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Comprehensive Evaluation and Obstacle Factor Analysis of High-Quality Development of Rural E-Commerce in China

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Abstract: The high-quality development of rural e-commerce is not only one of the important tasks to solve the "three rural" problems and comprehensively promote rural revitalization, but also the internal requirement to implement the new concept of high-quality development and promote the quality and efficiency of rural industries. On the basis of clearly defining the connotation of high-quality development of rural e-commerce in China, this paper established an evaluation index system of high-quality development of rural e-commerce and analyzes the high-quality development level and main restrictive factors of rural e-commerce in China under the new development concept by using the entropy method and an obstacle factor diagnosis model. The results showed that from 2015 to 2020, the overall development quality of rural e-commerce in China showed an upward trend, but it still needs to be improved. The five dimensions of innovation, coordination, openness, green and sharing have different degrees of impact on the development quality of rural e-commerce in China at the present stage, which are as follows: coordination, innovation, sharing, green and opening. The main obstacles to the high-quality development of rural e-commerce in China are coordination and innovation. Researchers; the difference in Internet penetration between urban and rural areas; the upward proportion of agricultural products; regional difference; and industrial agglomeration are the main obstacles to the high-quality development of rural e-commerce in China. Finally, aiming at the main restrictive factors, this paper puts forward the corresponding development countermeasures from five aspects: innovation, coordination, openness, green and sharing.

Keywords: rural e-commerce; high quality development; new development concept; entropy method; obstacle factor model

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1. Introduction

With the rapid development of China's economy, China has now entered a new era with high-quality development as the goal. As an important part of China's economy, the high-quality development of the rural economy is the focus and difficulty of China's overall high-quality economic development. However, with the deployment of relevant policies in China, the popularization of mobile Internet and the accelerated sinking of e-commerce platforms, rural e-commerce has developed rapidly, and become an important force in rural economic development. The high-quality development of rural e-commerce can effectively promote the high-quality development of the rural economy [1]. According to the data from the China Internet Information Center and the Ministry of Commerce, China's rural online retail sales will reach 1.79 trillion yuan in 2020, an increase of 5.30% compared with 2019. The scale of the rural e-commerce market increased from 180 billion yuan in 2014 to 3153.3 billion yuan in 2020, with a compound annual growth rate of 61.20%. At the same time, according to the data of the Alibaba Research Institute, the number of Taobao villages in China will reach 5425 in 2020, and there will be 1756 Taobao towns in 27 provinces (autonomous regions, municipalities directly under the Central Government) in China, an

increase of 638 compared with 2019, with a growth rate of 57%, and more than 8 million people will be employed (Taobao refers to a large online retail platform and business circle in the AP region, which is also a popular online retail platform in China. Taobao village refers to a village where the number of family online stores has reached more than 10% of the local families and the annual e-commerce turnover has reached more than 10 million yuan. Taobao town is proposed based on the concept of Taobao village, which refers to a Taobao village greater than or equal to three, owned by a town, township or street). However, while China's rural e-commerce shows speed advantages, there are still a series of problems such as the low quality of agricultural products, insufficient funds, and lack of talent. The high-quality development level of China's rural e-commerce is still unclear. At the same time, scholars' exploration of high-quality development of rural e-commerce is still limited to continuous optimization on the basis of the original shortcomings, and the specific connotation and direction of high-quality development of rural e-commerce are not clear. For example, Meng Qinglong et al. (2020), Luo Ling (2021), Chen Ronggui (2022) analyzed the current development dilemma of rural e-commerce and said that rural e-commerce can take a high-quality development path by increasing government support, strengthening rural road construction, strengthening talent support, and establishing brand awareness [2–4]. Liu Yan (2022) proposed that the high-quality development of rural e-commerce can be promoted by accelerating the digital transformation of rural e-commerce, improving the financing environment, strengthening personnel training, improving public facilities, and accelerating brand construction by exploring the factors that restrict the high-quality development of rural e-commerce [5]. In terms of the conclusions and judgments of the existing high-quality development research, it is important to clarify the connotation and research ideas of high-quality development. Therefore, this paper aims to combine the characteristics of rural e-commerce and the requirements of high-quality development, define the connotation of high-quality development of rural e-commerce, establish an evaluation system for the development quality of rural e-commerce, and objectively evaluate the development quality of rural e-commerce in China, so as to tap its development potential, improve its comprehensive benefits of development, and achieve its high-quality development.

The main contributions of this paper are as follows: first of all, the connotation of high-quality development of rural e-commerce was clearly defined according to the relevant literature of high-quality development of rural e-commerce and the relevant literature of high-quality development; secondly, according to the connotation of high-quality development of rural e-commerce, the indicator system and measurement method of high-quality development of rural e-commerce should be constructed; thirdly, according to the model analysis, this paper discussed the indicator measurement of the high-quality development of rural e-commerce; fourth, using an obstacle factor analysis to explore the main factors affecting the high-quality development of rural e-commerce; fifthly, according to the research conclusion of this paper, the countermeasures and suggestions for the high-quality development of rural e-commerce and the future research direction were proposed.

2. Literature Review

At present, the high-quality development of rural e-commerce has attracted the attention of the academic community, and a series of research results have emerged. From the existing literature research abroad, there is less research on the high-quality development of rural e-commerce, and more research on the development of rural e-commerce. For example, Jeffrey (2020) said that e-commerce is a good opportunity for direct marketing of rural farms [6]. Vijayant (2019) said that rural e-commerce is a great opportunity for rural development in India, and it should effectively use vernacular and auxiliary commerce to promote the development of rural e-commerce enterprises [7]. By studying the panel data of 27 EU countries from 2011 to 2020, Bădîrcea, et al. (2021) found that education level, consumer residence, consumer labor market status, online banking, mobile and non mobile user related variables all have a significant impact on the development of e-commerce [8].

Through the research on e-commerce development in Ukraine, Poland, et al. (2021) found that the stability of e-commerce investment can help countries recover their economic vitality from the COVID-19 epidemic faster and create more employment opportunities and business development opportunities [9]. Merzlyakova (2021) found that the global growth rate of e-commerce is very high, and its good prospects attract more and more participants [10]. Revinova (2021) found that e-commerce has a high contribution to achieving sustainable development goals and has a positive impact on the sustainable development of all countries, and the world. But at the same time, e-commerce also brings some environmental problems. Countries should improve the quality of e-commerce development and promote the sustainable development of e-commerce [11]. The domestic research on the high-quality development of rural e-commerce mainly includes the following aspects. First, some scholars have studied the concept of high-quality development of rural e-commerce. For example, Zhang Zhigang (2019) proposed to promote the high-quality development of rural e-commerce under the guidance of the new development concept [12]. Wang Xiaobing (2021) stated that. based on the new development stage, rural e-commerce must implement the new development concept, build a new development pattern, and promote the high-quality development of e-commerce for agricultural products [13]. Secondly, some scholars have conducted research on the challenges of the high-quality development of rural e-commerce. For example, Qin Aihua et al. (2021) stated that the high-quality development of rural e-commerce also faces challenges in infrastructure, information circulation, brand appeal, professionals, etc. [14]. Thirdly, some scholars have studied the high-quality development path of rural e-commerce. Liang Xinyue and Bai Minjie (2020) proposed a path to promote the high-quality development of rural e-commerce from the perspective of innovation chain, industry chain, supply chain, service chain and value chain based on the development of e-commerce platforms [15]. Jin Xueying (2021) proposed to promote the high-quality development of rural e-commerce in Liaoning Province from the aspects of rural e-commerce platforms and products, infrastructure construction, and personnel training [16]. Meng Qinglong et al. (2020) believed that the high-quality development of rural e-commerce can be promoted from government support, rural road construction, talent support and brand awareness [2]. Reviewing the above literature, it can be found that, on the one hand, the previous research content may not clearly define the connotation of high-quality development of rural e-commerce, on the other hand, it may lack corresponding quantitative analysis or systematic analysis. Therefore, this paper aimed to clearly define the connotation of high-quality development of rural e-commerce, build a high-quality development indicator system of rural e-commerce, and conduct a quantitative analysis of the development quality of rural e-commerce in China.

To define the connotation of high-quality development of rural e-commerce, we need to analyze the connotation of high-quality development. Some scholars believe that high-quality development is a green, sustainable, and efficient development to make people's lives happier [17,18]. Some scholars believe that high-quality development is a development that reflects the new development concept [19,20]. Some scholars believe that high-quality development is a combination of growth and development, and a combination of economic benefits, social benefits and ecological benefits [21]. Some scholars also set out from two aspects of the main social contradictions to build a high-quality development evaluation index system from five parts: economic vitality, innovation efficiency, green development, people's lives, and social harmony; or from economic development, reform and opening up, urban and rural construction, and ecological environment. Five aspects of people's lives interpret the connotation of high-quality development [22,23]. Based on this, this paper summarizes high-quality development as: to achieve quality and efficiency growth under the premise of paying more attention to meeting the needs of the people, and during this period, the new development concept of "innovation, coordination, openness, green, and sharing" is carried out. Extending the connotation of high-quality development to the field of rural e-commerce, combining the actual development of rural e-commerce in China, we can summarize the connotation of high-quality development of rural e-

commerce as follows, under the premise of implementing the new development concept of innovation, coordination, openness, green and sharing: taking meeting the needs of farmers as the starting point; promoting the development of various rural industries as the goal; improving the quality and efficiency of rural e-commerce; and showing the wealth of farmers and rural beauty. The beautiful blueprint of strong agriculture will accelerate the pace of integrated urban and rural development (Table 1).

Table 1. Research summary.

	Research Connotation	Research Indicators
Previous studies	Liang Xinyue et al. (2020) promoted high-quality development of rural e-commerce from the perspective of five chains of the value chain [15]; Jin Xueying (2021) proposed to promote the high-quality development of rural e-commerce from three aspects: e-commerce platform, infrastructure and talents [16]; Meng Qinglong et al. (2020) said that they could promote the high-quality development of rural e-commerce from the aspects of government, infrastructure, talents and brands [2]; Zhang zhigang (2019) said that the new development concept is of great significance to the high-quality development of rural e-commerce [12]. Wang Xiaobing (2021) said that the high-quality development of rural e-commerce must implement the new development concept [13].	At present, there are few evaluation indexes on the development quality of rural e-commerce, most of which are indicators to measure the development level of rural e-commerce, as follows: He Xin et al. (2020), Yu Xinyu et al. (2019), Li Chuying and Zhao Yuanfeng (2019) constructed research indicators from readiness, degree of application and influence degree directly based on the OECD [24–26]; Duan Lufeng et al. (2016) established an indicator system from the aspects of regional informatization development, macroeconomic development, urban and rural social coordinated development, rural economic development, and rural informatization foundation referring to OECD [27]; Wang Yihai (2020) established evaluation indicators from three aspects: industry development, infrastructure and industrial foundation referring to OECD [28].
This study	This study defines the high-quality development of rural e-commerce as follows: on the premise of implementing the new development concept of innovation, coordination, openness, green and sharing, to meet the needs of farmers and promote the development of rural industries, through rural e-commerce to improve quality and efficiency, we will show the beautiful blueprint of rich farmers, beautiful countryside and strong agriculture, and accelerate the pace of urban-rural integration and development.	Based on the new development concept, the indicator system is constructed from five dimensions of innovative development, coordinated development, open development, green development and shared development.
Research comparison	Previous studies mainly focused on how to promote the high-quality development of rural e-commerce, but did not define the connotation of high-quality development of rural e-commerce. Based on previous studies, this paper clearly defines the concept of high-quality development of rural e-commerce.	Compared with previous studies, this study has expanded the evaluation indicators for exploring the high-quality development of rural e-commerce, and explored a new indicator perspective for the development level of rural e-commerce. At the same time, the research indicators selected in this paper are more in line with the actual changes in the high-quality development of rural e-commerce, and more effectively reflect its high-quality development trend.

On the basis of clearly defining the connotation of high-quality development of rural e-commerce, it is particularly important to scientifically measure its development quality. First, scientific and reasonable evaluation indicators should be selected. At present, there are few indicator systems for the high-quality development of rural e-commerce, and most of them are evaluation indicators for the development of rural e-commerce. Some scholars

have established an indicator system directly based on the OECD method in terms of readiness, application and impact [24–26]. Some scholars have established an indicator system or evaluation indicators from the aspects of regional informatization development, macroeconomic development, urban and rural social coordinated development, rural economic development and rural informatization foundation on the basis of reference to OECD methods [27,28]. However, in the current construction of high-quality development evaluation indicator system, although the selection of indicator dimensions in existing studies is different, they are all based on the new development concept to build the indicator system. For example, some scholars have built an evaluation system from five dimensions: economic development benefits; education and scientific and technological innovation; coordinated development; environmental protection; and people's livelihood security [29]. Some scholars formed a high-quality development evaluation index system from five parts: economic vitality; innovation efficiency; green development; people's lives; and social harmony [22] (Table 1). Secondly, appropriate research methods need to be selected. At present, in the research methods of evaluating high-quality development, scholars mostly use the entropy method [30–32], TOPSIS evaluation method [33], the principal component analysis method [28], triangular fuzzy entropy [26] and other measurement methods. In previous research methods to measure the development level of rural e-commerce, scholars often use the entropy method to analyze and measure [34,35]. Among them, the entropy method is not only a classic, and the most commonly used research method to evaluate high-quality development, but is also a commonly used research method to measure the development level of rural e-commerce, which means that the entropy method is very suitable for evaluating high-quality development of rural e-commerce.

Therefore, this paper proposed to build a high-quality development indicator system of rural e-commerce based on the new development concept by selecting the entropy method to measure the development quality of rural e-commerce in China, and introduced the obstacle degree model to analyze the obstacle factors [36], in order to better analyze the influencing factors of the high-quality development of rural e-commerce, and clarify the influence degree of the key constraints.

3. Research Method

3.1. Index System

Following the principles of systematization, objectivity, and operability, based on the new development concept, this paper selected appropriate indicators and constructed a high-quality development measurement index system of rural e-commerce, including the five first-class indicators of innovative development: coordinated development; open development; green development; shared development; and 19 second-class indicators (Table 2).

Table 2. Measurement index system of rural e-commerce high quality development.

One-Level Index	Two-Level Index	Symbol	Definition	Attribute
Innovative Development	R & D Expenses	A1	R & D expenditure of e-commerce related industries/Total R & D expenditure of information service industry	+
	Research Worker.	A2	R & D personnel in e-commerce related industries/Total R & D personnel in information service industry (full-time equivalent)	+
	R & D Output	A3	Number of effective R & D achievements of rural e-commerce	+
	Enterprise Development Strength	A4	Financing amount of enterprises engaged in rural e-commerce	+

Table 2. *Cont.*

One-Level Index	Two-Level Index	Symbol	Definition	Attribute
Coordinated Development	Difference in Internet Penetration Rate between Urban and Rural Areas	B1	Ratio of urban and rural internet penetration	−
	Difference in Transaction Level of Online Shopping between Urban and Rural Areas	B2	Rural online retail sales/National online retail sales	+
	Degree of Regional Difference	B3	Regional difference of proportion of rural e-commerce online sales	−
	Proportion of Agricultural Products Up	B4	Online retail sales of agricultural products/Rural online retail sales	+
	Industrial Agglomeration	B5	Accumulated number of Taobao villages	+
Open Development	Export Contribution Rate	C1	Cross border e-commerce export of agricultural products/Total cross-border e-commerce export	+
	Trade Competitive Advantage Index	C2	Balance of cross-border e-commerce import and Export of agricultural products/Total amount of cross-border e-commerce import and export	+
	Balance of Product Trade	C3	Cross border e-commerce trade deficit of Chinese agricultural products	−
Green Development	Production of Green Agricultural Products	D1	Annual application amount of agricultural chemical fertilizer	−
	Green Packaging of Rural E-commerce	D2	Annual carbon emission from packaging of rural e-commerce products	−
	Green Logistics of Rural E-commerce	D3	Annual carbon emission of rural e-commerce product transportation	−
Sharing Development	Infrastructure Sharing	E1	Cumulative number of rural e-commerce service stations	+
	Technology Sharing	E2	Accumulated amount of e-commerce Industrial Park	+
	Logistics Sharing	E3	Rural coverage rate of China Express outlets	+
	Fund Sharing	E4	Special funds for rural e-commerce	+

Note: "+" indicates that the indicator plays a positive role in the high-quality development of rural e-commerce, and "−" indicates that the indicator plays a negative role in the high-quality development of rural e-commerce.

(1) Innovative Development Indicators

The level of innovation and development of rural e-commerce is measured by four secondary indicators: R & D expenses, researchers, R & D output, and enterprise development strength. The continuous investment of R & D funds, the continuous increase of R & D personnel and the continuous emergence of enterprise innovation achievements are all the manifestations of the high-quality development of rural e-commerce [37,38]. However, there is still a lack of statistical data specifically for R & D expenditure and R & D personnel in rural e-commerce. Considering that R & D investment and R & D achievements in e-commerce are industry wide, at the same time, refer to the evaluation index system of Zhang Xiaoli (2016) and Deng Jiandi (2021) [39,40]. Therefore, based on the availability of data and the research of relevant scholars, this paper uses the proportion of R & D expenditure of e-commerce related industries in the total R & D expenditure of information services to approximate the R & D expenditure of rural e-commerce industry, and uses the full-time equivalent of R & D personnel of e-commerce related industries in the total R

& D personnel of information services to reflect the R & D personnel investment of rural e-commerce industry ("related industries" refer to internet and related service industries). The R & D output of rural e-commerce industry can be measured by the number of effective R & D achievements applied by enterprises engaged in rural e-commerce. In addition, the innovation ability of rural e-commerce industry originates from the development strength of enterprises in the industry [41], and the development strength of enterprises is limited by the financing ability of various enterprises. Therefore, the financing amount of rural e-commerce enterprises can be used to reflect their development strength. The more the financing amount, the greater the power and support for rural e-commerce innovation.

(2) Coordinated Development Indicators

The level of coordinated development of rural e-commerce is measured by five secondary indicators: the difference in internet penetration rate between urban and rural areas, the difference in online shopping transaction level between urban and rural areas, the degree of regional difference, the proportion of agricultural products and the degree of industrial agglomeration. Among them, the difference between urban and rural internet penetration rates is expressed by the ratio of urban and rural internet penetration rates to reflect the coordination of urban and rural e-commerce development conditions [42]. The difference between urban and rural online shopping transaction level is expressed by the proportion of rural online retail sales in the national online retail sales to reflect the coordination of urban and rural e-commerce development level. The regional difference is reflected by comparing the retail sales of rural e-commerce networks in the eastern, central, western and northeast regions of the country. The greater the difference, the worse the coordinated development of rural e-commerce regions. The upward proportion of agricultural products is based on the basic concept of agricultural products upward. It is measured by the ratio of the online retail sales of agricultural products to the rural online retail sales. This index can reflect the coordination between the development of rural e-commerce and agricultural development to a certain extent, that is, the promotion of the sales of agricultural products by the network flow channels, and also reflect the development of the two-way circulation channels of rural e-commerce; that is, the coordination of "agricultural products up" and "industrial products down". "Agricultural products up" refers to the use of e-commerce platforms to sell agricultural products produced in rural areas to all parts of the country, especially urban areas. "Industrial products down" refers to the use of e-commerce platforms to purchase urban industrial products and then distribute them to rural areas [43,44]. The industrial agglomeration degree is expressed by the accumulated number of Taobao villages. Because Taobao village is the typical representative form of a rural e-commerce industrial cluster formed relying on rural traditional industries and e-commerce, the development of Taobao villages can reflect the coordination between rural e-commerce development and various industries to a certain extent.

(3) Open Development Indicators

The open development level of rural e-commerce is measured by three secondary indicators: export contribution rate, trade competitive advantage index and product trade difference. According to the strategic deployment of the new development pattern, rural e-commerce should not only be based on the domestic market, but also make good use of the international market. Therefore, in the development of rural e-commerce, it is necessary to vigorously develop cross-border e-commerce of agricultural products [45]. Among them, the export contribution rate is measured by the proportion of cross-border e-commerce exports of agricultural products in the total cross-border e-commerce exports to reflect the contribution of the opening and development of rural e-commerce to cross-border e-commerce exports. The trade competitive advantage index uses the proportion of cross-border e-commerce import and export balance of agricultural products in the total cross-border e-commerce import and export to reflect the competitive strength of cross-border development of rural e-commerce in the overall development of cross-border e-commerce in China [46]. The product trade deficit is expressed by the difference between the cross-border e-commerce import and export of agricultural products, that is, the cross-

border e-commerce trade deficit of Chinese agricultural products, to reflect the ability of Chinese rural e-commerce to export agricultural products [47].

(4) Green Development Indicators

The green development level of rural e-commerce is measured by three secondary indicators: green agricultural product production, rural e-commerce green logistics and rural e-commerce green packaging [48]. To promote the green development of rural e-commerce, we need not only green agricultural products that meet the needs of consumers and ensure product safety from the source, but also a green circulation system to reduce the environmental pressure caused in the circulation process. To realize the production of green agricultural products, we need to start with technology, management, and methods, especially to strictly limit the use of chemical substances such as chemical fertilizers and pesticides. Therefore, the annual application of agricultural chemical fertilizers is selected to reflect the production of green agricultural products. The green development of rural e-commerce circulation can be measured by measuring the annual carbon emissions of logistics and product packaging. However, there are no statistical data specifically for the annual carbon emissions of logistics and product packaging in the development of rural e-commerce. Therefore, based on the measurement principle of entropy method and the availability of data, the annual carbon emissions of e-commerce logistics and product packaging were selected in this paper to indirectly reflect the annual carbon emissions of rural e-commerce logistics and packaging [49,50].

(5) Shared Development Indicators

The development level of rural e-commerce sharing is measured by four secondary indicators: infrastructure sharing, technology sharing, logistics sharing and capital sharing [51,52]. Among them, infrastructure sharing is mainly expressed by the accumulated number of rural e-commerce service stations, which not only reflects the importance the country attaches to the construction of rural e-commerce infrastructure, but also provides the premise and foundation for the development of many enterprises engaged in rural e-commerce. The cumulative number of e-commerce parks available for technology sharing indicates that as a professional park focusing on building various e-commerce transaction technology platforms and developing enterprises providing various services for e-commerce transactions, the e-commerce industrial park can not only share technologies among enterprises in the e-commerce Park, but also promote the overall technology sharing of the e-commerce industry due to its strong technology spillover. Logistics sharing is expressed by the rural coverage rate of China Express outlets. This indicator can reflect the construction of logistics sharing channels and shared distribution system of rural e-commerce enterprises to a certain extent. The sharing of funds is reflected by the investment of special funds for rural e-commerce. In order to promote the development of rural e-commerce, the Ministry of Commerce set up the project of "comprehensive demonstration of e-commerce in rural areas" in 2014 and allocated special funds from the Ministry of Finance for the development of rural e-commerce. After that, from the state to local government departments, such funds were allocated every year. The investment of rural e-commerce special funds can benefit many rural e-commerce enterprises and help to realize the sharing of rural e-commerce funds.

3.2. Entropy Method

Entropy method is one of the classical algorithms used to calculate the index weight, which is objective and comprehensive. Sun Kang et al. (2021) calculated the comprehensive index of agricultural high-quality development in Hebei, Shandong and Henan provinces by using the entropy method [30]; Wang Wei (2020) combined the entropy method and TOPSIS method in measuring the high-quality economic development of 31 provinces in China [31]; Sun Peilei (2021) used the entropy method to measure the high-quality development level of China's provincial economy [32]. The existing research shows that it is feasible to measure the high-quality development level by using the entropy method. Therefore, this paper uses entropy method to measure the high-quality development level

of rural e-commerce in China. Before the entropy method is used for calculation, and because the dimensions and units of the selected indicators are inconsistent, the data cannot be directly used for calculation or comparison. In order to eliminate the impact, the indicators are first dimensionless. The specific calculation steps of entropy method are as follows:

(1) Find the proportion of the *i*-th year in the *j*-th index:

$$P_{ij} = \frac{A_{ij}}{\sum_{i=1}^{n} A_{ij}} (j = 1, 2, \ldots, m)$$

Among them, n = 1, 2, . . . , 6, indicates the number of objects to be evaluated, here refers to the selected year; m = 1, 2, . . . , 19, indicating the number of secondary indicators.

(2) Find the entropy value of the *j*-th index:

$$e_j = -k * \sum_{i=1}^{n} P_{ij} * \ln P_{ij}$$

Among them, the constant k is related to the number of objects to be evaluated, let $k = 1/\ln n$, then $0 < e \leq 1$.

(3) Find the difference coefficient of index J:

$$q_j = 1 - e_j$$

Among them, the greater the difference coefficient, the greater the evaluation effect on specific indicators, and the smaller the entropy value. Therefore, the greater the difference coefficient, the more important the indicators are.

(4) Find the weight of index J:

$$\mathrm{R}_j = \frac{q_j}{\sum_{j=1}^{m} q_j} (j = 1, 2, \ldots, m)$$

(5) Obtain comprehensive evaluation score:

$$F_i = \sum_{j=1}^{m} \mathrm{R}_j * A_{ij} (i = 1, 2, \ldots, n)$$

3.3. Obstacle Factor Analysis

Scholars often use obstacle factor analysis to explore the influencing factors [36,53]. The evaluation index system of the high-quality development of rural e-commerce in China contains multiple indicators of different dimensions, and the specific impact of each indicator on the comprehensive index of the high-quality development of rural e-commerce is different. In order to further explore the impact of various dimensions and indicators on the high-quality development of rural e-commerce, this paper introduces the barrier degree model to analyze, so as to find out the key factors restricting the high-quality development of rural e-commerce. The obstacle degree model includes three parts: factor contribution degree, index deviation degree and obstacle degree, wherein factor contribution degree represents the influence degree of a single factor on the overall goal; The indicator deviation indicates the gap between a single indicator and the ideal goal of high-quality development of rural e-commerce; The barrier degree indicates the barrier degree of each indicator to the high-quality development of rural e-commerce. The specific formula is as follows:

$$\mathrm{H}_j = S_c * R_j$$

$$\mathrm{B}_j = 1 - \mathrm{P}_{ij}$$

$$\mathrm{T}_j = \frac{\mathrm{B}_j * H_j}{\sum_{j=1}^{n} B_j * H_j} * 100\%$$

$$L_c = \sum T_j$$

In the formula, H_j represents the factor contribution degree, S_c represents the weight of the *c*-th first-class index in the evaluation system, and R_j represents the weight of the *j*-th index in the *c*-th first-class index; B_j represents the deviation degree of the index, and P_{ij} represents the standardized value of the *j*-th index; T_j represents the obstacle degree of each secondary index, and L_c represents the obstacle degree of each primary index.

3.4. Data Sources

The State Council formally proposed to promote the development of rural e-commerce in 2015, so this paper selects the relevant data of rural e-commerce from 2015 to 2020 for research. The data mainly come from China Statistical Yearbook, China Rural Statistical Yearbook, China Science and technology statistical yearbook, China rural e-commerce logistics development report, China rural e-commerce industry report, China rural e-commerce market data report and China industrial information network from 2015 to 2020. For some incomplete data, this paper used a regression model to calculate the predicted value. In addition, for the indicators with different positive and negative directions in the evaluation index system, the direction of the indicators was standardized through range standardization.

4. Results and Analysis

4.1. Index Weight Result

Based on the connotation of high-quality development of rural e-commerce in China, we selected relevant data to calculate the weight of each indicator in the high-quality development indicator system of rural e-commerce through entropy method, as shown in Table 3. It can be seen from Table 3 that the contribution of the five first level indicators to the comprehensive evaluation index of rural e-commerce is ranked as: coordination, innovation, sharing, green, and opening. In the secondary indicators, researchers (A2), urban-rural Internet penetration difference (B1), enterprise development strength (A4), regional difference (B3), capital sharing (E4), agricultural products up share (B4), green agricultural products production (D1), rural e-commerce green logistics (D3), and industrial agglomeration (B5) account for a large proportion in the indicator system of high-quality development of rural e-commerce, and are mainly concentrated in innovation Among the four first level indicators of coordination, green and sharing, the weight of each second level indicator under the opening indicator is small.

Specifically, the improvement of the high-quality development of China's rural e-commerce in the period from 2015 to 2020 mainly depends on the promotion of coordination and innovation dimensions. The opening dimension is the weakest link in the high-quality development of China's rural e-commerce. Among them, the coordinated development dimension contributes the most, which is due to the comprehensive and rapid promotion of China's urban-rural integration construction in recent years, and the strong industrial correlation effect; The contribution of innovation and development dimension is only lower than that of coordinated development, which is not only due to the joint efforts of government departments at all levels, e-commerce enterprises and relevant institutions, but also inseparable from the powerful role of the market mechanism; The contribution of the open development dimension lags behind the other four aspects, which means that the open development of rural e-commerce should be the focus of its high-quality development in the next stage, which is similar to the case study analysis results of Sheng Fan (2021) [54].

Table 3. Index weights.

One-Level Index	Weight	Two-Level Index	Symbol	Weight	Rank
Innovative Development	0.2570	R & D Expenses	A1	0.0375	13
		Research Worker.	A2	0.1012	1
		R & D Output	A3	0.0397	12
		Enterprise Development Strength	A4	0.0786	3
Coordinated Development	0.3078	Difference in Internet Penetration Rate between Urban and Rural Areas	B1	0.0888	2
		Difference in Transaction Level of Online Shopping between Urban and Rural Areas	B2	0.0264	19
		Degree of Regional Difference	B3	0.7460	4
		Proportion of Agricultural Products Up	B4	0.0663	6
		Industrial Agglomeration	B5	0.0517	9
Open Development	0.0975	Export Contribution Rate	C1	0.0304	17
		Trade Competitive Advantage Index	C2	0.0373	14
		Balance of Product Trade	C3	0.0298	18
Green Development	0.1646	Production of Green Agricultural Products	D1	0.0620	7
		Green Packaging of Rural E-commerce	D2	0.0496	10
		Green Logistics of Rural E-commerce	D3	0.0530	8
Sharing Development	0.1731	Infrastructure Sharing	E1	0.0404	11
		Technology Sharing	E2	0.0309	16
		Logistics Sharing	E3	0.0324	15
		Fund Sharing	E4	0.0694	5

4.2. Analysis on the High Quality Development of Rural E-Commerce in China

According to the measurement results of the above-mentioned high-quality development level measurement indicator system of rural e-commerce, the scores of each level-1 indicator, comprehensive evaluation scores and growth rate of each year from 2015 to 2020 are calculated, as shown in Table 4. In order to make the analysis results more clear, we analyzed them in turn from the comprehensive evaluation scores, the growth rate and the index scores of each level in each year.

Table 4. Comprehensive score of high-quality development level of rural e-commerce in 2015—2020.

Year	Innovation	Coordinate	Open	Green	Sharing	Comprehensive Score (%)	Growth Rate (%)
2015	0.0514	0.1416	0.0433	0.1026	0.0099	34.88	-
2016	0.1511	0.1062	0.0640	0.0717	0.0381	43.10	23.57
2017	0.1251	0.1167	0.0798	0.0602	0.0942	47.59	10.42
2018	0.1134	0.0751	0.0789	0.0611	0.1444	47.29	−0.63
2019	0.0429	0.1487	0.0709	0.0673	0.1125	44.24	−6.45
2020	0.0978	0.2069	0.0290	0.0621	0.1037	49.94	12.88

First of all, a simple analysis was carried out on the comprehensive score of high-quality development of rural e-commerce. It can be seen from Table 4 and Figure 1 that the comprehensive score of high-quality development of China's rural e-commerce increased from 34.88% in 2015 to 49.94% in 2020, with an increase of 16.06%. This shows that the overall comprehensive score of high-quality development of China's rural e-commerce from 2015 to 2020 shows an upward trend, and the quality of China's rural e-commerce development is constantly improving. Among them, in 2019, the comprehensive score

decreased significantly. The main reason for this is that the comprehensive score of the three indicators of innovation, openness and sharing decreased at the same time, especially the innovation and development level, which contributed a lot to high-quality development, declined significantly.

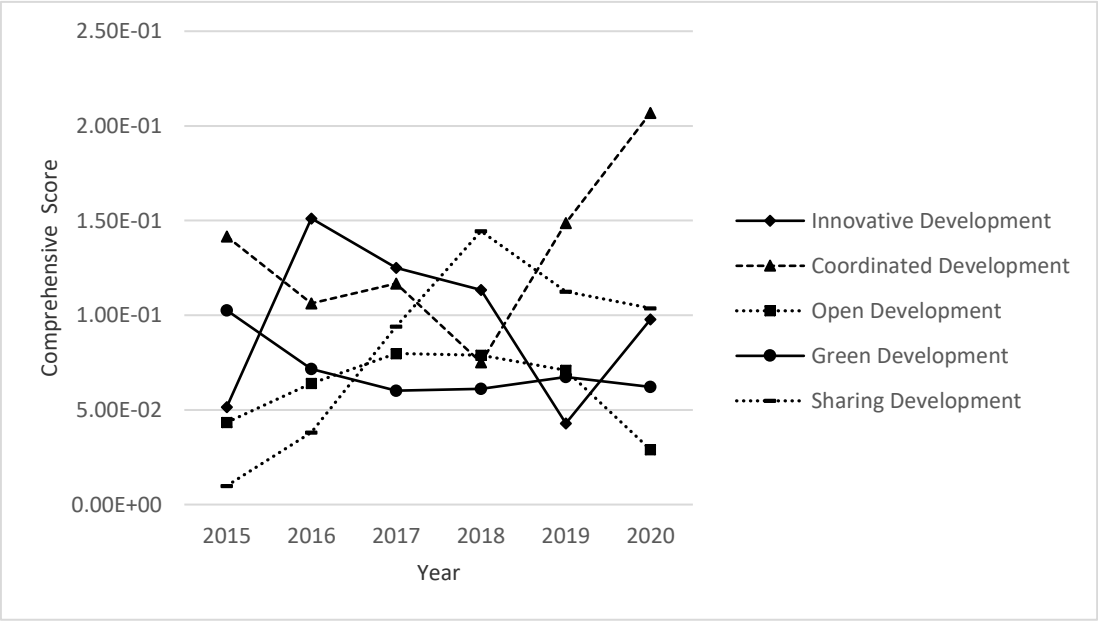

Figure 1. Comprehensive evaluation score of primary index of rural e-commerce development quality.

Secondly, after understanding the comprehensive score changes of high-quality development of rural e-commerce, continue to analyze its growth rate. From the perspective of growth rate, the growth rate of rural e-commerce in China increased significantly from 2015 to 2016, which is due to the explosive growth of rural e-commerce in this period. Although the comprehensive score of its high-quality development level is relatively low, the growth rate is fast. Specifically, on 4 May 2015, the State Council issued the Opinions on Vigorously Developing E-Commerce and Accelerating the Cultivation of New Economic Motives, which clearly put forward relevant policies to promote the development of rural e-commerce, leading the development of rural e-commerce to a new climax. The enthusiasm for the development of rural e-commerce in various regions rose, e-commerce enterprises accelerated their pace of entering the countryside, rural e-commerce service sites were rapidly established, and the vast majority of farmers have access to the Internet. Therefore, rural e-commerce grew rapidly during this period. However, after the initial rapid growth, some problems in the development of rural e-commerce gradually exposed, its development gradually became rational, and the development speed began to slow down. Therefore, since 2017, the comprehensive score growth rate of China's high-quality development level of rural e-commerce began to decline, and even negative growth in 2018 and 2019. Until 2020, the outbreak of COVID-19 not only affected and impacted the production and operation of traditional industries, but also created new opportunities for the development of online business. The development of rural e-commerce has risen against the trend, and the comprehensive score growth rate of its high-quality development level has increased significantly. Further analysis of the reasons shows that in 2020, innovative development and coordinated development played a significant role in driving forward development, promoting the comprehensive score growth rate of the high-quality development level of rural e-commerce from negative to positive. From the above analysis, it can be seen that the development quality of rural e-commerce in China has obviously

fluctuated and has not been steadily improved, and there is still a big gap with regard to the goal of high-quality development.

Third, after understanding the changes of comprehensive score and growth rate of high-quality development of rural e-commerce, we will further analyze the changes of specific primary and secondary indicators. From the perspective of innovation and development indicators, the comprehensive score of China's rural e-commerce innovation and development increased from 0.0514 in 2015 to 0.0978 in 2020. The overall score showed an upward trend, but the fluctuation was obvious. It continued to decline in 2016–2019, dropped to the lowest in 2019, and then began to rise. It can be seen from the specific analysis that the innovation development needs the continuous promotion of sufficient human and financial resources. The researchers (A2) and the enterprise development strength (A4) fluctuate too much during this period, and their comprehensive effects inhibit the stable improvement of the innovation development level. In fact, this kind of change is something that needs to be paid attention to in industrial innovation and development [55,56].

From the perspective of coordinated development indicators, its comprehensive score increased from 0.1416 in 2015 to 0.2069 in 2020, with a large increase, but it has been in a downward trend from 2015 to 2018. Specific analysis shows that during 2015–2018, the growth rate of online retail sales of agricultural products was significantly slower than the growth rate of rural online retail sales, and the upward proportion of agricultural products (B4) decreased [43]. At the same time, in this stage, although rural e-commerce in China develops rapidly, the phenomenon of regional imbalance is relatively obvious, and the indicators show that the regional difference (B3) after standardized treatment is continuously decreasing. Therefore, under the influence of the changes of these two indicators, the coordinated development level of rural e-commerce has declined. After 2018, in addition to the regional difference, the change trends of other secondary indicators are conducive to promoting the coordinated development of rural e-commerce. In particular, the difference between urban and rural internet penetration rates is getting smaller and smaller, creating the basic conditions for the coordinated development of urban and rural e-commerce [57].

From the perspective of open development indicators, the change of its comprehensive score is relatively gentle, from 0.0433 in 2015 to 0.0290 in 2020, with only 0.0143 change during the period, and the overall change is small. Specific analysis shows that before 2017, the total cross-border e-commerce exports of agricultural products increased year by year, and the trade competitive advantage index (C2) increased, which became the main reason for the improvement of the comprehensive score of rural e-commerce opening and development. After 2017, although the total amount of cross-border e-commerce exports of agricultural products has been rising, its proportion in the total amount of cross-border e-commerce exports has become smaller and smaller. Moreover, after 2017, the cross-border e-commerce trade deficit of agricultural products has become larger and larger, and its proportion in the total amount of cross-border e-commerce imports and exports has become smaller and smaller, resulting in a gradual decline in the opening development index of rural e-commerce [58]. Especially in 2020, due to the impact of COVID-19, cross-border e-commerce exports of agricultural products plummeted, resulting in an obvious decline in the open development curve [59].

From the perspective of green development indicators, its comprehensive score decreased by 0.0405 from 0.1026 in 2015 to 0.0621 in 2020. According to the development of rural e-commerce in recent years, in the initial stage of rural e-commerce development, speed is more important than quality. It blindly pursues the improvement of economic benefits and lacks the concept of green development. Therefore, with the continuous increase of rural e-commerce transaction volume, the annual carbon emissions of logistics and packaging are also on the rise, which will inevitably lead to the continuous decline of its green development level. After 2017, the Chinese government, relevant competent departments and e-commerce subjects gradually realized that the sustainable and healthy

development of rural e-commerce needs to be guided by the new development concept, and green development has become a new direction of rural e-commerce development. In this context, rural e-commerce has started to advocate the concepts of green distribution, green packaging, and green storage in the development of rural e-commerce, in order to effectively reduce the pollution and waste caused by the development of rural e-commerce. Therefore, after 2017, due to the gradual promotion of green logistics and green packaging, and the rapid increase in the types and quantities of green agricultural products traded through rural e-commerce platforms, the comprehensive score of green development in this period did not continue to decline, showing a relatively stable development state. In fact, this change is basically consistent with the current development of rural e-commerce [60].

From the perspective of shared development indicators, its comprehensive score increased from 0.0099 in 2015 to 0.1037 in 2020, an increase of 0.0938. However, there were obvious fluctuations during the period, which continued to rise before 2018 and then fell. After the five development concepts of "innovation, coordination, green, openness and sharing" were first proposed at the Fifth Plenary Session of the 18th CPC Central Committee in October 2015, the concept of shared development began to permeate in all fields, and rural e-commerce also began to make full use of the advantages of the sharing economy in its development. Infrastructure sharing, technology sharing and logistics sharing were important factors to promote the shared development of rural e-commerce in this period. After 2018, as the special funds for rural e-commerce issued by the government began to decrease continuously, the lack of shared funds led to a downward trend in the comprehensive score of shared development indicators, which reflects that the development of rural e-commerce sharing still relies on the government and needs to continue to rely on government support. This is basically consistent with the research results of Shen Yanhang et al. (2022) [55].

4.3. Diagnosis and Analysis of Obstacle Factors

On the basis of measuring the high-quality development level of China's rural e-commerce, in order to further explore the key constraints of the high-quality development of China's rural e-commerce, this study continued to use the obstacle factor diagnosis method to calculate the obstacle degree of each indicator in the high-quality development indicator system of China's rural e-commerce from 2015 to 2020.

First, the obstacle degree of each level-1 indicator was calculated. It can be seen from Figure 2 that the obstacle degree of coordinated development gradually increased from 2015 to 2018 and was significantly higher than that of other first-class indicators from 2016 to 2018, reaching 54.42% in 2018. After that, the obstacle degree of coordinated development gradually decreased and dropped to 29.32% in 2020. The degree of obstacles to innovation and development showed a trend of first decreasing, then slowly increasing, and then gradually decreasing, and reached the highest among the first level indicators in 2015, 2019 and 2020, and the highest was 40.69%. In addition, the barrier degree of green development shows a trend of rising first, then falling and then rising, the barrier degree of shared development shows a trend of falling first and then rising, and the barrier degree of open development shows a trend of falling first and then rising. As can be seen from Figure 2, the barrier degree of these three indicators is relatively low, especially the barrier degree of open development is always at the lowest level. At the same time, it can be seen from Figure 2 that since 2018, the blocking effect of shared development factors and open development factors on the high-quality development of rural e-commerce in China has gradually increased, while the blocking effect of coordinated development factors has gradually weakened. At the same time, the ranking of the average value of each level of indicator obstacles from 2015 to 2020 is as follows: coordinated development (41.68%), innovative development (31.27%), green development (12.29%), shared development (11.85%), and open development (2.9%). It shows that although the obstacles of coordinated development factors tend to weaken, coordinated development and innovative development are still the most critical factors restricting the high-quality development of rural e-commerce in China.

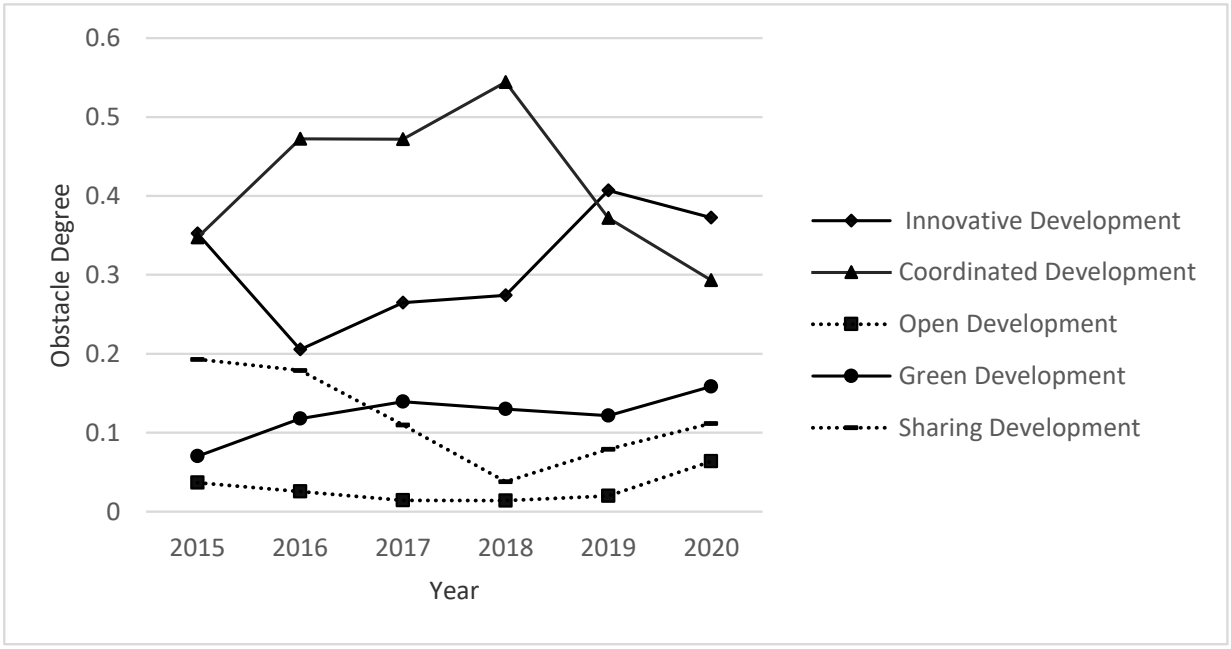

Figure 2. Obstacle degree of primary index for high-quality development of rural e-commerce in China in 2015–2020.

Secondly, the obstacle degree of each secondary index was measured, as shown in Table 5. Considering that there are many secondary indicators in the evaluation index system, in order to deeply explore the key obstacle factors affecting the high-quality development of rural e-commerce in China, the top five indicators with the highest obstacle degree each year are determined as the main obstacle factors. It can be seen from Table 4 that during 2015–2020, researchers (A2) have become the main obstacle factors for five times; The enterprise development strength (A4), the difference in internet penetration rate between urban and rural areas (B1), and the upward proportion of agricultural products (B4) have been the main obstacles four times; The degree of regional difference (B3) and the degree of industrial agglomeration (B5) have become the main obstacles three times; green agricultural product production (D1) and capital sharing (E4) became the main obstacles twice; green packaging (D2) and green logistics (D3) became the main obstacles once. Ranking the secondary indicators from 2015 to 2020 according to the average value of the degree of obstacle, we can find that researchers (A2) has the highest degree of obstacles, and the average value of the degree of obstacle is 14.16%; The second is the difference in Internet penetration rate between urban and rural areas (B1), with an average barrier of 13.51%; The third to fifth places are the upward share of agricultural products (B4), regional difference (B3) and enterprise development strength (A4).

From the obstacle factor analysis, we can determine the measurement value of the obstacle degree of the primary and secondary indicators, and see that the key restricting factors for the high-quality development of rural e-commerce in China are coordinated development and innovative development. Specifically, this is mainly manifested in such factors as researchers, the difference in Internet penetration rate between urban and rural areas, the proportion of agricultural products, the regional difference, the development strength of enterprises, and the industrial concentration.

Table 5. Major obstacles to China's rural e-commerce development in 2015—2020.

Secondary Indicators	Obstacle Degree (%)/(Year)						Top5 Frequency
	2015	2016	2017	2018	2019	2020	
X1	2.78	2.40	2.86	0.00	7.22	6.95	1
X2	12.02	0.00	19.28	11.19	18.96	23.48	5
X3	6.91	5.78	4.35	3.90	0.00	1.01	0
X4	13.57	12.35	0.00	12.30	14.51	5.82	4
X5	18.27	20.66	19.05	16.02	7.09	0.00	4
X6	5.57	0.01	0.00	1.57	0.91	1.93	0
X7	0.00	2.33	2.56	17.10	15.87	21.72	3
X8	0.00	13.46	16.43	13.93	10.44	5.67	4
X9	10.88	10.80	9.14	5.80	2.90	0.00	3
X10	1.14	0.00	0.04	0.50	0.75	2.83	0
X11	2.53	2.22	0.83	0.18	0.00	0.78	0
X12	0.00	0.33	0.55	0.72	1.25	2.76	0
X13	7.02	7.44	6.37	3.74	0.99	0.00	2
X14	0.00	2.05	3.56	4.37	5.35	7.67	1
X15	0.00	2.28	3.98	4.88	5.83	8.18	1
X16	4.78	4.16	3.29	2.66	1.52	0.00	0
X17	3.69	2.47	0.83	0.21	0.11	0.00	0
X18	3.86	2.78	1.63	0.92	0.31	0.00	0
X19	6.98	8.48	5.25	0.00	5.99	11.19	2

4.4. Discussion

The comprehensive evaluation and obstacle factor analysis of high-quality development of rural e-commerce in China will help to accurately grasp the overall development level and dynamic trend and clarify the specific direction of high-quality development of rural e-commerce. In this study, based on the new development concept, we clearly defined the connotation of high-quality development of rural e-commerce, and measured the level and influencing factors of high-quality development of rural e-commerce in China using entropy method and obstacle factor analysis. This study supplements the connotation of high-quality development of rural e-commerce and enriches the research content of high-quality development of rural e-commerce. At the same time, the research conclusions have important reference value for solving the "three rural" problems, promoting the high-quality development of rural economy and rural e-commerce, and helping rural revitalization.

The study found that the quality of rural e-commerce development in China has significantly improved, and the overall trend is on the rise. The key to the high-quality development of China's rural e-commerce should also be coordinated development and innovative development. Researchers, the difference between urban and rural Internet penetration rates, the upward proportion of agricultural products, regional differences, and industrial clustering are the main obstacles affecting the high-quality development of China's rural e-commerce. Although there are few documents measuring the high-quality development of rural e-commerce in China, it can be further explained and supported by other research results on rural e-commerce development or factors affecting rural e-commerce development. First, in recent years, with the progress of e-commerce technology, the improvement of rural infrastructure and the strong support of relevant policies, China's rural e-commerce has developed rapidly, the development model has been constantly changing, and the development quality has been significantly improved. Liu Jia (2020) found that China's rural e-commerce is in the stage of transformation from growth to maturity [61], Wang Xiaoyu (2021) measured that the overall rural e-commerce in Anhui Province is growing [34], and Chen Dongyue (2020) measured that the development level of rural e-commerce in Ningxia has significantly improved, showing an overall upward trend, which also supports the research conclusions of this paper from the side [35]. Second, the focus of high-quality development of rural e-commerce in China should also be coordinated

development and innovative development. The above conclusions are basically consistent with the research of the following scholars: Feng Xianwei (2022) and Zhang Huajie (2022) indicated that rural e-commerce should promote innovative development [62,63]; Tan Yanwei (2021) attached importance to the cultivation of innovative talents in rural e-commerce [64]; Guo Na (2021) concluded that coordinated development has a greater impact on rural e-commerce development [65]. However, compared with previous studies, the coordinated development and innovative development in this study cover more elements, and the indicator variables are more specific. Third, researchers, differences in Internet penetration between urban and rural areas, the proportion of agricultural products rising, regional differences, and industrial clustering are the main obstacles affecting the high-quality development of China's rural e-commerce. This research conclusion is more consistent with the research conclusions of the following scholars, including Bu Wenjuan (2018) who found that the upward movement of agricultural products in rural e-commerce is still a problem [66]; Wang Xiaoyu et al. (2021), who concluded that industrial agglomeration, informatization foundation and two-way circulation pattern of industrial and agricultural products have an important impact on the development of rural e-commerce [34]; Chen Dongyue (2020) who concluded that the internet foundation has a significant impact on the development level of rural e-commerce [35]; and Zhang Hong, et al. (2019) concluded that the regional differences of rural e-commerce in China are large, and the development level of rural e-commerce is unevenly distributed [67]. However, in view of the impact of the two-way circulation pattern of industrial and agricultural products on the development of rural e-commerce and the uneven development level of regional rural e-commerce caused by large regional differences, this study further uses the proportion of agricultural products in the upstream and regional differences to quantify the specific impact of these two factors on the high-quality development of rural e-commerce compared with previous studies [34,66,67]. At the same time, the key influencing factors obtained in this study also include researchers. In previous studies, scholars may have constructed more indicators to evaluate the development level of rural e-commerce based on the readiness, application, and impact of rural e-commerce, so they rarely took into account the impact of industrial innovation changes on the development level of rural e-commerce [24–28]. However, in the process of discussing the high-quality development of rural e-commerce, we found that the innovative changes brought about by researchers are also crucial to the high-quality development of rural e-commerce, which should be paid attention to.

5. Conclusions and Countermeasures

5.1. Conclusions

On the basis of defining the connotation and requirements of the high-quality development level of rural e-commerce, this paper constructed a measurement index system of the high-quality development level of rural e-commerce in China from the five dimensions of innovation, coordination, openness, green and sharing, and used the entropy method to measure the relevant statistical data of rural e-commerce. At the same time, it further analyzed the specific influencing factors through the obstacle factor analysis. Finally, we obtained the research conclusion of the high-quality development level of rural e-commerce in China and its influencing factors.

First of all, from 2015 to 2020, the quality level of China's rural e-commerce development has significantly improved, and the overall trend is on the rise. Secondly, the growth rate of the comprehensive score of the high-quality development level of China's rural e-commerce fluctuates greatly, with negative growth in some years. The quality of China's rural e-commerce development has not yet maintained a steady rise. Third, the ranking of the primary indicators that affect the quality of China's rural e-commerce development is: coordinated development, innovative development, shared development, green development, and open development. Fourth, the key constraints to the high-quality development of rural e-commerce in China are coordinated development and innovative development at this stage, which means the focus of high-quality development of rural e-commerce in

China should also be coordinated development and innovative development. To be specific, researchers, differences in urban and rural Internet penetration, the upward proportion of agricultural products, regional differences, and industrial agglomeration are the main obstacles affecting the high-quality development of rural e-commerce in China, which means that researchers, differences in urban and rural Internet penetration, the upward proportion of agricultural products, regional differences, and industrial agglomeration are the main factors affecting the high-quality development of rural e-commerce in China. Therefore, attention should be paid to the development of these aspects when promoting the high-quality development of rural e-commerce.

5.2. Countermeasures

It can be seen from the above research conclusions that in order to promote the high-quality development of China's rural e-commerce, efforts should be made from five dimensions: innovation, coordination, openness, green and sharing. We should recognize the weaknesses, lock in the main obstacles, and clarify the development priorities in the meantime.

(1) Strive to intensify the force of innovative development of e-commerce. On the one hand, local government departments and e-commerce enterprises should formulate attractive talent introduction measures to attract college graduates of relevant majors to engage in R & D in rural e-commerce. At the same time, the administrative department in charge, industry associations and e-commerce enterprises should conduct regular training and technical exchanges for existing R & D personnel through various ways to continuously improve their innovation awareness and innovation ability. On the other hand, local government departments should create a good policy environment for relevant enterprises engaged in rural e-commerce through preferential policies in combination with local actual conditions. Simultaneously, various financial institutions should give certain support to rural e-commerce enterprises in terms of loans, especially give special interest rate preference to the funds used for the development of new technologies, application of new models and new patent applications of rural e-commerce, to improve its financing environment.

(2) Continue to promote the degree of coordinated development of rural e-commerce. Firstly, we will vigorously promote the construction of digital villages, continue to improve the rural network infrastructure, improve the internet penetration rate in rural areas, and reduce the difference in internet penetration rate between urban and rural areas. Secondly, it is necessary to further strengthen the construction of rural e-commerce platform, improve farmers' e-commerce awareness and online sales skills, continuously expand the types of agricultural products sold online, and standardize the online sales operation of agricultural products, so as to promote the faster growth of online retail sales of agricultural products, and gradually increase the ratio of online retail sales of agricultural products to rural online retail sales, promote the coordination between two-way circulation channels of rural e-commerce and agricultural production. Thirdly, the government or enterprises should promote the better development of rural e-commerce to provide docking assistance to the underdeveloped areas, including the mining of characteristic products, the building of characteristic brands, experience and technical support, to reduce the regional differences of rural e-commerce development to a certain extent. Fourthly, local government departments should continue to encourage and guide the development of Taobao village and Taobao town. While achieving the growth of Taobao village and Taobao town, they should cultivate the characteristics of Taobao village, reduce low-level competition, constantly expand the scale of Taobao village and Taobao town, and further enhance the industrial agglomeration of rural e-commerce. At the same time, the national and local government departments, on the premise of clarifying the regional differences in the current development of rural e-commerce, should comprehensively promote the healthy development of rural e-commerce according to local conditions through the joint role of policy guidance and market driving, that is, the regions with earlier, faster and better e-commerce development should do a good

job of transformation and upgrading, while the regions with later and slower e-commerce development, or even not yet started, should accelerate the construction process.

(3) Focus on formulating measures for the open development of rural e-commerce. Open development is the weakest link in the high-quality development of rural e-commerce in China, and it is also an area that should be focused on. On the one hand, in order to promote rural e-commerce enterprises to carry out cross-border trade, we should continue to introduce a number of support policies and and relevant preferential policies to promote qualified enterprises to carry out cross-border e-commerce of agricultural products, such as implementing tax incentives and financial subsidies for certain products. On the other hand, we should closely focus on the "the Belt and Road" economic belt, and guide enterprises engaged in rural e-commerce to timely understand the huge foreign agricultural product market demand, so that they can actively participate in cross-border e-commerce of agricultural products. In addition, because cross-border e-commerce has more business links, more complex operations, more stringent conditions, more difficult environment control and higher risks than domestic e-commerce, it also requires joint efforts in finance, logistics, customs, technology, and other related fields to provide various support services for rural e-commerce enterprises, and ultimately achieves the goal of improving the open development level of rural e-commerce.

(4) Constantly enhance the depth of rural e-commerce sharing development. At present, China's rural e-commerce has achieved certain results in infrastructure sharing, technology sharing, logistics sharing, capital sharing, etc. However, only shallow sharing has been realized, there is still an obvious gap in capital sharing. Therefore, on the first hand, we should continue to promote the construction of rural e-commerce service stations and industrial parks, optimize, and upgrade them in a timely manner, and create a better infrastructure and technology sharing environment for the development of rural e-commerce. The second aspect is to identify the weaknesses of rural logistics, improve the construction of rural logistics system, optimize the layout of logistics outlets, and realize the deep sharing of rural e-commerce logistics. Third, the national and local government departments should allocate special funds according to the actual needs of rural e-commerce development in various regions, effectively improve the use efficiency of special funds, and do not equate fund sharing with equal distribution. In addition, it is also necessary to seize the opportunity to integrate human resource sharing, management sharing and cultural sharing into the development of rural e-commerce, so as to enhance the depth and breadth of rural e-commerce sharing.

(5) Effectively accelerate the green development of rural e-commerce. On the one hand, we should accelerate the integration of the concepts of ecological logistics, environmental logistics and low-carbon logistics into all aspects of logistics activities. At the same time, it is necessary to make full use of advanced science and technology to reasonably plan logistics activities, improve logistics efficiency, comprehensively build a logistics system that reflects the "green" characteristics, actively promote the upgrading of the logistics industry to help the green development of rural e-commerce. On the other hand, enterprises engaged in rural e-commerce business should improve their awareness of environmental protection. When selling goods through the internet, they should constantly improve the utilization rate of degradable materials in commodity packaging to limit white pollution to the maximum extent. At the same time, we should advocate simplicity and economy in the use of sales packaging to gradually change the phenomenon of excessive packaging; In the use of transportation packaging, we should advocate the use of recyclable packaging to realize the reuse of packaging resources. In addition, while actively promoting the development of green logistics and green packaging, enterprises engaged in rural e-commerce should also provide "two-way" guidance for the production and consumption of green agricultural products, and gradually increase the market share of green agricultural products.

5.3. Prospects

Although we have measured the high-quality development level of rural e-commerce in China and analyzed its influencing factors, there are still the following shortcomings: First, based on the availability of data and the quantifiability of indicators, some indicators of the evaluation indicator system in this paper may not be refined and accurate enough, and the correlation between the first and second level indicators needs to be further strengthened. In measuring the high-quality development of China's rural e-commerce, there may be a need to be more convincing. Second, although the research method of this paper is a classic indicator evaluation method, it may be too weak for in-depth research on the high-quality development of rural e-commerce and its influencing factors, which needs to be expanded and improved in future research for analysis. Third, because the research units were selected at the national level, the study only discusses the differences between regions in China from the part of coordinated development, which is not deep enough. In this regard, future research can improve our shortcomings in the above aspects: first, future research can try to explore more indicators that can directly measure the high-quality development of rural e-commerce, so as to enhance the persuasiveness of the research results; Secondly, future research can choose other methods to measure the high-quality development of rural e-commerce and its influencing factors. Finally, future research can further narrow down the research units and make further analysis from the provincial and municipal perspective, which will help to further understand the space-time evolution of the high-quality development of rural e-commerce.

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