four modernizations" synchronous development indicator system, model methods, and theories, this article measures and analyzes 25 provincial-level cities in the Huaihe River Ecological Economic Belt, to provide relevant suggestions for continuously promoting the stable, balanced, and high-quality development of the Huaihe River Ecological Economic Belt.

3. The Connotation and Theoretical Analysis

The first is about the respective concepts of "simplification". The concept of industrialization has been clearly defined, which means that with the continuous development of industry, the proportion of industrial economy in the overall national economy continues to increase, and finally gradually replaces agricultural economy as the main economy. There is no formal definition of informatization, urbanization, and agricultural modernization, and academic interpretations vary. However, fundamentally, informatization is a process of dynamic changes in human production and life, which gradually integrates with industrialization to achieve the ultimate goal of promoting economic growth; Urbanization is widely understood as the continuous flow of rural population to cities, as well as the continuous transfer of secondary and tertiary industries to cities. It can even be seen as the process of urban lifestyle spreading to rural areas. The main purpose of urbanization is not to eliminate rural areas, nor to ruralize cities, but to gradually narrow the gap between urban and rural areas in the process of continuous urbanization, Enable urban and rural residents to share the achievements of material civilization and spiritual civilization. Agricultural modernization is a long and dynamic process of transforming traditional agriculture into modern agriculture based on the general laws of market economy development, combined with industrialization, information achievements, methods, and means. Some theorists believe that agricultural modernization is also a manifestation of rational resource allocation, and through rational resource allocation, the country can further improve labor productivity and achieve the goal of improving the overall agricultural output value.

The second is the concept and basic requirements for the synchronous development of the "four modernizations". The report and official documents of the 18th National Congress of the Communist Party of China did not clearly specify the measurement standards for synchronous development. Synchronization "refers to the movement of two or more quantities or things over time to maintain a certain relative relationship, while" development "refers to the movement of things from small to large, from low to high, and from old materials to new materials. In this article," four modernizations "develop synchronously, with the core content of comprehensive, coordinated, and sustainable development, constantly adding new development directions from simplification to four modernizations, And they are interrelated and form a coordinated whole, thus achieving mutual benefit and win-win situation, and achieving synchronous development. Therefore, in the research process, comprehensive consideration, layout, and measures should be taken, emphasizing the mutual promotion and restriction of the "four modernizations". At the same time, sustainable development is required, emphasizing the sustainable use of resources and environment, sustainable innovation in technology, sustainable survival and development of population, and sustainable supply of products.

The third is the synchronous development context and interactive relationship of the "four modernizations". In the early stages of China's economic construction, the goal was to continue the Western industrial revolution and gradually achieve industrialization. During the reform and opening up period, urbanization and industrialization developed rapidly, while the process of agricultural modernization steadily advanced. After the 21st century, information technology has made rapid progress, permeating with other "three modernizations" and consciously embarked on the path of synchronous development of the "four modernizations".

Various phenomena indicate that the "four modernizations" are interrelated, influencing, and promoting each other. Industry provides guarantees for production, urban construction drives the development of residents' needs, and the development of industrialization and urbanization further promotes agricultural efficiency, informatization, and mechanization. Agricultural modernization also provides necessary guarantees and support for urbanization and industrialization, and informatization also promotes the common development of industrialization, urbanization, and agricultural modernization.

According to the planning of the Huaihe River Ecological Economic Belt, the Huaihe River Economic Belt still has great development potential. In the process of synchronous development of the "four modernizations", combined with the development plan of the Huaihe River Economic Belt, agricultural modernization is the foundation of development, industrialization is the driving force of development, urbanization is the catalyst for development, and informatization plays a coordinating role.

4. Empirical Analysis

4.1. Construction of the four modernizations development level system

This article is based on the basic statistical data of economic and social development of 25 provincial and municipal administrative units in the Huaihe River Ecological Economic Belt from 2018 to 2020, combined with a comprehensive evaluation index system composed of industrialization, informatization, urbanization, and agricultural modernization. According to the system coupling coordination model, the coupling and coordinated development trend of the four layers of synchronization are measured, and the development level of the "four modernizations synchronization" in the Huaihe River Economic Belt is analyzed, Explore the synchronous development path and overall pattern of the "four modernizations" in the Huaihe River Ecological Economic Belt.

4.1.1. Overview of the study area

The Huai River Basin is located in the central Henan and eastern regions of China, including Jiangsu and Anhui provinces. The basin contains two major water systems, the Huai River and the Yishusi River, covering 25 provincial capital cities and 4 counties (cities) in Jiangsu Province, Shandong Province, Anhui Province, Henan Province, and Hubei Province. The Huaihe River Basin has fertile land, abundant mineral resources, and a strong agricultural foundation. It is an important traditional agricultural production base in China and an important transportation corridor nationwide. With the proposal of watershed economy, the Huaihe River Ecological Economic Belt is expected to become a regional ecological economic community that connects the eastern and central regions, with the Huaihe River as the economic flow, Zhunan, Bengbu, Xinyang as the core, and Huoqiu, Suqian, and other places in Henan Province as nodes.

To sum up, the development of the Huaihe River ecological economic basin plays a vital role in China's economic and social development and the process of common prosperity for the people of the whole country. At present, the Huaihe River ecological economic belt is still facing constraints such as lagging agricultural development, insufficient urbanization, unbalanced regional development, and environmental, social and economic contradictions. Therefore,

achieving the synchronization of "four modernizations" is a major test for the Huaihe River ecological economic belt.

4.1.2. Data sources

This article selects 25 provincial-level cities within the Huaihe River Ecological Economic Belt as the basic research unit, which has strong regional economic empirical representativeness. The above data is sourced from the China Transportation Statistical Yearbook, China Energy Statistical Yearbook, Jiangsu Statistical Yearbook, Shandong Statistical Yearbook, Anhui Statistical Yearbook, and relevant provincial statistical yearbooks from 2018 to 2020 Annual Statistical Bulletin on National Economic and Social Development and Statistical Bulletin on Environmental Conditions.

4.1.3. Indicator selection

In the selection of the evaluation system for the synchronous development level of the four modernizations, in order to ensure the scientificity, comprehensiveness, and operability of the evaluation indicators, this article establishes an evaluation index system for the "four modernizations" development level of the Huaihe River Ecological Economic Belt, consisting of four primary indicators, 12 secondary indicators, and 36 basic indicators, covering four levels of industrialization, informatization, urbanization, and agricultural modernization.

This article establishes an industrialization evaluation subsystem consisting of 3 categories and 9 indicators, 8 indicators covering 3 aspects of informatization basic indicators, information development indicators, and informatization efficiency indicators, an urbanization evaluation subsystem consisting of 9 indicators from 3 categories, and an agricultural modernization evaluation subsystem consisting of 10 indicators from 3 aspects. The following are the indicators:

Table 1. Indicators of industrialization, informatization, urbanization, and agricultural modernization

Primary indicators	Secondary indicators	Weight
Industrialization	Per capita GDP (yuan)	0.0189
	Per capita industrial output value (yuan)	0.0124
	The proportion of industrial added value to GDP (%)	0.0235
	The proportion of non agricultural personnel in all employees (%)	0.0072
	Labor productivity in the secondary industry (10000 yuan/person)	0.0145
	Proportion of employed personnel in the secondary industry (%)	0.0121
	Output value of comprehensive utilization products of three wastes (yuan)	0.0276
	Comprehensive treatment rate of industrial solid waste (%)	0.0098
	Industrial wastewater discharge compliance rate (%)	0.0122
Informatization	Telephone penetration rate (%)	0.0226
	Mobile phone penetration rate (%)	0.0087
	Internet penetration rate (%)	0.0134
	Per capita postal and telecommunications business volume (yuan/person)	0.0109
	The proportion of employees in the information industry to the total number of employees (%)	0.0022
	The proportion of information industry to GDP (%)	0.0041
	Electronic information industry, manufacturing industry, industrial added value (100 million yuan)	0.1118
	Total profit of electronic information industry manufacturing industry (100 million yuan)	0.0067
Urbanization	Proportion of urban population (%)	0.0129
	Urban registered unemployment rate (%)	0.0013
	Engel's coefficient of urban households (%)	0.0019
	Per capita disposable income of urban households (yuan)	0.0117
	Every 10000 people in the city have public transportation vehicles (standard units/10000 people)	0.0110
	Number of medical beds per 10000 people (pcs)	0.0078
	Urban per capita living area (square meters)	0.0116
	Urban per capita road area (square meters/person)	0.0149
	Green coverage rate in built-up areas (%)	0.0124
Agricultural modernization	Per capita disposable income of farmers (yuan)	0.0152
	Engel's coefficient of rural residents (%)	0.0167
	Per capita housing area of rural residents (square meters/person)	0.0193
	Per capita grain production (kg/person)	0.0220
	Total power of agricultural machinery (10000 kilowatts)	0.0175
	Fertilizer application area (1000 hectares)	0.0126
	Installed capacity of hydropower station (10000 kilowatts)	0.0188
	Rural electricity consumption (100 million kWh)	0.0122
	Per capita agricultural output value (yuan/person)	0.0215
	The proportion of added value of the primary industry to GDP (%)	0.0254

4.1.4. Data processing and weight determination

Considering that the "four modernizations and synchronization" evaluation index system constructed based on the principle of indicator selection has different physical meanings represented by various indicators and there are differences between different dimensions, and some third level indicators have inconsistent measurement units, including positive and

negative attributes. Therefore, in order to comprehensively calculate and compare and analyze indicators of different dimensions. This article adopts the method of extreme standardization to standardize the raw data of various indicators. To eliminate the impact of different dimensions of evaluation indicators, the original indicator values are standardized using formula (1), and then the entropy method is used to objectively measure the weights of each indicator data.

$$Z_{ij} = \begin{cases} \dfrac{X_{ij} - \min X_{ij}}{\max X_{ij} - \min X_{ij}}, & X_{ij} \text{ is a positive indicator;} \\[3mm] \dfrac{\max X_{ij} - X_{ij}}{\max X_{ij} - \min X_{ij}}, & X_{ij} \text{ is a negative indicator.} \end{cases} \tag{1}$$

Where, Xij (i=1, 2... n; j=1, 2... m) is the original value of the jth evaluation index in the i-th year; Zij (i=1, 2... n; j=1, 2... m) is the standardized standard value of the evaluation index.

4.2. Analysis of the development level of the four modernizations

4.2.1. Entropy method

Step 1: Build a data matrix.

$$A = \begin{pmatrix} X_{11} & \cdots & X_{1m} \\ \vdots & \ddots & \vdots \\ X_{n1} & \cdots & X_{nm} \end{pmatrix}_{n \times m} \tag{2}$$

Among them, Xij is the numerical value of the jth indicator in the i-th scheme.

Step 2: Non negative data processing.

Eliminate the impact of different dimensional indicator data on measurement, add 1 to the standardized data, and obtain new indicator data that is still recorded as Xij.

For indicators that are larger and better:

$$X'_{ij} = \frac{X_{ij} - \min(X_{1j}, X_{2j}, \cdots, X_{nj})}{\max(X_{1j}, X_{2j}, \cdots, X_{nj}) - \min(X_{1j}, X_{2j}, \cdots, X_{nj})} + 1 \tag{3}$$

Where, i=1, 2,..., n; j = 1,2,...,m.

For indicators that are smaller and better:

$$X'_{ij} = \frac{\max(X_{1j}, X_{2j}, \cdots, X_{nj}) - X_{ij}}{\max(X_{1j}, X_{2j}, \cdots, X_{nj}) - \min(X_{1j}, X_{2j}, \cdots, X_{nj})} + 1 \tag{4}$$

Where, i=1, 2,..., n; j=1, 2,..., m, for convenience, the data after non negative processing is still recorded as Xij.

Step 3: Calculate weights and entropy values.

Calculate the weight under the jth indicator in the i-th region:

$$P_{ij} = \frac{X_{ij}}{\sum_{i=1}^{n} X_{ij}}$$

(5)

Where, i=1, 2,..., n; j = 1, 2, ..., m. Calculate the entropy value of the jth indicator:

$$e_{ij} = -(\ln m)^{-1} \sum_{i=1}^{n} (P_{ij} \times \ln P_{ij})(0 \leq e_{ij} \leq 1)$$

(6)

Where, ln is the natural logarithm, ej ≥ 0, where the constant k is related to the number of samples m, if k=1/lnm, then 0 ≤ e ≤ 1.

Calculate the coefficient of difference for the jth indicator, and the weight of the indicator obtained is:

$$W_j = \frac{g_j}{\sum_{j=1}^{m} g_j}$$

(7)

Where, j=1, 2,..., m.

Step 4: Calculate score.

Calculate the weights of each indicator from 2018 to 2020 through the above steps, calculate the comprehensive development level of the four modernizations in 25 provincial cities of the Huaihe River Ecological Economic Belt, and rank them accordingly. The formula is as follows:

$$S_i = \sum_{j=1}^{m} W_j^* P_{ij}$$

(8)

Where, i=1, 2,..., n; j=1, 2,..., m. For a more intuitive expression, the final score of the comprehensive development level of the four modernizations synchronization is converted to a percentage system after deducting 1.

Table 2. Comprehensive Score and Ranking of the Four Modernizations Synchronous Development Level of the Huaihe River Ecological Economic Belt from 2018 to 2020

Region	2018		2019		2020		Maximum order difference
	Score	ranking	Score	ranking	Score	ranking	
Yangzhou	72.843	1	75.382	1	73.394	1	0
Bengbu	45.471	11	49.564	10	41.679	11	1
Bozhou	35.984	16	32.092	22	34.041	17	6
Chuzhou	33.14	18	42.985	13	49.916	9	9
Fuyang	36.962	15	35.209	17	34.452	16	2
Heze	44.212	12	37.341	14	38.071	14	2
Huai'an	54.107	7	65.982	5	59.541	5	2
Huaibei	26.604	25	35.421	15	29.941	20	10
Huainan	35.209	17	**28.095**	25	28.841	22	8
Jining	52.595	9	59.712	6	58.253	6	3
Lianyungang	52.692	8	58.471	7	55.082	7	1
Linyi	56.393	5	53.274	9	50.012	8	4
Lu'an	38.551	14	34.731	18	39.367	12	6
Luohe	38.692	13	43.523	12	38.173	13	1
Pingdingshan	30.883	22	32.94	20	33.534	19	3
Shangqiu	32.602	20	28.831	24	26.082	25	5
Suqian	54.271	6	53.381	8	48.288	10	4
Suzhou	32.213	21	31.948	23	33.938	18	5
Taizhou	69.752	2	72.742	2	68.963	2	0
Xinyang	30.242	23	32.728	21	28.481	24	3
Xuzhou	65.985	4	71.383	3	68.043	3	1
Yanchen	68.281	3	67.272	4	62.429	4	1
Zaozhuang	47.285	10	47.591	11	37.713	15	5
Zhoukou	32.931	19	35.341	16	29.51	21	5
Zhumadian	27.23	24	33.321	19	28.837	23	5

Table 3 provides the comprehensive scores and rankings of the development levels of 25 provincial-level cities in the Huaihe River Ecological Economic Belt from 2018 to 2020, reflecting the spatiotemporal dynamic characteristics of regional development. It can be seen that the overall development level of the Huaihe River Ecological Economic Belt is not high (with scores below 80%), which is closely related to the long-term concept of "water disaster control as the main focus and economic development as a supplement" in the Huaihe River Basin and the lack of national development strategy support; The overall development level of each city within the economic belt fluctuates significantly, with most showing an upward trend, indicating that the overall development situation of the economic belt is improving;

From the perspective of the development speed of the "four modernizations", although the level of informatization is slightly lower than other levels, the level of agricultural development ranks second. The development level and speed of urbanization rank third. From the scores of each region, there is a significant regional difference, and the gap is expanding. Among them, Yangzhou ranks first and has the most stable comprehensive development level, with a maximum order difference of 0. It is in a leading position in the entire economic belt.

4.2.2. Coupling degree and coordination model

4.2.2.1. Coupling degree model

This article constructs a composite system coupling model consisting of four subsystems: industrialization, informatization, urbanization, and agricultural modernization. The calculation formula is as follows:

$$C_m = m \left\{ \frac{(u_1 \cdot u_2 \cdot \cdots \cdot u_m)}{\prod (u_r + u_s)} \right\}^{\frac{1}{m}}$$

(9)

Among them, Cm represents the coupling degree of these m systems, m represents the number of systems, u1, u2,..., and um represents the comprehensive index indicator of a certain evaluation unit in the system.

4.2.2.2. Coordination model

This article introduces the concept of coupling coordination index to measure the synchronous development of the "four modernizations" in the Huaihe River ecological and economic belt. The formula is as follows:

$$D = \sqrt{C_m \cdot T}$$

(10)

$$T = \partial u_1 + \beta u_2 + \gamma u_3 + \delta u_4$$

(11)

Among them, D represents the coupling coordination index, and T represents the regional comprehensive evaluation index evaluation index, α, β, γ and δ is the undetermined weight, α + β + γ + δ = 1.

Due to the synchronous and coordinated development of industrialization, informatization, urbanization, and agricultural modernization, each subsystem is regarded as an equal weight calculation of the "four modernizations" synchronous comprehensive development degree of the Huaihe River ecological economic belt, namely α, β,γ and δ The same value is 0.25. On this basis, based on existing research results, the evaluation values of coupling coordination degree are graded according to different values of coupling coordination degree, as shown in Table 3.

Table 3. Classification criteria for coupling coordination degree

Types of coordination	Severe imbalance	Near Dysfunction	Barely coordinated	Primary coordination	Intermediate coordination	Good coordination	High quality coordination
Scope of coordination	[0,0.3)	[0.3,0.5)	[0.5,0.6)	[0.6,0.7)	[0.7,0.8)	[0.8,0.9)	[0.9,1.0]

Table 4. Coupling Coordination Degree and Level of Huaihe River Ecological Economic Belt System (2020)

Region	C	T	D	Coordination type
Yangzhou	0.9806	0.7271	0.8444	Good coordination
Taizhou	0.9096	0.6972	0.7963	
Huai'an	0.9055	0.6937	0.7926	
Xuzhou	0.9196	0.6075	0.7474	
Fuyang	0.9916	0.5563	0.7427	Intermediate coordination
Bengbu	0.965	0.5344	0.7181	
Zaozhuang	0.9931	0.491	0.6983	
Luohe	0.8965	0.5425	0.6974	
Zhumadian	0.9669	0.503	0.6974	
Linyi	0.9809	0.4727	0.6809	Primary coordination
Suqian	0.9569	0.3635	0.5898	
Huaibei	0.9268	0.3331	0.5556	
Chuzhou	0.9554	0.3196	0.5526	
Zhoukou	0.8546	0.3532	0.5494	Barely coordinated
Huainan	0.9326	0.3211	0.5472	
Xinyang	0.946	0.313	0.5441	
Heze	0.8676	0.3121	0.5204	
Bozhou	0.8696	0.2969	0.5081	
Suzhou	0.8587	0.2898	0.4988	
Shangqiu	0.797	0.2931	0.4833	Near Dysfunction
Pingdingshan	0.8975	0.2576	0.4808	
Jining	0.7057	0.3268	0.4802	
Lianyungang	0.8946	0.2482	0.4712	
Lu'an	0.9766	0.2061	0.4486	
Yanchen	0.7085	0.1354	0.3097	

According to the classification criteria of coupled coordinated dispatch, the Huaihe River Ecological Economic Belt can be divided into seven types: high-quality coordination, good coordination, intermediate coordination, primary coordination, reluctant coordination, near imbalance, and severe imbalance. Combined with the level of regional development, it can be roughly divided into four echelons: coordinated development, relative coordination, low-level relative coordination, and low-level imbalance.

According to Table 4, the first tier includes 5 cities: Yangzhou, Xuzhou, Taizhou, Yancheng, and Huai'an. The second tier includes 6 cities: Lianyungang, Suqian, Jining, Linyi, Bengbu, and Chuzhou. The third tier includes 8 cities: Zaozhuang, Heze, Huaibei, Lu'an, Fuyang, Bozhou, Luohe, and Pingdingshan. The fourth tier includes 5 cities: Huainan, Suzhou, Zhumadian, Shangqiu, and Xinyang.

4.2.3. Grey correlation degree measurement

While analyzing the synchronous development of the "four modernizations", this article further analyzes the coupling coordination degree of the "four modernizations" synchronous development and the correlation strength of various influencing factors in the Huaihe River Ecological Economic Belt. The grey correlation method is introduced to measure the correlation degree between the "four modernizations" and their indicators. The calculation results of the correlation degree are shown in Table 5.

Table 5. Grey Correlation Degree of the Synchronous Development Level of the "Four Modernizations" in the Huaihe River Ecological Economic Belt

Primary indicators	Secondary indicators	Correlation
Industrialization	Per capita GDP (yuan)	0.872
	Per capita industrial output value (yuan)	0.911
	The proportion of industrial added value to GDP (%)	0.659
	The proportion of non agricultural personnel in all employees (%)	0.711
	Labor productivity in the secondary industry (10000 yuan/person)	0.904
	Proportion of employed personnel in the secondary industry (%)	0.662
	Output value of comprehensive utilization products of three wastes (yuan)	0.714
	Comprehensive treatment rate of industrial solid waste (%)	0.802
	Industrial wastewater discharge compliance rate (%)	0.703
Informatization	Telephone penetration rate (%)	0.813
	Mobile phone penetration rate (%)	0.714
	Internet penetration rate (%)	0.926
	Per capita postal and telecommunications business volume (yuan/person)	0.799
	The proportion of employees in the information industry to the total number of employees (%)	0.872
	The proportion of information industry to GDP (%)	0.822
	Electronic information industry, manufacturing industry, industrial added value (100 million yuan)	0.917
	Total profit of electronic information industry manufacturing industry (100 million yuan)	0.916
Urbanization	Proportion of urban population (%)	0.611
	Urban registered unemployment rate (%)	0.617
	Engel's coefficient of urban households (%)	0.701
	Per capita disposable income of urban households (yuan)	0.554
	Every 10000 people in the city have public transportation vehicles (standard units/10000 people)	0.592
	Number of medical beds per 10000 people (pcs)	0.721
	Urban per capita living area (square meters)	0.773
	Urban per capita road area (square meters/person)	0.612
	Green coverage rate in built-up areas (%)	0.529
Agricultural modernization	Per capita disposable income of farmers (yuan)	0.922
	Engel's coefficient of rural residents (%)	0.718
	Per capita housing area of rural residents (square meters/person)	0.623
	Per capita grain production (kg/person)	0.836
	Total power of agricultural machinery (10000 kilowatts)	0.921
	Fertilizer application area (1000 hectares)	0.824
	Installed capacity of hydropower station (10000 kilowatts)	0.710
	Rural electricity consumption (100 million kWh)	0.724
	Per capita agricultural output value (yuan/person)	0.810
	The proportion of added value of the primary industry to GDP (%)	0.824

According to the model calculation, the correlation degree of indicators in most target layers of the "Four Modernizations" synchronous development level of the Huaihe River Ecological Economic Belt remains at 0 Above 50, there is a strong correlation with relevant influencing factors. All indicators have a significant impact on the synchronous coupling coordination of

the "four modernizations". In terms of industrialization, the correlation degree between per capita industrial output value, secondary industry labor productivity, per capita GDP, and the comprehensive treatment rate of industrial solid waste is above 0.8, which can be considered to have a positive promoting effect on the synchronous coupling coordination of the "four modernizations" in the Huaihe River Ecological Economic Belt; In terms of informatization, the correlation between the three indicators of electronic information industry manufacturing industry added value, total profit of electronic information industry manufacturing industry, and internet penetration rate is the strongest; In terms of urbanization, the number of medical beds per 10000 people, per capita urban living area, and Engel's coefficient of urban households have the highest correlation with the synchronous coupling and coordination of the "four modernizations" in the indicators; In terms of agricultural modernization, the correlation between per capita disposable income of farmers and the total power of agricultural machinery is higher.

Overall, the correlation between informatization is stronger than industrialization and urbanization, while the overall correlation between industrialization and agricultural modernization is not significantly different, but there are differences in the correlation between the influencing factors of different indicators.

5. Conclusion and Suggestions

Based on the panel data from 2018 to 2020, this paper calculates the synchronous development level of the "four modernizations" of the Huaihe River Ecological Economic Belt, examines and analyzes the development level and influencing factors of the "four modernizations" of China on the Huaihe River Ecological Economic Belt, and finally puts forward countermeasures and suggestions for innovative ways to achieve common prosperity of the Huaihe River Ecological Economic Belt.

The synchronous development level of the "four modernizations" in the Huaihe River Ecological Economic Belt has improved compared to the past, but its development speed is slowing down. The regions with faster development rates are showing a trend of agglomeration from north to south to the central region, and the relative development level of each region may further narrow, but the absolute gap is still very large. The pressure of synchronous development of the "four modernizations" in the Huaihe River ecological and economic belt is still great.

Based on the above analysis of the Huaihe River Ecological Economic Belt, government departments should accelerate the integration of informatization, industrialization, and agricultural modernization, assist in regional industrial transformation, and establish a new pattern of synchronous development of the "four modernizations" with the implementation of the rural revitalization strategy as a coordination mechanism. On the premise of always adhering to the development of agriculture as the foundation, we should continuously leverage the unique advantages of agricultural modernization and steadily move forward together with industrialization and urbanization; Strengthen technological innovation, improve the informatization development level of the Huaihe River Economic Belt as a whole, so as to build a path to achieve common prosperity of the Huaihe River Ecological Economic Belt.

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References

[1] Zhang Sumin. Research on the Reform of Financial Support System for the Development of New Urbanization in China [D]. Xi'an University of Electronic Science and Technology, 2019.

[2] Zhang Guochao. Measurement Methods and Empirical Research on the Synchronous Development of the "Five Modernizations" in Jilin Province [D]. Jilin University of Finance and Economics, 2019.

[3] Liu Yantong. Research on the Development of "Four Modernizations Synchronous" in Sichuan Province Based on the Coupling Coordination Model [D]. Chengdu University of Technology, 2018.

[4] Liu Cong. Research and Countermeasures for the Coordinated Development of the Four Modernizations in Shandong Peninsula [D]. Central China Normal University, 2018.

[5] Li Yang Comparative Study on the Measurement of the Integrated Development Level of China's "New Four Modernizations" [D]. Xi'an University of Electronic Science and Technology, 2017.

[6] Li Guojun. Research on Innovation Driven Promoting the Synchronous Development of the "Four Modernizations" [D]. Henan University, 2017

[7] Shen Xiao. Research on the Development Level and Optimization Strategy of the "San Sheng Space" in Mountain and Rural Areas [D]. Huazhong University of Science and Technology, 2017

[8] Wang Fen. Research on Comprehensive Measurement of the Development Level of New Urbanization [D]. Northeastern University of Finance and Economics, 2016.

[9] Gu Xian asked Comprehensive Evaluation and Empirical Study on the Coordinated Development of Regional "Four Modernizations" and Its Influencing Factors [D]. Hefei University of Technology, 2016.

[10] Yu Wenhua. Research on the Model and Promotion Mechanism of the Synchronous Development of the "Four Modernizations" in the Yangtze River Delta Region [D]. Zhejiang University of Technology, 2015.

[11] Sun Dezhong. Research on Measurement and Evaluation of "Four Modernizations Synchronization" [D]. Henan Agricultural University, 2016.

[12] Shu Jijun. Research on the spatiotemporal differences and impact mechanisms of the synchronous development of China's "four modernizations" [D]. Zhejiang University of Technology, 2015.