Big Data Based Research on E-commerce Distribution Optimization of Fresh Agricultural Products in Gansu Province

Haiying Ma [*]

School of Economics, Northwest Minzu University, Lanzhou, Gansu, China

[*]Corresponding author: lxmahaiying8888@163.com

Keywords: E-commerce Distribution; Optimization; Big Data; Fresh Agricultural Products

Abstract: The maturity and wide application of agricultural big data technology has brought new opportunities to the development of agricultural E-commerce market and the circulation of agricultural products, which has put agricultural production enterprises on the road of E-commerce. Logistics distribution is an important bottleneck restricting the development of fresh agricultural products E-commerce. As the only way to promote modern agriculture, the construction of agricultural E-commerce big data platform will become the most important measure to help the supply side reform. Based on the characteristics of E-commerce distribution of fresh agricultural products in Gansu Province, this paper studies the problems faced by E-commerce distribution of fresh agricultural products, such as high distribution cost, high damage rate and cold chain logistics lag, objectively analyses the current big data application of fresh agricultural products E-commerce distribution facing many challenges, and proposes to realize the optimization of E-commerce distribution of fresh agricultural products based on big data.

1. Introduction

The emergence of fresh E-commerce has changed the traditional circulation mode of agricultural products, reduced the level of circulation, effectively connected small production and large market, and promoted the sales and brand building of high-quality agricultural products. In recent years, with the continuous upgrading of consumption, the promotion of agricultural supply side structural reform and the application and popularization of the Internet, China's fresh agricultural products E-commerce market has maintained a growth rate of more than 50% for five consecutive years, reaching 139.13 billion Yuan in 2017, and is expected to reach 190 billion Yuan in 2018 [1]. But at the same time, the penetration rate of fresh agricultural products E-commerce in the whole fresh food E-commerce market is only 3%, and the vast majority of enterprises are in a loss state [2]. Fresh agricultural products have the characteristics of non-standard and timeliness of distribution. Logistics distribution has become an important bottleneck restricting the development of fresh agricultural products E-commerce. The high cost of distribution restricts the development of the industry. In the current big data environment, it is an important way for the fresh agricultural products E-commerce industry to effectively meet customer needs and reduce distribution costs to accurately locate customer needs, optimize distribution path and site selection based on big data analysis technology.

2. Characteristics of Fresh Agricultural E-commerce Distribution

2.1 Timeliness Requirements

Fresh agricultural products mainly refer to primary agricultural products such as vegetables and fruits that have not been deeply processed. They are characterized by non-standard, perishable, seasonal and regional characteristics. Their life cycle is short, their preservation requirements are high, and they are easily affected by temperature, humidity and the surrounding environment. At the same time, the industrial chain of fresh agricultural products from the field to the dining table is long and has a long time span, involving a series of links such as harvesting, transportation,

circulation processing, packaging, etc. In addition, consumers' demands for time have higher requirements for timeliness of distribution.

2.2 Scattered Customers and Demand

The fresh agricultural products E-commerce order has the characteristics of small batch, small amount, dispersion and randomness. The personalized demand of distribution time is significant, which leads to the lack of scale economy of distribution activities. Therefore, it has higher requirements for distribution capacity, including human, material resources and distribution cost management. At the same time, we need to innovate distribution mode and carry out joint distribution to improve distribution efficiency and reduce distribution cost.

2.3 The Distribution Facilities and equipment less specialized

Fresh agricultural products have the characteristics of easy corrosion, deterioration, high preservation requirements, as well as the needs of food safety, its distribution activities cannot be separated from the support of cold chain logistics. Relevant data shows that 70% of the cost of fresh agricultural products distribution comes from the insurance cold chain cost. Therefore, fresh agricultural products distribution activities need to use special cold chain logistics transport vehicles and related refrigeration equipment, cold chain logistics distribution center, cold chain logistics handling equipment and packaging equipment, etc., to reduce product loss rate through special facilities and equipment.

2.4 Diversification of Distribution Mode

At present, there are many types of fresh agricultural products E-commerce distribution mode, mainly including self-supporting logistics, third-party house distribution, self-supporting mode, including self-supporting cabinets, stores and convenience stores, etc., self-supporting logistics and third-party house distribution, self-supporting logistics and self-supporting mode, community joint distribution mode and o2o mode, etc. Fresh agricultural products E-commerce enterprises through continuous innovation of distribution mode will use a variety of distribution mode, in order to improve market competitiveness. For example, Jingdong fresh agricultural products distribution adopts self-operated cold chain team, third-party distribution, cooperation with community stores, self-built stores and JingDong home crowdsourcing distribution mode, so as to maximize the distribution efficiency and reduce the distribution cost.

3. Problems in Fresh Agricultural Products of E-commerce distribution

3.1 High Cost of Distribution

The logistics cost of fresh agricultural products E-commerce in China accounts for 25% - 40% of the sales price, which is much higher than that of other products E-commerce, especially the distribution cost accounts for 35% of the whole logistics cost [3]. The first reason is the small batch, multi-level and irregular demand of customers, which leads to the increasingly prominent contradiction between the satisfaction of personalized distribution demand and distribution cost. Moreover, fresh agricultural products E-commerce distribution needs the support of cold chain logistics. The use of cold chain distribution vehicles, cold chain distribution centres and cold chain logistics equipment undoubtedly increases the cost of distribution. Data shows that 70% of the cost of fresh agricultural products distribution comes from the cold chain cost [4]. In addition, the current distribution network layout is unreasonable and imperfect and the distribution route and distribution mode need to be optimized. In addition, fresh agricultural products distribution involves many links; high damage rate is also an important reason for the high cost of distribution.

3.2 High Damage Rate

Compared with less than 1% of industrial distribution loss rate, fresh agricultural products E-commerce distribution loss rate is as high as 10%-20%. Fresh agricultural products distribution involves many links such as packaging, loading and unloading, circulation processing, storage, etc.

[5]. Each link may produce damage. In addition, the products own corrosion resistance increases the probability of product damage. At the same time, at present, the development of cold chain logistics in China lags behind, the infrastructure of cold chain logistics is incomplete, and the phenomenon of pseudo cold chain exists in a large range of distribution process, such as the use of dry ice, ice and cotton wadding. The broken chain of cold chain often occurs, and the quality of fresh agricultural products cannot be guaranteed.

3.3 Lagging of Cold-Chain Logistics

At present, the development of cold chain logistics in China starts late, the infrastructure is weak, and the technology of cold chain logistics lags behind. At the same time, China's cold chain logistics lacks a clear regulatory department and mandatory distribution service quality standards, resulting in uneven service quality. Moreover, the phenomenon of "cold chain becomes cold end" is prominent [6]. In the cold chain distribution of fresh agricultural products by E-commerce, some logistics companies only open the air conditioner when receiving and delivering goods in order to save fuel cost and lack of in transit monitoring, while the middle transportation link does not open the air conditioner, resulting in the phenomenon that the two ends are cold and the middle is not cold. The lagging development of cold chain logistics restricts the development of fresh agricultural products E-commerce distribution.

4. Challenges of fresh agricultural products in E-commerce distribution

The modern information society has entered the era of big data, which is constantly changing the operation and management mode of enterprises, providing valuable opportunities for the development of enterprises. Similarly, big data analysis and utilization technology provides new solutions for fresh agricultural products E-commerce distribution. But at the same time, due to the late start of E-commerce of fresh agricultural products in China, there are still a series of challenges to realize the full use of big data analysis methods and tools.

4.1 Backward Infrastructure

At present, the overall level of logistics information in China is low, and the awareness of informatization is insufficient. In the environment of high cost, the purchase of computers, RFID, databases, sensors, terminal equipment, etc. for information collection, storage and processing is not in place, Lack of corresponding information technology, unable to complete the collection and storage of in transit information of distribution vehicles, product traceability information, etc., [9] resulting in the loss of a lot of information generated in the distribution process which is beneficial to food safety and valuable to the society and end consumers. Therefore, due to the lack of attention on data and the lag of equipment in the early stage, the collected historical data information is insufficient. At the same time, the existing hardware equipment and database are lack of interconnection, independent, low-level repeated construction, forming an "information island", with less information processing, use and decision support.

4.2 Lack of Data Standards

Due to the imperfection of logistics laws and regulations, the current logistics standards and data standards of fresh agricultural products E-commerce distribution are missing and basis of data collection of different enterprises are different. In terms of logistics standards, there is a lack of unified standards on the size of distribution vehicles, loading capacity, temperature and humidity requirements of different products, lighting, refrigeration time, and bacteria exceeding the standard. Data standards mainly refer to the standards of data collection, transformation and processing in the big data environment. In the process of data collection, storage, processing and sharing, it is necessary to establish standards for big data analysis technology, process model and visualization tools [7]. At the same time, the basic data such as data element, classification code and metadata are standardized. The lack of current data standards is a big challenge for big data analysis.

4.3 Information chain has not been formed

The information chain based on supply chain has not been fully formed. The traceability of supply chain products can be realized through information chain. At present, only some enterprises can realize consumers to see the whole life cycle process of products through scanning, especially the query of key information in the process of production and transportation, such as production date, storage time, temperature, humidity, etc., so as to ensure food safety. Due to the interruption of the information chain and the poor information in all links, it is more difficult for the upstream and downstream enterprises of the supply chain to cooperate with each other, and the response ability and competitiveness of the supply chain to the market are insufficient.

4.4 Insufficient application of data

At present, some fresh agricultural products E-commerce enterprises pay more attention to information technology within the enterprise. The use of information is mainly to provide positioning information for customers, while other information services are less. At present, most enterprises fail to realize the value of data, and lack the means, methods and tools of big data to fully mine the existing data information, so as to obtain more valuable information, and then provide information value-added services and support management decisions.

5. Workflow of fresh distribution system based on big data analysis

The fresh agricultural products E-commerce distribution system firstly collects the information and data of distribution vehicles, operators and fresh agricultural products through GPS, radio frequency, sensor and barcode scanning and other means and tools, and stores the collected data on the premise of ensuring the authenticity, real-time and integrity of the data[8]. The collected data mainly includes three aspects of information: first, the real-time dynamic positioning information of goods and vehicles is generated by GPS; second, the information generated by temperature, humidity and changes of chemical substances in vehicles is collected by sensors in transportation vehicles for food safety monitoring; The third is to obtain the safety information of the vehicle equipment by installing sensors on the key parts of the transport vehicle, such as engine and refrigeration device. The collected information is processed and processed by spatial analysis, data mining, operational research modelling and other methods to generate useful knowledge and form a big data value chain. And use these knowledge to assist the decision-making and optimization of distribution scheme, to realize the maximization of customer value and management benefit, as shown in Figure 1.
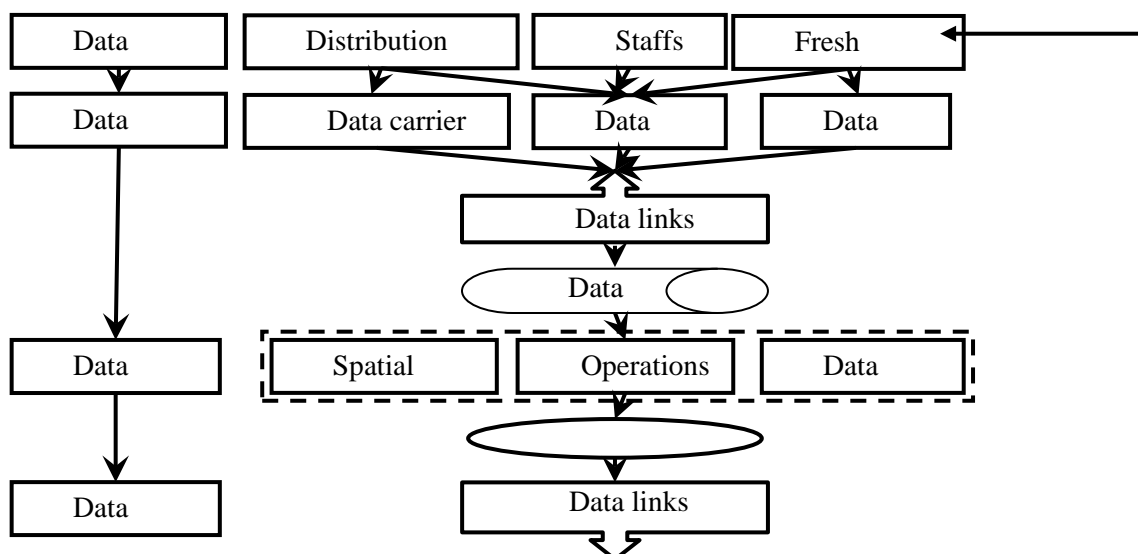
Figure 1. big data work-flow of fresh agricultural products E-commerce distribution system

6. Big Data Application in E-commerce Distribution Optimization

Big data analysis emphasizes relevance, which can be used to analyse and mine the business

value behind the data. Fresh agricultural products E-commerce distribution management has a lot of data information. With the maturity of big data analysis technology, it creates conditions for the application of big data. Through big data analysis, we can more effectively supervise and dispatch distribution vehicles, improve vehicle utilization and product safety. At the same time, it helps to optimize the vehicle distribution route, reduce the distribution cost and better meet the timeliness requirements [9]. Moreover, it is also helpful to accurately study and judge customer behaviour and achieve accurate distribution. In addition, big data analysis is helpful to realize intelligent pricing and refined cost management of distribution services, and improve operational efficiency. Specifically, through big data analysis, we can realize the optimization of fresh agricultural products E-commerce distribution in the following aspects:

6.1 Manage and Monitor Distribution Vehicles

Based on the daily distribution plan, before distribution, combined with the information of the load, capacity and storage conditions of distribution vehicles, a machine learning model for vehicle scheduling optimization is constructed under the support of big data, and the distribution tasks are classified, which is related to the distribution operation plan of each vehicle and each batch. Realize the joint optimization of vehicle scheduling, vehicle routing and distribution sequence. At the same time, establish one-to-one association information between distribution vehicles and drivers to ensure one vehicle one certificate, avoid cheating and ensure the safety of goods. In the process of distribution, the running state of vehicles is monitored. After distribution, we can find the source of goods based on the big data platform, or refrigerate the car without air conditioning when returning, transport general goods, and improve the utilization rate of the car.

6.2 Optimize the Driving Personnel Arrangement of Distribution Vehicles

The timeliness of fresh agricultural products requires that the products must be delivered to the customers with low cost and high efficiency. At present, the selection of fresh agricultural products E-commerce distribution path in China is subjective, mostly determined by experience, and lack of scientific decision support. Therefore, it is necessary to optimize the vehicle driving path. In the big data environment, the distribution enterprise uses the on-board computer to upload the RFID sensor information on the goods to the server through the vehicle internal sensing system. The server dynamically arranges the vehicle driving path according to the customer preference and distribution plan based on the received vehicle information, package information, and the weather, traffic, road conditions and other information provided by the public data cloud. At the same time, according to the feedback information of vehicle driving state, according to the online dynamic vehicle path optimization model, adjust the driving route in real time. Furthermore, by analysing the existing vehicle driving path and driving time records, we can excavate the general laws of road traffic and make reasonable driving arrangements [10]. In addition, based on the big data platform, we can analyse and calculate the remaining delivery time, timely notify customers to pick up goods, reduce customer waiting time, and improve the quality of distribution service and timeliness of the whole process of distribution. In the E-commerce distribution of fresh agricultural products, according to the historical data and real-time incremental data, through big data analysis, we can get the performance model and several prediction models of driver's work, accurately predict the driver's fatigue driving degree and personnel flow, reasonably determine the driver's scheduling, improve the safety of driver's work, and reduce the occurrence of related risks.

6.3 Analysis of Consumers Ordering Behaviour

Through the collection of consumer ordering behaviour information at the front end of the platform, the association rules between ordering goods and time latitude are established by using big data analysis technology, and then the distribution behaviour is advanced according to a certain probability, and the distribution sorting operation, personnel arrangement and vehicle scheduling are carried out in advance. The ordering behaviour of consumers includes the number of times that consumers click on the goods, the time of browsing, the number of goods in the shopping cart and the historical purchasing behaviour, etc., so as to accurately predict the needs of customers. Before

the customer places an order, the goods have been assembled. Once the customer places an order, the goods will be received immediately. At the same time, according to the prediction of customer demand, analyse the distribution of customers and consumer demand, reasonably determine the location of distribution site and store distribution goods here in advance. For fresh agricultural products, there is a relatively fixed consumption period. Through the analysis of consumers' ordering behaviour, after mastering customers' consumption habits, it can also accurately push and suggest relevant distribution periods. Through the analysis of customers' consumption behaviour, it is helpful to arrange distribution resources in advance, distribute stations reasonably, and improve the timeliness of distribution. For example, Amazon launched the pre delivery patent that is, according to the analysis of customer consumption data, early delivery and shortens the logistics time.

6.4 Intelligent Pricing and Refined Cost Management

The traditional urban distribution pricing method is less differentiated pricing based on timeliness. With the support of big data, revenue management theory can be used to subdivide the distribution time demand and location demand of consumers. The more accurate the distribution time demand, the higher the timeliness requirement, the more specific the distribution location, and the higher the distribution service price. The distribution time and location are divided into different options, and the options are combined. Finally, according to the analysis technology of big data, the distribution service pricing based on different options is determined reasonably. At the same time, the current distribution cost management is mainly based on post event cost management. In the big data environment, the relevant sensor equipment can be used to collect the operation status of the equipment, timely grasp the vehicle consumption information, and provide data support for the refined cost management.

Conclusions

As a new generation of information technology, big data brings new opportunities for the development of agricultural E-commerce in Fujian Province. In the context of supply side structural reform, promoting the application of agricultural big data can effectively promote and guide the production and operation of agricultural products and improve economic efficiency. The development of modern agriculture in Fujian Province is not balanced enough. We should continue to increase the research on data application, improve the collection, collation and monitoring of agricultural data, and improve the authenticity and reliability of agricultural data. Solve many problems existing in the development in time, improve the information management level of production and operation enterprises, carry out data collection and sorting according to market analysis and prediction, build a cloud logistics platform based on cloud computing technology, so that farmers can not only increase production and income, but also increase benefits. Taking the above measures will enhance the competitiveness of agriculture and the circulation efficiency of agricultural products in Fujian Province, and create a new type of electricity supplier industry with unique characteristics of Internet plus modern agriculture + big data + cloud logistics.

Acknowledgements

References

[1] Chu Xinmin, Li houting (2017) Development mechanism of agricultural E-commerce: Based on the sand collection model. Price Monthly, 12, 84-89

[2] Qiu Bizhen (2014) Analysis and Countermeasures for the development of agricultural E-

commerce in Fujian Province. Research on Agricultural Modernization, 4, 50-60.

[3] Wang Ke, Li Zhen, Zhou Jian (2014) Analysis of agricultural product supply chain channels under the participation of E-commerce: Taking "food steward" as an example. East China Economic Management, 12, 157-161.

[4] Wang Yanhua (2016) Internet plus agriculture opens up a new mode of agricultural upgrading in China [J]. Economy and Management, 1, 104-106.

[5] Zhai Wei Wei, Shao Yunchuan, Wang Quan (2015) Analysis of agricultural products logistics information service platform based on "Internet plus". Southern Agriculture, 6, 242-251.

[6] Liu Chunying (2014) Research on the construction of agricultural products production and marketing information service platform based on cloud computing. Value Engineering, 2, 212-219.

[7] Sun Zhenxing (2015) Review on the construction of cloud logistics platform for agricultural products [J]. Productivity Research, 4, 157-166.

[8] Zhang Shihua (2016) Research on logistics system and mode of agricultural products E-commerce under the cloud of supply chain. Scientific Management Research, 2, 216-22

[9] Chen Fenghe (2016) Research on the *last kilometer* of fresh E-commerce logistics and distribution. Modern Economic Information, 14, 101-114.

[10] Wang Lin, Zhao Yu, Fu Xiaojie (2016) Research on *last kilometer* distribution of fresh E-commerce. Logistics Technology, 35, 33-42.