Research Article

Research on the Operation of Agricultural Products E-Commerce Platform Based on Cloud Computing

Lingxiao Liu

School of Business, Xuchang University, Xuchang, Henan 461000, China
Zhongyuan Rural Development Research Center, Xuchang, Henan 461000, China

Correspondence should be addressed to Lingxiao Liu; 12006022@xcu.edu.cn

Received 19 March 2022; Revised 9 April 2022; Accepted 18 April 2022; Published 16 May 2022

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As a large agricultural country, the three rural areas have always been one of the key areas of concern for national economic development. Among them, agricultural products finance is not only related to the development of agricultural economy, but also related to the poverty alleviation and wealth of thousands of farmers. With the rapid development of big data, cloud computing, blockchain, and other financial technologies, it will be important to build a new model of agricultural products supply chain finance and a special agricultural products O2O cloud service platform by relying on new technologies. Therefore, this paper conducts a study on the operation of agricultural products e-commerce platform based on cloud computing. This paper firstly introduces the advantages and key technologies of cloud computing. Secondly, this paper constructs the revenue models of e-merchants, farmers, and leading enterprises under insurance and risk-sharing modes and analyzes the optimal decisions of e-merchants, farmers, and leading enterprises under each mode and the influencing factors of the optimal decisions, so as to provide a new way of thinking for the construction of agricultural supply chain finance mode.

1. Introduction

The majority of China’s distinctive agricultural products are abundant in natural resources. However, due to the inability of traditional sales channels to sell agricultural products on time, as well as high distribution costs and poor sales of agricultural products, the centralized listing of agricultural products will result in unsalable sales and price drops, which will result in significant economic losses for farmers and a significant reduction in their income. Positivism: E-commerce has become increasingly popular since the advent of the rapid delivery business has enabled consumers to simply purchase the items they desire without ever leaving their homes. Agricultural e-commerce, particularly the agricultural product trading platform, is an important component because it has the potential to enhance efficiency, reduce costs, and broaden the scope of the agricultural product market [1–6]. Farmer income can be increased by using this magical tool, and it is extremely important for the export of agricultural products from most regions of China, particularly those with distinctive characteristics. Recently, as the level of informatization has improved, a number of agricultural product information websites have been established in most parts of China, including the Fujian Agricultural Information Network, the Guizhou Sannong Network, the Luguo Network, and other agricultural information platforms, but the majority of service quality has been deteriorating. Although not particularly high, primarily in the category of comprehensive information, there is currently no clothing product trading platform that is specifically designed for the combination of online transactions and offline services, and improving the service capabilities of e-commerce platforms for agricultural products has emerged as an urgent requirement for current development. Cloud computing (CC) can ensure the steady and reliable operation of the platform, as well as the reduction of construction and maintenance expenses, as well as the provision of flexible and diverse services with high compatibility and strong scalability, among other benefits. Using CC technology to develop an agricultural product...
e-commerce cloud service platform, it is possible to more effectively solve the problem of information asymmetry in agricultural product transactions, increase sales, reduce transaction risks, and effectively assist enterprises in resolving the shortage of talents in the development of agricultural products e-commerce, as well as the high cost of construction and maintenance of the platform. Building an e-commerce platform for agricultural products on the CC platform is therefore quite important and plays an important role [7–15].

In CN, agriculture is one of the most vital fundamental businesses. Agriculture, on the other hand, is characterized by a high level of risk, making it difficult to satisfy the risk preferences of lending institutions. The industrial process is confronted with a major problem of a scarcity of available financial resources. Now, e-commerce firms are entering the clothing product supply chain finance market one by one. These companies are supplying farmers with financing during the early stages of planting [16, 17], and after the harvest, these companies will sell the agricultural products they have harvested on the Internet. This financial approach not only ensures the production of high-quality agricultural products by closely monitoring the planting of farmers, but also eliminates the problem of farmers being unable to secure loans. Farmers, on the other hand, are more vulnerable to weather-related natural catastrophic risks when they are planting because of the unique nature of agriculture. When farmers experience disaster years, massive inputs may result in modest yields, or possibly no harvest, depending on the situation. When the farmer’s income is less than the amount of the loan, the farmer declares bankruptcy and is relieved of the need to repay the debt. At this point, the loss resulting from the farmer’s insolvency risk is passed from the farmer to the e-commerce industry [18–21]. The question of how to mitigate losses caused by farmer bankruptcy risk is a fundamental concern faced by agricultural firms and academics when it comes to evaluating the inclusion of e-commerce in agricultural supply chain finance.

Although a large number of scholars have conducted research on supply chain finance, the majority of them have concentrated their efforts on the manufacturing sector, failing to consider the bankruptcy risk posed by the uncertainty of the output of the agricultural product supply chain, which is a growing concern [22, 23]. When Eisenstadt and colleagues first established the definition of supply chain finance, they did so on four levels: the legal foundation, the business model, the warehousing method, and the operating process. They summarized supply chain finance on these four levels [24, 25]. Many academics have carried out a series of research from the perspective of the influence of capital flow introduction on supply chain operations as a result of the continual development of the field of supply chain finance. Given the fact that both suppliers and retailers are subject to financial limits and may be forced to file for bankruptcy, some researchers have investigated the optimal decision-making problem of financing between them and financial institutions [26–28]. Other researchers have conducted the first-ever study of the ideal retailer’s decision based on financing, and they have confirmed the necessity of taking into account both financing and manufacturing decisions in the supply chain. Some academics have conducted a study on supply chain finance from the standpoint of risk mitigation and risk prevention. For the purpose of preventing the moral wind in supply cone financing, Shi Jinzhao et al. investigated the best profit distribution contract between banks and B2B platforms under the two types of collaborative credit extension and entrusted investment and reception of credit in two different scenarios. Some academics have investigated whether the buyer’s intermediary supplier financing model can effectively cut costs, as well as how to mitigate supply chain financing risks, in order to determine their conclusions [29, 30]. The research findings of the aforementioned academics are beneficial in fully comprehending the operation process of supply chain finance as well as the hazards that should be taken into consideration during the operation process of supply chain finance, among other things.

Despite the fact that the study described above has aided e-commerce significantly in making scientific decisions in practice, there are still some areas of confusion for e-commerce, such as which risk protection strategy should be used in agriculture supply chain financing. The article examines the operation of a cloud-based e-commerce platform for agricultural products that facilitates transactions through the use of CC. This paper begins by discussing the benefits of CC and the underlying technologies that enable them. Second, this study examines farmer bankruptcy risk through the lens of agricultural supply chain finance, employing game theory to develop an expected return model for e-commerce farmers and leading companies under both the insurance and risk-sharing models. The optimal decision-making process for each mode is investigated, as well as the factors that influence the optimal decision-making process. Some management inspirations are obtained through model reasoning and example analysis, which can be used as a guideline for the decision-making process in e-commerce enterprises.

2. CC Related Theory and Agricultural Product Supply Chain Financial Model

2.1. CC Theory. On the technological side, cloud computing is the result of extensive development and integration of numerous technologies, and it represents a new computing model that is based on the Internet. Virtualization technology transforms the computing environment into a unified, elastic, and flexible resource pool, allowing for the sensible distribution of software and hardware resources. Virtualization technology is becoming increasingly popular. As a result of distributed storage technology, the same data is replicated on a variety of devices, significantly boosting data security and scalability. Techniques for large-scale data management can examine and optimize data stored in the cloud. Service virtualization, stability and dependability, cost reduction, flexibility, good compatibility, high scalability, and ultra-large scale are some of the characteristics of cloud computing. It also provides users with transparency and low-cost services. Shortly put, employing CC to establish a
cloud service platform for agricultural products can result in significant cost savings in terms of construction and maintenance. System users and administrators can take advantage of cloud services that are secure, dependable, scalable, flexible, and diverse at any time and from any location.

2.1.1. Concept of CC. Compute Cloud (CC) is a computing model that makes it possible to provide dynamically scalable virtualized resources as a service over the Internet, which can be swiftly installed and released with low administration overhead. CC is a concept that emerged from its field, which encompasses computer technology, communication technology, sensor technology, and control technology, among other things. In the realm of e-commerce, CC technology has been widely adopted, and many operators have effectively implemented cloud computing infrastructure. Parallel computing is the foundational technology of CC. The underlying concept is to pool the resources of numerous servers to tackle a single problem. The problem to be solved is divided into numerous pieces, each of which is independently calculated in parallel, and the result of the computation is returned to the user at the end of the process.

2.1.2. Characteristics of CC. With CC, users can receive the resources they require in a free and efficient manner, without being constrained by time or space limits and without having to engage with resources or service providers. All services and functionalities can be stored in the cloud network and accessed from any location at any time. It is possible to receive the resources required as soon as a network terminal device can be connected to a network. You can upload resources to the cloud server at any moment, or you can retrieve the resources you released in order to increase the amount of cloud storage space available. The resources available to users across the whole network are practically nonexistent.

2.1.3. Distinctions. An on-demand distribution and measurable service given externally under the technical assistance of CC, which may be used to replace the local self-built service of the user, is referred to as a cloud service. The particular structure of the CC system will alter depending on the application services that are used. The present mainstream CC system is capable of providing customers with services that are organized on three levels of hierarchy.

2.2. Agricultural Product Supply Chain (APSC) Financial Model. It is a business model that uses the credit of core agricultural product supply chain firms to solve problems of difficult, expensive, and time-consuming financing of noncore enterprises, with the goal of achieving a win-win situation for both APSC enterprises and financial institutions.

When it comes to agricultural development, financial assistance is critical, and the introduction of supply chain finance has upended the traditional commercial banking model. Despite the fact that supply chain finance has been developed for more than two decades and has achieved remarkable results in a variety of industrial fields, it has received little attention from banks, businesses, or governments. However, the application of supply chain finance in the clothing industry is still in its early stages, and it is still in the development process. Because of the weak financial strength of financing parties, the low management level, the low credit rating, the small financing scale, the dispersed nature of financing entities, the significant impact of natural disasters, and the fierce competition in the homogenization of agricultural products, the majority of agricultural financial needs have not been fully met. A lack of efficient integration among the numerous stakeholders involved in agricultural product supply chain finance is a major problem. Whether it is order finance for agricultural products, inventory pledge financing, or factoring financing, there are still a number of negatives to consider during the business development process.

APSC Finance was founded in 2000. The operation of APSC Finance is more difficult because it is responsible for determining not only the credit standing of agricultural product traders but also the authenticity of transactions. Bigger means riskier. The APSC’s financial operations can be classified into the following major stages: The first stage is 1.0, dominated by financial institutions such as commercial banks, and financed by the credit of the agricultural supply chain’s core enterprises. Then there’s 2.0, which is dominated by governments like the World Bank. According to APSC regulations, the core enterprise confirms the rights and pledges the accounts receivable or agricultural product inventory, and financial institutions such as commercial banks factor the financial products to farmers or distribution enterprises. Second, the APSC 2.0 stage is dominated by core firms. The APSC’s key enterprises are not only the operation’s but also the financial operation’s driving force, and they promote, coordinate, and reverse insurance at this point. In the third stage, APSC core firms and commercial banks are expected to meet higher standards. While using professional Internet platforms has improved this stage’s efficiency, lack of credit among various APSC entities, poor information, distorted information, high financing risks, and other factors have contributed to its inefficiency. Despite this, issues like severe disease still exist. In today’s rapidly evolving financial technology environment, APSC Finance is intrinsically linked to overall financial technology advancement.

3. Method

3.1. E-Commerce Platform. Online marketing and online purchase for agricultural products are referred to as an e-commerce platform, which is used to drive offline activities and consumption. Online marketing refers to the practice of using the Internet as a platform to promote offline product information to Internet users through discounts, information provision, services, and other means in order to convert them into potential offline consumers (also known as cross-selling). O2O models integrate business models into
traditional agriculture, effectively combine e-commerce with traditional agriculture, and take full advantage of the vast amount of Internet information and fast transmission speeds to realize information-based operations for clothing products in order to achieve information-based operations for clothing products (Figure 1).

The system is separated into modules based on the fundamental requirements of the platform, including the user management module, the security management module, the supply and demand information management module, the transaction service module, and the resource database support module. The following are the specific functions of the module:

1. The user administration module. The user management module is responsible for the administration of user information, which includes user registration, user management, merchant management, and authority administration.

2. A module for security management. The security management module is primarily responsible for the administration of security measures, such as user hierarchical access control and access security control, among others.

3. Supply and demand information management module (number three). The publication of supply and demand information and the generation of transactions are the two most important aspects of the design of the cloud service platform for Fujian agricultural products. The publisher is required to register and to confirm the legitimacy and dependability of the information that is published. Aside from that, the supply information should include the following information about the agricultural product: the name, grade, quantity, unit price, origin, and contact information; if necessary, the relevant quality inspection certificate should be provided; and the purchase information should include the following information about the agricultural product: the name, grade, quantity, price, and contact information. Due to the importance of freshness and shelf life of produce, fruit, and vegetables, such information is only available for a limited period of time. Within the validity time, any user can also do a search for supply and demand information to see what is available.

4. The transaction service module is the fourth component. On the Internet, the agricultural goods e-commerce platform connects agricultural products firms and farmers throughout Fujian Province, creating a virtual marketing market for agricultural products as well as a virtual and dense agricultural product sales market for agricultural products. In order to build sales and purchase relationship services, the platform can rely on third-party payment platforms. These services are primarily comprised of online shopping, seller delivery, buyer receipt, and capital flow. Customers can use the online shopping service to negotiate rates based on the needs of both parties, place electronic orders and contracts, and transfer payments to third parties to ensure transaction security, to name a few examples. In order for the seller’s delivery service to be effective, the third-party must first obtain money before the seller’s user will comply with the agreement, making arrangements for supplies, as well as delivering the items to the logistics business in charge of transportation and sending the platform notification of the delivery information. The buyer’s receiving service is responsible for inspecting the quality of the goods received; if the quality matches the contract requirements, the goods will be accepted; otherwise, the items will be rejected, and the logistics firm will coordinate with the seller to complete the transaction. Using third-party payment platform capital flow, services that rely on the capital flow between buyers and sellers can provide complete protection against capital flow theft. Figure 1 depicts the functional design of the product.

3.2. Construction and Analysis of Supply Chain Decision Model. First, this paper gives the basic assumptions.

Assumption 1. Without considering the moral hazard of both farmers and e-commerce, there is no default of farmers.

Assumption 2. E-commerce loans to farmers can only be used to purchase agricultural materials and pay agricultural production costs from leading enterprises, and there is no surplus.

Assumption 3. The out-of-stock loss and end-of-period residual value income of agricultural products are not considered, and all information is the consensus of all members in the supply chain.

Assumption 4. All agricultural products produced by farmers are purchased by e-commerce and sold on the e-commerce platform. At this time, the number of agricultural products sold by e-commerce is equal to the output of agricultural products.

Then the top decision-making sequence of supply chain members is as follows: the leading enterprise determines the optimal wholesale price of agricultural materials $W^f$, and the e-commerce company responds to the decision made by the leading enterprise to determine the optimal purchase price of agricultural products $p_i^f$ and the input quantity of agricultural products production $Q^f$ and then determine the production volume of agricultural products according to the output level. Under the insurance model, the expected profit function of the leading enterprise is

$$E\pi_L = Q^f(\omega^f - c_1),$$

(1)

where $Q^f$ is farmer’s input, $\omega^f$ is wholesale prices, and $c_1$ is cost of production [7, 19].

The expected profit function of e-commerce is
\[ E\eta_f^0 = kQ_f^r \left[ (p - p_f^0)x_H + (w_f + cQ_f^r) \right] + (1 - k)Q_f^r \left[ x_Lp - (w_f + cQ_f^r) + b - a \right] , \]

where \( p_f^0 \) is e-commerce purchase price, \( p \) is e-commerce selling price, \( b \) is claim amount, and \( a \) is risk factor.

And the expected profit function of farmers is

\[ E\eta_f^N = kQ_f^r \left[ p_f^0 x_H + (w_f + cQ_f^r) (1 + r) \right] , \]

where \( r \) is the interest rate, and \( k \) is a constant.

Then:

\[ \frac{\partial^2 E\eta f_N}{\partial Q_f^2} = -k (1 + r) \times 2c < 0 . \]

Then:

\[ \frac{\partial E\eta f_N}{\partial Q_f} = 0 . \]

Then, the optimal production input \( Q_f \) is

\[ Q_f^r = \frac{p_f x_H}{2c (1 + r)} \times \frac{w_f}{2c} \]

Then the expected profit function of e-commerce is

\[ E\eta_f^0 = kQ_f^r \left[ (p - p_f^0)x_H + (w_f + cQ_f^r) r - a \right] + (1 - k)Q_f^r \left[ x_Lp - (w_f + cQ_f^r) + b - a \right] . \]

Taking the second-order derivative of \( p_f^0 \) for equation (7), we get

\[ \frac{\partial^2 E\eta f_D}{\partial Q_f^2} = -k \times x_H^2 - x_H^2 - kr \times x_H^2 < 0 . \]

Figure 1: Main modules of the platform.

Then we have

\[ p_f^0 = \frac{(k w_f x_H^2 + k^2 x_H^2 + w_f x_H^2 - x_H^2) (1 + r)}{k x_H^2 (1 + r) + x_H^2} \times \frac{(1 + r)(1 - k) x_H^2 (x_L p - w_f + b)}{k x_H^2 (1 + r) + x_H^2} . \]

Then we get the best wholesale price and the best purchase price

\[ w_f^* = \frac{K p x_H + (1 - k)(x_L p + b) - a - c_l}{2} \]

\[ Q_f^r = \frac{k p x_H + (1 - k)(x_L p + b) - a - c_l}{4c [k(1 + r) + 1]} . \]

Combining the above formula, we get another model, the optimal price of the risk-sharing model.

\[ W_m^* = \frac{A_t - (1 - k)aB}{2IC + (1 - k)D} \]

\[ Q_m^* = \frac{p_m^0 x_h - w_m^*}{2c (1 + r) - \frac{w_m^*}{2c}} . \]

4. Experiment

PYTHON is used for numerical computation and analysis on the basis of the building, analysis, and solution of the income models of e-commerce, farmers, and leading firms under the aforementioned insurance model and risk-sharing model.

The examination of the Zhanjiang Agricultural and Reclamation Bureau in [12] indicates that, within 10 years,
there are seven years of good harvests and three years of disasters in Zhanjiang, according to the literature. As a result, the likelihood of incorrectly confiscating a good harvest year is \( k = 0.7 \), the output factor of a good harvest year is \( x_H = 0.9 \), and the disaster probability is \( x_L = 0.1 \). Due to the fact that production data is dispersed, the production data of the firm is kept confidential, and it is impossible to obtain an exact estimate of the production cost. If the production cost of the top firm is \( c_1 = 0.2 \), then it follows that agricultural materials are used in the manufacturing process by the e-commerce. The cost of production coefficient is \( c = 0.01 \), which stands for cost of production coefficient. Because different insurance companies charge varying premiums and pay different claims amounts, the information gathered is dispersed across a wide range of variables. As a result, based on an examination of the insurance market, the claim per unit of production input is considered to be \( a = 0.35 \) under the insurance model. The amount is equal to \( b = 0.87 \).

Select three different interest rates, high, medium, and low, as well as three different risk-sharing factors, large, medium, and small, and substitute the above parameters into the profit models of the insurance model and the risk-sharing model and then compare and analyze the supply chain members under the two different risk prevention models, as shown in the following table: high, medium, and low. Figure 2 depicts the ideal decision and the optimal profit obtained as a result of the analysis.

In a bountiful year, as illustrated in Figure 2, the higher the output factor, the greater the increase in the wholesale price of agricultural inputs, which is passed along to farmers. The reason for this is that when the output factor in a bumper year is high, farmers have the ability to produce a large amount of product with a small amount of production input. In addition, farmers’ demand for agricultural materials will fall during this period. Leaders in the industry will choose to raise the wholesale price of capital attack in order to boost their own profits. The best wholesale price of agricultural products for leading firms is greater under the risk-sharing model than it is under the insurance model, according to the results of a study. It does not matter how low the output factor of a bountiful year is; the wholesale price of apparel materials from leading firms operating under the risk-sharing model is still higher than 0. In contrast, under an insurance approach, a higher wholesale price for agricultural products from leading firms will be realized only when the output factor of a bumper year exceeds a predetermined threshold. There will be a price that is larger than zero. The reason for this is that, under the risk-sharing model, the leading enterprises share the risks associated with e-commerce, which increases the likelihood of lenders lending to farmers, encourages producers to increase production input, and increases the demand for agricultural materials significantly.

As illustrated in Figure 3, the price of agricultural products purchased via e-commerce has decreased in recent years as output has increased during bumper years. This is because as the output factor of the bumper year increases, the output of the farmers’ businesses increases as well. At this point, e-commerce will reduce the cost of agricultural products by decreasing their purchase price; the optimal purchase price of e-commerce agricultural products under the risk-sharing model is always greater than the optimal purchase price of agricultural products under the insurance
model. This is because, under the risk-sharing model, major corporations share the risks associated with e-commerce. Farmers are being prompted to expand their production capacity at the moment by a price increase on agricultural products purchased via e-commerce.

As illustrated in Figure 4, increasing the risk-sharing factor increases farmers' production input, and the optimal production input for farmers in the risk-sharing model is always determined by the insurance model. Due to the fact that leading businesses participate in e-commerce by sharing risk, the overall cost of doing business in a competitive environment is reduced. At this point, e-commerce will increase the price of agricultural commodities on the market, encouraging farmers to increase production and expand their businesses.

5. Conclusion
This article examines the benefits of cloud computing before constructing a cloud-based e-commerce platform for agricultural products. Second, this article develops expected return models for e-commerce, farmers, and leading enterprises under two risk prevention modes and discusses the optimal decision-making for each subject in the agricultural supply chain under the two modes by comparing the benefits. The study discovered that, regardless of the profit rate and risk-sharing factor, the optimal decision-making of e-commerce, farmers, and leading enterprises occurs under the risk-sharing model. For e-commerce and farmers, the risk-sharing model enables optimal decision-making. Profitability is always greater than the insurance model, and the risk-sharing factor has an effect on the optimal interest rate of the leading company. When the risk-sharing factor is high, the optimal profit of the leading company under the insurance model is greater than the optimal profit under the risk-sharing model; in other words, choosing a risk-sharing model allows the leading company to reduce not only its own risks but also the supply chain’s efficiency.

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

Conflicts of Interest
The author declares that he has no conflicts of interest.

Acknowledgments
This study was supported by Major Project of Xuchang University (no. XCU2021-ZD-002).

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