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Research Article

Influencing Factors Analysis of Collaborative Development Level of New Retail and Cold Chain Distribution of Agricultural Products under Low-Carbon

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With the annual growth of agricultural products， which has greatly met People's daily needs. It is of great practical significance to introduce the low-carbon concept into the retail and cold chain logistics of agricultural products. However, few studies have designed the coupling relationship between the new retail of agricultural products and the development of cold chain distribution. In this context, this work uses principal component analysis (PCA) to extract the common core factors that affect the operational benefits of cold chain low-carbon distribution and the consumer experience of new agricultural retail. Then, the coupling linkage model of cold chain low-carbon distribution and new retail of agricultural products was constructed by using grey correlation analysis. Finally, a new retail and agricultural products cold chain coupling mechanism under low-carbon distribution is designed. The work is helpful to improve the new downstream supply chain retail enterprise management ability of agricultural products, promote cold-chain distribution business benefit and business value, and also helps to promote the implementation of the strategy of rejuvenating and promote the country. This study is conducive to improving the downstream supply chain management ability of new agricultural retail enterprises, enhancing the cold chain distribution business efficiency and business value, and ultimately promoting the implementation of a rural revitalization strategy.

1. Introduction

Despite the rapid development, China's cold chain logistics started later than in other countries [1, 2]. The layout of the cold chain infrastructure is unreasonable. Cold storage and refrigerated vehicles are widely distributed in the eastern coastal regions, while few are distributed in the inland and western regions [3]. The uneven distribution leads to functional imbalance. Due to the lack of systematic and coherent links in production, transportation, and sales, it is easy to cause a serious loss of agricultural product quality [4]. At present, about 77% of domestic aquatic products, 85% of meat, and 92% of fruits and vegetables are not transported by cold chain but are transported and sold at normal temperature. The annual loss of fruits alone is about 12 million tons, and the loss of vegetables is close to 130 million tons.

Data show that nearly 25% of fruits and 33% of vegetables are damaged in the process of transportation and storage every year, with a value of up to 75 billion yuan [5]. From the purchase and transportation of fresh products to the final delivery to customers, the reason for the breakpoint of cold chain logistics is ultimately the high logistics cost. The special characteristics of cold chain logistics require that the whole process from fresh product output to final consumption should set the temperature in a suitable range, which requires the cold chain distribution center to have a certain number of refrigeration facilities, equipment storage sites, and advanced operation and management level. Naturally, logistics enterprises choose to give up the cold chain or partially choose the cold chain, thus allowing some fresh products to suffer loss or quality problems, which is very common in some vegetables and fruits logistics transportation.

According to the National Bureau of Statistics, the GDP of 2021 was about 114.367 trillion yuan, an increase of about 8.1% compared with 2020. The national disposable income of residents was 80976 yuan, and the per capita consumption expenditure was 24,387 yuan, among which, consumer spending about 26% of used in food consumption expenditure [6]. With the improvement of social and economic level, people's quality of life has also been greatly improved [7]. The heat of fresh e-commerce has increased since 2014, especially Alibaba, Jingdong, and other leading e-commerce enterprises in the development of fresh agricultural products have achieved great success. The current fresh e-commerce is in the blue sea, which means that the total market size growth rate of 59.7%. However, the growth trend is relatively slow, as shown in Figure 1. Where the blue line represents the total trade size of agricultural products (100 million yuan), and the yellow line represents the growth rate of the total market size. This is because the traditional fresh food e-commerce has no physical business place, the cost of goods is much higher than the traditional fresh food enterprises, and the user experience of consumers is not good, so the popularity is not very high.

In addition, the online business brings insufficient consumer experience, insufficient services, and other phenomena. It is far from enough to expand the consumer market through online operation. Therefore, agricultural fresh e-commerce needs to expand offline business at the same time. In addition to model innovation, new retail also needs good products, which makes cold chain logistics play a crucial role in the distribution of fresh products. Besides, the characteristics of efficiency cost need to be considered comprehensively when selecting the location of a distribution center [8], which greatly increases the complexity of the decision-making process. If the location of the distribution center is reasonable, it will help to improve the smoothness and distribution efficiency of cold chain logistics and ultimately improve the development level of the cold chain distribution industry of agricultural products. Reference [9]. Since the World Climate Conference in Copenhagen has attracted wide attention around the world and the low-carbon concept characterized by more and more people [10, 11]. The logistics industry is one of the ten revitalization industries planned by the state. To study the factors affecting the collaborative development level of new retail is of great significance to reduce logistics cost, consumer satisfaction is improved and the collaborative development of cold chain distribution is promoted in the agricultural retail industry [12]. The research of this paper has important theoretical and practical significance: the logistics and distribution process consumes a lot of fuel, and the energy consumption cost has accounted for 40% or even more of the enterprise's operating cost. As the economy shifts to a high level of development and produces a large number of carbon emissions, cold chain logistics enterprises can reasonably arrange the delivery time and route according to the local traffic laws. Thus, the pressure of urban carbon emission can be effectively alleviated.

2. Related Work

While ensuring the development of the industrial economy, it is also necessary to reduce consumption as much as possible and avoid the generation of greenhouse gases through some technological innovations [13, 14]. The cold chain logistics distribution mode can be divided into power refrigeration cold chain distribution mode and cold storage cold chain distribution mode [15]. Power refrigeration cold chain distribution mode refers to the use of a vehicle engine driven refrigeration unit system to provide the cold source. Using refrigerated truck refrigeration, the temperature is easy to control, and suitable for a long time, long distance, or large volume of fresh perishable goods distribution and transportation [16]. The power refrigeration cold chain distribution mode will naturally consume energy. At present, most cold chain distribution vehicles are powered by gasoline, which not only consumes a lot of energy but also produces a lot of polluting gas and causes great pollution to the environment. Cold storage cold chain distribution mode refers to the distribution mode that maintains the temperature of fresh products by using cold storage materials (such as dry ice, ice cubes, and temperature storage board) and cold storage packaging to complete cold chain distribution and transportation. This mode is very suitable for small batch, multiple times, end customers scattered short distance low temperature distribution [17]. At present, the common and standard cold storage distribution is to put the frozen cold storage into the cold storage box as a cold source and observe the temperature in the box through the thermometer outside the box to maintain the conditions required by the cold chain products. This distribution mode can be delivered by ordinary pickup trucks. Optimizing the distribution network is one of the effective ways to reduce greenhouse gas and air pollutant emissions from vehicles. The location of the cold chain distribution center is ultimately to determine the geographical location and number of distribution centers in the logistics network, which should comply with the principles of economic, adaptability, coordination, and strategic location. The goal is to minimize greenhouse gas emissions and air pollutants, maximize benefits, and optimize service levels.

Due to the characteristics of perishable and fragile, timely distribution, and so on; fresh agricultural products in the procurement, distribution, and transportation of each link should be equipped with refrigeration and maintain constant temperature logistics equipment [18, 19]. Based on this, the cold chain distribution of new retail fresh e-commerce has the following characteristics: (1) the new retail environment consumers most belong to high salary ($1.5w$ + monthly income) work white-collar clan, and they do not price sensitive. However, the pursuit of higher product service and cold chain distribution process to ensure the efficient transportation process and maintain product freshness is also an important factor affecting the development of new retail of agricultural products. (2) The dispersion and uncertainty of consumers' order areas will

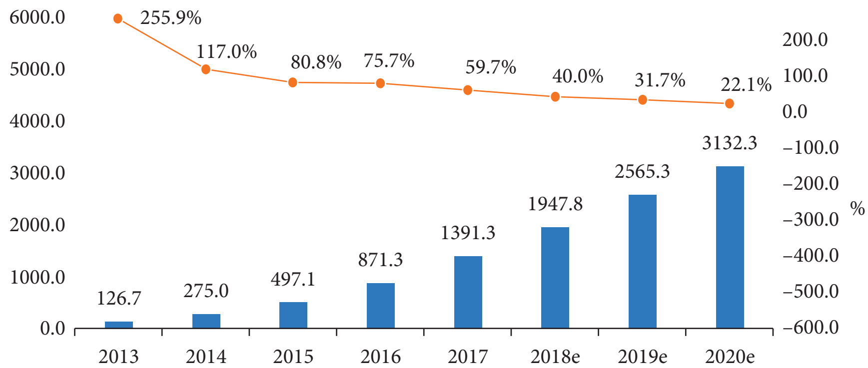

Figure 1: Trade size of agricultural products market in China from 2013 to 2020.

increase the cost of cold chain distribution. Therefore, in response to consumers' demand for immediacy and to ensure the timeliness of distribution in the future, it is necessary to divide distribution scope and limit distribution distance [20]. (3) To ensure that the fresh agricultural products delivered to consumers are in a fresh state and reduce the product loss rate on the way to distribution, the distribution needs to be equipped with cold chain devices that can maintain refrigeration and constant temperature. At the same time, in order to quickly respond to the fragmented and immediate consumer demand in the new consumption scenario.

At present, the domestic research studies on the logistics distribution mode of fresh agricultural products are relatively less and mainly focus on the optimization of the distribution mode. Through extensive literature research, we know that the existing cold chain distribution of agricultural products is mainly based on a self-established logistics mode. Secondly, as consumers pay more and more attention to the quality of products and services, fresh e-commerce is gradually developing to a diversified distribution model. However, the consumption concept and consumption structure are gradually changing [21].

The concept of low-carbon advocated by the Chinese government is deepening [22, 23]. Some experts and scholars put forward corresponding suggestions for the unsolved problem and many scholars have taken the carbon emission factor into consideration when studying the path optimization problems of single distribution center and multidistribution center. Considering the insufficient capacity of a single distribution center, scholars have gradually changed their research on path optimization from a single distribution center to multidistribution center and taken the carbon emission factor into consideration, but such research is relatively rare [24, 25]. In order to ensure the quality of fresh agricultural products and meet the requirements of low-carbon green logistics, an optimization model of the cold chain distribution path of fresh agricultural products was established to minimize the total cost, and a genetic algorithm and tabu search algorithm were designed to solve the model in [26]. However, the relevant solving algorithms are mainly focused on the basic heuristic algorithm. Therefore, in the case that the enterprise has multiple distribution centers and enough distribution vehicles, the algorithm and model are improved to provide a theoretical basis for exploring the development level of cold chain distribution and new retail [27, 28]. The urban environment has attracted wide attention more and more researchers are paying attention to low-carbon logistics. At present, most of the research on low-carbon logistics focuses on three aspects: location of low-carbon and cold chain distribution center, optimization of low-carbon and cold chain logistics path, and operation management of low-carbon and cold chain logistics.

It is found that the research on cold chain logistics in recent years mainly focuses on the following aspects:

(1) Strengthening cold chain logistics management through research on cold chain storage inventory management, temperature control, risk warning, operation process management, and logistics alliance

(2) Reduce new retail costs: at present, most scholars at home and abroad are focused on the study of retail sales model, focusing on how to improve the algorithm to make the calculation method better, how to build a better model to reduce the cost of cold chain logistics to achieve energy saving and consumption reduction, which is of great significance to improve the development of cold chain logistics

(3) To improve the service: improve the service quality of cold chain logistics by analyzing consumer behavior and factors affecting consumer experience, such as delivery time and freshness of products

(4) Policy interpretation and industry forecast. Fresh e-commerce, cross-border trade, and technological innovation have promoted the rapid development of the cold chain industry

Based on the above-given discussions, the main contributions of this paper are given as follows:

(1) In this paper, PCA and GRA models are fused for the first time to analyze the coupling relationship between agricultural retail and cold chain distribution

(2) The research content of this paper not only has important theoretical significance but also can provide decision support for the development of

the agricultural retail and cold chain distribution industry and has certain practical application value

3. The Proposed New Method

3.1. Principal Component Analysis Model. Principal Component Analysis (PCA) [29] is the most common and representative multivariate statistical method, which is widely used in fault detection. It converts the original variables into new unrelated variables through the maximum variance criterion. The new variables with larger variances are called the principal components and can retain the information in the original data as much as possible, while the variables with smaller variances are the projections of the original data in the residual space. Therefore, PCA decomposed the original data into master subspace and residual subspace and established statistical indicators in the two subspaces respectively for fault detection. The specific mathematical principles are as follows:

$$\mathbf{X} = \sum_{i=1}^{m} \mathbf{t}_i \mathbf{p}_i^{\mathrm{T}} = \mathbf{T}\mathbf{P}^{\mathrm{T}} + \mathbf{E}, \tag{1}$$

where $\mathbf{t}_i$ and $\mathbf{p}_i$ are the ith principal component and the corresponding load vector, respectively, $\mathbf{P}$ and $\mathbf{T}$ are the load matrix and score matrix of the master subspace, respectively. $\mathbf{E}$ represents the residual matrix. K represents the number of retained principal components, which is usually determined by the cumulative percent variance (CPV) principle for new real-time measurement data set X. The following two statistics (also called Square Prediction Error, SPE) are often used to monitor the variation and correlation of principal component subspace PCS and residual subspace (RS), respectively.

$$\begin{aligned} T^2 &= \mathbf{x}^{\mathrm{T}} \mathbf{P} \mathbf{\Lambda}^{-1} \mathbf{P}^{\mathrm{T}} \mathbf{x}, \\ Q &= \mathbf{x}^{\mathrm{T}} \left(\mathbf{I} - \mathbf{P}\mathbf{P}^{\mathrm{T}} \right) \mathbf{x}, \end{aligned} \tag{2}$$

where Λ is the covariance matrix of T, and the following control limits are used to determine whether the monitored process is running under normal conditions.

$$\begin{aligned} T_{\lim}^2 &\leq \frac{d(n-1)}{n-k} F_{k,(n-k),\rho}, \\ Q_\rho &\leq g\chi_{h,\rho}^2; \, g = \frac{v}{2a}, h = \frac{2a^2}{v}. \end{aligned} \tag{3}$$

Among them, the $F_{k,(n-k),\rho}$ is the F distribution of degrees of freedom k and $n-k$ with confidence ρ. a and v are the mean and variance estimated from the Q statistic, respectively.

3.2. Grey Relation Analysis. Grey Relation Analysis (GRA) is a multifactor statistical analysis method [30]. To put it simply, in a grey system, we want to know the relative strength of a certain item we are concerned with influenced by other factors. We can see which of the factors we are looking at are more relevant. The analysis index system is determined and analysis data are collected according to the analysis purpose. Suppose n data sequences form the following equation:

$$\left(X_1', X_2' \ldots, X_n' \right) = \begin{pmatrix} x_1'(1) & x_2'(1) & \cdots & x_n'(1) \\ x_1'(2) & x_2'(2) & \cdots & x_n'(2) \\ \vdots & \vdots & \vdots & \vdots \\ x_1'(m) & x_2'(m) & \cdots & x_n'(m) \end{pmatrix}, \tag{4}$$

where the $x_1'(1)\ldots x_1'(m)$ are the time series values, and m is the number of variables.

$$\begin{aligned} X_i' &= \left(x_i'(1), x_i'(2), \ldots, x_i'(m) \right)^T, \\ i &= 1, 2, \ldots, n, \\ X_0' &= \left(x_0'(1), x_0'(2), \ldots, x_0'(m) \right), \\ x_i(k) &= \frac{\left(x_i'(k) \right)}{\left(1/m \sum_{k=1}^{m} x_i'(k) \right)}, \\ x_i(k) &= \frac{x_i'(k)}{x_i'(1)}, \\ \left(X_0, X_1, \ldots, X_n \right) &= \begin{pmatrix} x_0(1) & x_1(1) & \cdots & x_n(1) \\ x_0(2) & x_1(2) & \cdots & x_n(2) \\ \vdots & \vdots & \vdots & \vdots \\ x_0(m) & x_1(m) & \cdots & x_n(m) \end{pmatrix}. \end{aligned} \tag{5}$$

According to (6), the similarity indexes are calculated, respectively,

$$\zeta_i(k) = \frac{\min_i \min_k \left| x_0(k) - x_i(k) \right| + \rho \cdot \max_i \max_k \left| x_0(k) - x_i(k) \right|}{\left| x_0(k) - x_i(k) \right| + \rho \cdot \max_i \max_k \left| x_0(k) - x_i(k) \right|}, \tag{6}$$

where ρ is the resolution coefficient, and ρ is set as 0.5 in this paper. And, a new calculation method is used here to solve the following problem:

$$\zeta_i(k) = \frac{\min_i \left| x_0'(k) - x_i'(k) \right| + \rho \cdot \max_i \left| x_0'(k) - x_i'(k) \right|}{\left| x_0'(k) - x_i'(k) \right| + \rho \cdot \max_i \left| x_0'(k) - x_i'(k) \right|}. \tag{7}$$

Based on the above-given discussions, the analysis method of influencing factors on the collaborative development level proposed in this work under the perspective of low carbon is shown in Figure 2, which mainly includes based on PCA, the cold chain distribution model by GRA, after that the influencing factors are discussed.

4. Experimental Results and Analysis

4.1. Experimental Data Collection and Design. The simulation data set used in this paper comes from China Statistical Yearbook (2010–2020), China Logistics Statistical Yearbook (2010–2020), etc. All data sets are standardized and noise, abnormal points, and other unusable data are eliminated.

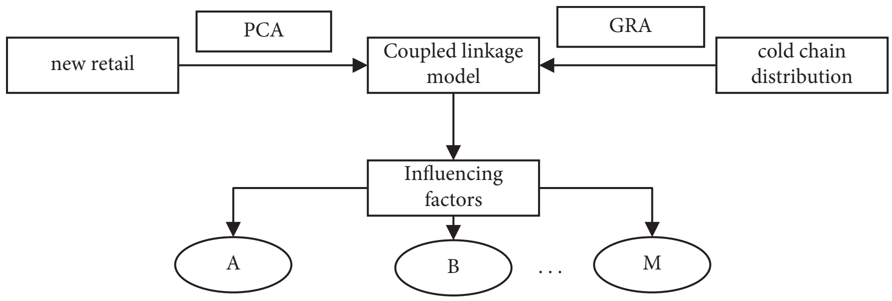

Figure 2: The overall process of the method proposed in this paper.

4.2. Establishment of Influencing Factors System. On the basis of full market research, the common core factors affecting the operation efficiency of cold chain low-carbon distribution and consumer experience of new retail of agricultural products are extracted by PCA. In particular, the development level of the new retail of agricultural products is mainly determined by the scale of foreign trade and living standard. The level of economic development is mainly determined by the per capita GDP ($Y1$), the total economic investment ($Y2$), and so on. And, the cold chain distribution is mainly determined by logistics development income, cold chain development potential, and cold chain development basis, which is specifically determined by cold chain transportation income ($X1$), the proportion of cold chain income to total income ($X2$), and other factors. The details are shown in Table 1.

In addition, although the coupling factor system shown in Table 1 has been established based on literature research, the operation among these influencing factors is very complex, and the probability of occurrence of different factors is also different, which is beneficial for future studies. Figure 3 shows the posterior probability and probability importance of all influencing factors. As can be seen from the figure, the posterior probabilities of $Y9$ and $X3$ are the most important.

4.3. Experimental Results. In particular, Table 2 gives the coupling relationship of cold chain distribution and agricultural retail. From the table, we know that after 2018, the development of cold chain distribution has grown rapidly, exceeding the development speed of agricultural retail. In addition, the coupling degree (0.9490~ 0.9956) is significantly higher than the coupling coordination degree (0.5307~ 0.8088).

In addition to some objective quantitative factors mentioned above that can describe the effect of the model, some subjective factors of cold chain distribution will also have a great impact on the collaborative development level, such as $X1$, $X4$, and $X6$. The specific statistical results are shown in Figure 4. As can be seen from the figure, the mean values of most factors are in a relatively stable range, but the factor $X2$ varies widely. This means that the factor $X2$ has an unusual influence on cold chain distribution.

Figure 5 gives the coupling trends from 2011 to 2020. As can be seen from the figure, the coupling coordination degree of 2011 to 2013 are 0.5307 and 0.5465, which means cold chain distribution can not keep up with new retail developments. And, the same situation happens on 2013 to 2017. From 2019 to 2020, the degree of coordination fluctuated between 0.7330 and 0.8088, indicating that the two are in a transitional stage from moderate coordination to good coordination. Then, on this basis, specific strategies are developed to narrow the difference between the actual cost and the standard cost of each operation link, so as to realize the cost control of the horizontal operation process.

Besides, Table 3 gives the coupling effect matrix of cold chain distribution and new retail. It can be seen from the table that there is a close correlation between cold chain distribution and new retail.

Figure 6 shows the correlation distribution among different influencing factors, in which different points represent different factors, and the line indicates the correlation between the two factors, while the color of the line indicates the correlation.

In addition, based on the above-given analysis of influencing factors on the collaborative development of them, we present the variation trend of carbon emission and total carbon cost with carbon price under full carbon quota, as shown in Figure 7. As can be seen from the figure, under the interaction of these factors, the carbon trading price, total carbon emissions, and total consumption are in a relatively stable trend, indicating that the research in this paper meets the requirements of low-carbon emissions. Through longitudinal distribution transportation operation link in process of cost control, vehicle scheduling, precooling, stock, check the documents, handling, loading, distribution, transportation operation link cost control optimization effect is obvious, other assignments link before and after the optimization of the total cost difference is smaller before and after optimal total cost curve is a slight fluctuation but basic overlap.

According to the above-mentioned analysis, in order to promote the long-term development of enterprises, enterprises need to enhance the awareness of social responsibility and environmental protection, pay attention to the distribution efficiency and quality of cold chain distribution of fresh agricultural products, and pay attention to the impact of carbon emissions on the environment.

Table 1: The influencing factors system.

System	Dimension	Index	Codes
New retail development	Economic development level	The per capita GDP	$Y1$
		Total investment in fixed assets	$Y2$
		Added value in the tertiary industry	$Y3$
	Foreign trade level	Per capita retail sales of consumer goods	$Y4$
		Total import volume	$Y5$
		Foreign direct investment	$Y6$
	Living standards	Per capita food consumption	$Y7$
		Per capita disposable income	$Y8$
		Number of employees	$Y9$
		Household consumption levels	$Y10$
Cold chain distribution	Cold chain distribution benefits	Cold chain road transport revenue	$X1$
		Total revenue of cold chain industry	$X2$
		Total value of food transported	$X3$
	Cold chain distribution operation capability	Cold chain freight growth rate	$X4$
		Cold chain freight turnover	$X5$
		Agricultural products cold chain distribution demand	$X6$
	Cold chain distribution fundamentals	Number of cold-chain distribution personnel	$X7$
		Urban cold chain distribution growth rate	$X8$
		The per capita cold storage capacity	$X9$
		Growth rate of refrigerated vehicles	$X10$

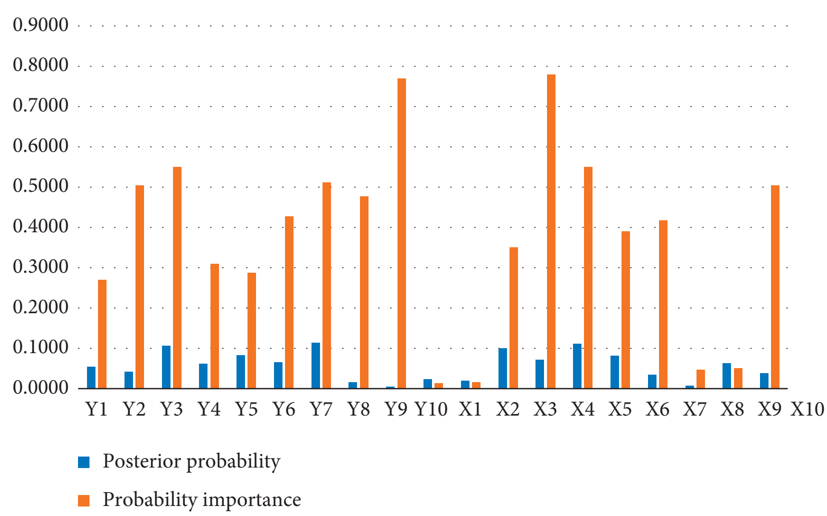

Figure 3: Comparison of prior probability and posterior probability of each factor.

Table 2: Evaluation results of cold chain distribution and agricultural retail.

Year	Cold chain distribution development index U	New retail development index G	Coupling degree C	Coupling stages	Coupling coordination degree D	Coupling coordination grade
2010	0.212	0.314	0.951	High level coupling stage	0.523	Coordination
2011	0.284	0.388	0.972	High level coupling stage	0.571	Coordination
2012	0.243	0.3728	0.969	High level coupling stage	0.534	Coordination
2013	0.362	0.476	0.980	High level coupling stage	0.623	Basic coordination
2014	0.425	0.491	0.991	High level coupling stage	0.623	Basic coordination

Table 2: Continued.

Year	Cold chain distribution development index U	New retail development index G	Coupling degree C	Coupling stages	Coupling coordination degree D	Coupling coordination grade
2015	0.403	0.492	0.988	High level coupling stage	0.657	Basic coordination
2016	0.342	0.523	0.976	High level coupling stage	0.624	Basic coordination
2017	0.372	0.556	0.984	High level coupling stage	0.672	Basic coordination
2018	0.512	0.572	0.919	High level coupling stage	0.754	Moderate coordination
2019	0.722	0.610	0.992	High level coupling stage	0.817	Good coordination

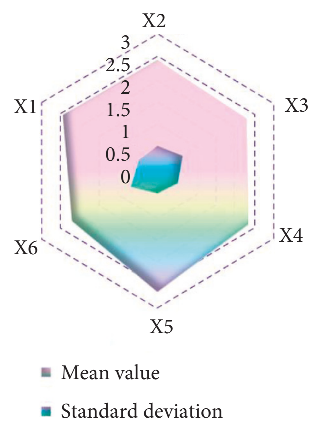

Figure 4: Statistical results of influencing factors of them.

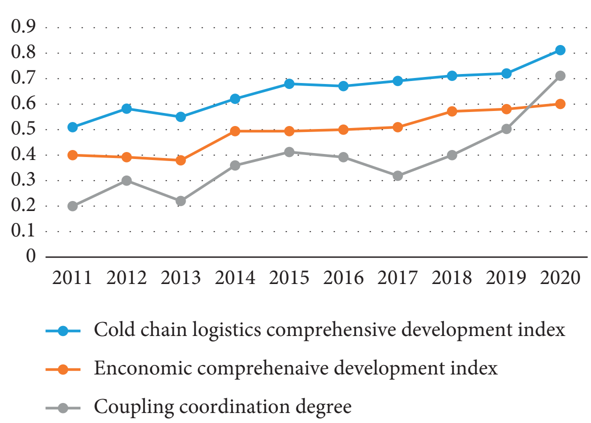

Figure 5: Coupling trends from 2011 to 2020.

Table 3: The coupling effect matrix of cold chain distribution and new retail.

	*X*1	*X*2	*X*3	*X*4	*X*5	*X*6	*X*7	*X*8	*X*9	*X*10	Avg
Y1	0.672	0.766	0.824	0.456	0.872	0.743	0.886	0.569	0.928	0.53	0.756
Y2	0.794	0.612	0.687	0.527	0.724	0.679	0.722	0.597	0.881	0.547	0.674
Y3	0.654	0.7587	0.8615	0.466	0.937	0.756	0.922	0.516	0.996	0.592	0.733
Y4	0.714	0.718	0.785	0.452	0.8387	0.7342	0.841	0.512	0.924	0.570	0.702

Table 3: Continued.

	*X*1	*X*2	*X*3	*X*4	*X*5	*X*6	*X*7	*X*8	*X*9	*X*10	Avg
***Y*5**	0.475	0.545	0.487	0.803	0.475	0.567	0.480	0.903	0.4799	0.754	0.584
***Y*6**	0.4638	0.654	0.585	0.696	0.557	0.566	0.546	0.851	0.5343	0.752	0.627
***Y*7**	0.719	0.636	0.733	0.565	0.742	0.721	0.794	0.513	0.776	0.586	0.667
***Y*8**	0.519	0.5498	0.524	0.772	0.515	0.534	0.560	0.780	0.562	0.627	0.507
***Y*9**	0.807	0.586	0.642	0.534	0.678	0.623	0.6901	0.599	0.709	0.563	0.621
***Y*10**	0.6814	0.727	0.826	0.482	0.884	0.763	0.838	0.538	0.970	0.568	0.714
Avg	0.653	0.657	0.691	0.583	0.723	0.665	0.755	0.697	0.705	0.514	0.668

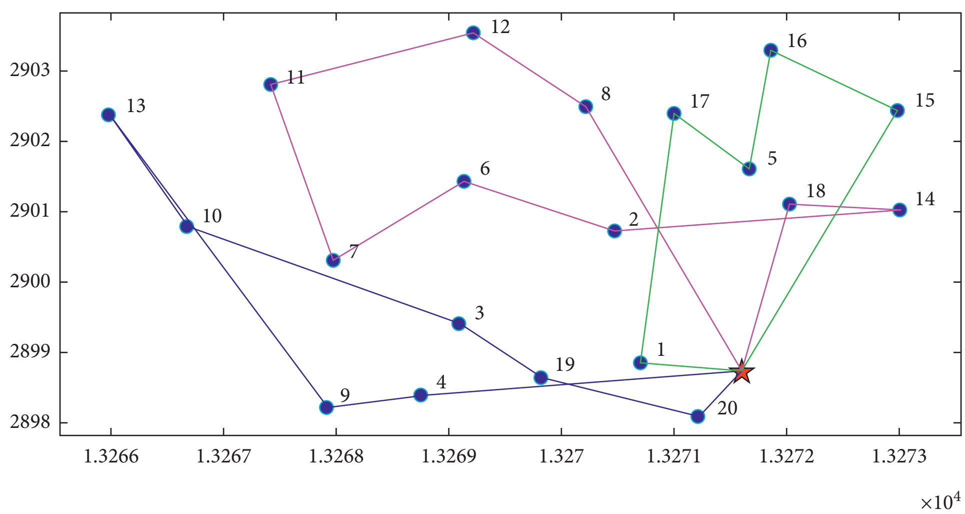

Figure 6: The distribution of effect matrix between cold chain distribution and new retail.

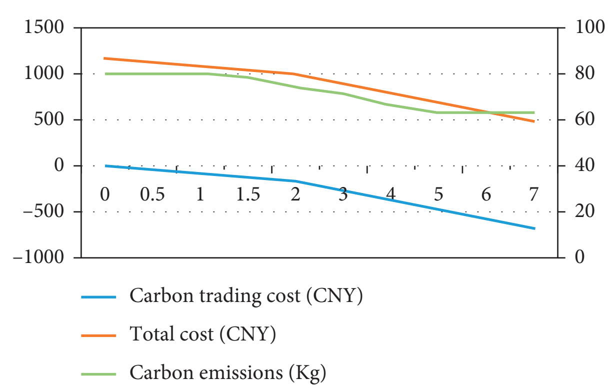

Figure 7: The variation trend of carbon emission and total carbon cost with carbon price under full carbon quota.

5. Conclusions

Based on the full market research, this paper uses principal component analysis to extract the common core factors that affect the operational benefits of cold chain low-carbon distribution and consumer experience of new agricultural retail. Then, the coupling linkage model of cold chain low-carbon distribution and new retail of agricultural products was constructed by using the grey correlation degree coupling analysis method. Finally, this paper discusses a new retail and agricultural products cold chain coupling mechanism under low-carbon distribution; the study is helpful to improve the new downstream supply chain retail enterprise management ability of agricultural products and also helps to promote the implementation of the strategy of rejuvenating.

The following aspects can be regarded as the focus of future research:

(1) Collaborative modeling and analysis of multiple influencing factors. Under the condition of customer sharing, several common distribution centers provide customers with cold chain distribution services for agricultural products.

(2) Cold chain distribution and new retail of agricultural products in the context of big data. At present, the

amount of data is still small. With the development of data storage and acquisition technology, big data scenarios may be frequently seen in the future.

(3) Analysis of synergistic factors under customer demand changes. In the actual distribution process, customer demand is not invariable, and the impact of customer demand change on distribution path optimization needs to be further explored.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

Acknowledgments

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