



# Research on the Optimization of Logistics Distribution Path of Fruit and Vegetable Agricultural Products in Guangxi Based on the Internet of Things

Zhu Jinghuan, Liu Yuxue, and Wang Shilong<sup>(✉)</sup>

Guangxi Science and Technology Normal University, Laibin, China  
270336472@qq.com

**Abstract.** With the rapid development of the information age and the continuous improvement of people's living standards, the freshness and quality safety of fruit and vegetable agricultural products have attracted widespread attention and high attention. However, in the process of logistics and distribution of agricultural products, problems such as untimely distribution and decay of agricultural products often occur, seriously affecting people's food safety. Based on this, this paper takes Guangxi as an example to deeply analyze the current situation of agricultural products logistics distribution and the problems in distribution at that time, and put forward the logistics distribution plan and optimization measures of fruits and vegetables agricultural products based on the Internet of Things technology to improve the efficiency of agricultural products distribution, ensure the freshness and quality safety of agricultural products, and then create a safe and harmonious eating environment for people.

**Keywords:** Internet of Things · Logistics distribution · informationize

## 1 Introduction

With the continuous improvement of People's living standards and the adjustment of agricultural supply-side structure, People's demand for fresh vegetables and fruit agricultural products has gradually increased. Fruits and vegetables have become essential food for people every day. In order to meet People's needs, the logistics demand for fruits and vegetables agricultural products has also increased [1]. as an important agricultural production base, Guangxi has a rich variety of agricultural products and sufficient output, especially fresh vegetables and fruits. With the increasing demand for fruit and vegetable agricultural products, the logistics problem of agricultural products is increasingly obvious, especially in the distribution of fruit and vegetable agricultural products. As we all know, agricultural products have biochemical characteristics and perishability, which puts forward more strict requirements for its cold chain logistics, especially in the temperature and humidity control and transportation time control of agricultural products. In recent years, with the rapid development of the Internet and the Internet of Things and

other technologies and their deep penetration into the logistics industry, the logistics distribution of agricultural products also needs to be continuously optimized. At this stage, there are problems in the logistics and distribution process of fruit and vegetable agricultural products in Guangxi, such as the backward logistics and distribution facilities, the low level of information construction of the distribution platform, and the insufficient reserve of specialized logistics talents. These problems have seriously affected the quality, safety and economic development of local agricultural products. Based on this, how to ensure the freshness and quality of agricultural products in the process of logistics and transportation is related to the quality of People's life and the development of agricultural economy, which has gradually become one of the hot research issues in the field of logistics and transportation in recent years.

As a new technology in the information age, the Internet of Things is an innovative network technology that the internet has developed to a certain extent. It can realize the intelligent identification, positioning, tracking and temperature and humidity monitoring of agricultural products logistics management, effectively strengthen the communication of all links of the cold chain logistics, reduce information asymmetry, improve the efficiency of the cold chain, and prevent the interruption of the cold chain, thus reducing the circulation loss rate of fresh agricultural products, and ensuring the freshness and quality safety of fruits and vegetables agricultural products. With the help of the Internet of Things technology, optimizing the logistics distribution path of fresh agricultural products can not only ensure the product quality in the whole logistics process, but also improve the distribution efficiency and control the distribution cost [2]. Therefore, it is particularly important to optimize the logistics distribution path of fruits and vegetables agricultural products in Guangxi under the background of the Internet of Things.

## **2 Overview of the Internet of Things**

### **2.1 Connotation of the Internet of Things**

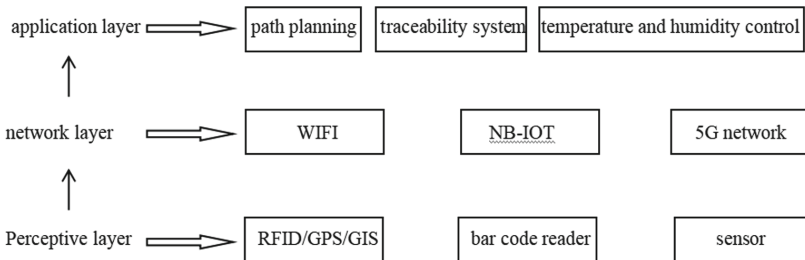
Generally speaking, the Internet of Things is a kind of interconnected Internet between things, and its core and foundation are still the Internet. At present, the academic community has a relatively unified understanding of the Internet of Things. As a special information processing technology, the Internet of Things connects things through RFID, bar code and other information sensing devices, and realizes intelligent identification, positioning, tracking, monitoring and management of things through information exchange and communication between them [3]. At present, the two key technologies of the Internet of Things are embedded technology and sensor technology, which mainly include three parts: the perception layer, the network layer and the application layer. The application layer mainly provides practical applications based on the Internet of Things, such as smart cities and logistics, which are the fundamental goals of the development of the Internet of Things.

### **2.2 The Role of the Internet of Things in the Logistics Distribution of Fruits and Vegetables**

From the perspective of logistics, distribution contains almost all the elements of logistics, and is the embodiment of logistics activities in a small range, such as packaging,

storage, transportation and loading and unloading. In recent years, with the rapid development of information technology, intelligent logistics distribution has attracted the general attention and high attention of many scholars, especially in today’s rapid development of e-commerce models such as O2O, B2C and B2B. Therefore, how to integrate the Internet of Things and agricultural products logistics distribution is particularly important.

The in-depth integration of the Internet of Things technology and the logistics and distribution of fruits and vegetables can not only solve the problems encountered in the logistics and distribution of agricultural products to a certain extent, but also improve customer satisfaction with agricultural products. At the sensing layer of the Internet of Things technology, the information of fruit and vegetable agricultural products can be collected through sensor, QR code, RFID and other information collection technologies, and then the information between all agricultural products can be transmitted through wireless transmission technologies such as Bluetooth and ZigBee, information collection middleware technology and other sensor networks; At the network layer of the Internet of Things, the collected data of fruits and vegetables can be encoded, authenticated and transmitted using wired network technology and wireless network technology; In the application layer of the Internet of Things, it can provide practical applications based on the Internet of Things, such as temperature and humidity monitoring of transport vehicles, optimization of vehicle distribution routes, and real-time monitoring of agricultural products. If the temperature in the transport vehicle is identified by RFID as too high, an early warning can be issued in advance, and the temperature in the vehicle can be automatically adjusted to ensure that fruit and vegetable agricultural products can always be in a low temperature state during the distribution process, thus ensuring the quality and safety of agricultural products [4]. In addition, consumers can also timely query and share the distribution time, quality and safety information of agricultural products through mobile terminal equipment [5]. Once the after-sales problems of agricultural products occur, the information traceability and tracking function of the Internet of Things can be used to trace the root cause of the problems of agricultural products, thus greatly reducing the time to deal with the after-sales problems, and also can play a certain role in ensuring the quality and safety of agricultural products, which plays an important role in the sales and logistics distribution of agricultural products [6]. See Fig. 1 for details.



**Fig. 1.** Framework of agricultural products logistics distribution system based on the Internet of Things

### **3 Problems in the Logistics Distribution of Fruits and Vegetables in Guangxi**

#### **3.1 Backward Logistics and Distribution Facilities**

The logistics industry in Guangxi started late, and the supporting facilities for agricultural products logistics are relatively backward as a whole. The software and hardware facilities of most logistics distribution platforms are not perfect, and an efficient and stable operation mode has not yet been formed. At this stage, the local cold chain logistics facilities are obviously insufficient, the construction of cold storage in the production area is seriously lagging behind, the total amount of cold storage is in the middle and lower position in the country, and the transportation and circulation rate of agricultural products cold storage is low, which has seriously affected the circulation and development of local fruits and vegetables agricultural products. According to statistics, the loss of local agricultural products only in the circulation link each year is up to 20% of their total output, and the loss rate is far higher than the average level in developed regions [7]. The number of transportation vehicles for refrigerated transportation and distribution of agricultural products is relatively small. Most fresh agricultural products can only be refrigerated by ice in ordinary trucks, or even transported under normal temperature or open air, greatly increasing the loss rate of fruits and vegetables. With the rapid development of e-commerce models such as O2O, B2C and B2B, agricultural products logistics and distribution services have been difficult to meet the diversified and personalized needs of customers. At the same time, the lag of network infrastructure has fundamentally affected the informatization level of agricultural product logistics and distribution, making it difficult to realize information sharing and traceability in the process of agricultural product logistics and distribution, and to some extent affecting consumer satisfaction and the development of local agricultural economy.

#### **3.2 The Informatization Construction Level of Logistics Distribution Platform is Low**

As we all know, agricultural products have their own biochemical characteristics and perishability, which puts forward more stringent requirements for the logistics management of agricultural products, especially in the temperature and humidity control and transportation time control of agricultural products. In recent years, with the rapid development of information technology such as the Internet of Things and cloud computing and its deep penetration into the logistics industry, the logistics distribution of agricultural products also needs to be continuously optimized. At this stage, the informatization level of Guangxi agricultural products logistics distribution platform is not high, and all links of cold chain logistics are basically decentralized, the whole chain is loose, and the information collection and transmission are not timely enough, which is very easy to lead to the phenomenon of information asymmetry or "information island". According to the survey, the local agricultural products rarely use RFID, barcode, sensor and other advanced technologies in the circulation process, and more rely on the traditional experience in the past to sell and transport agricultural products. Therefore, when agricultural products arrive at the place of sale, the phenomenon of supply exceeding demand often

occurs due to the asymmetric information in the early stage, resulting in the extrusion of agricultural products inventory. Due to the biochemical characteristics and perishability of agricultural products, the long-term storage of agricultural products and the shortage of local cold chain equipment have seriously affected the freshness and safety of agricultural products, thus greatly reducing the value of agricultural products. In addition, a large amount of data will be generated during the circulation of agricultural products. If the information of upstream and downstream links is not close and timely enough, these data will be difficult to be accurately identified, analyzed and managed, which will cause a certain degree of loss to the inventory of agricultural products, and may also affect the efficiency of dealing with emergency problems in the circulation of agricultural products. Therefore, it is very necessary to deeply integrate the Internet of Things technology with the logistics and distribution of fruits and vegetables agricultural products.

## **4 Suggestions for Logistics Distribution of Fruit and Vegetable Agricultural Products in Guangxi Based on the Internet of Things**

### **4.1 Strengthen the Construction of Logistics Distribution Infrastructure**

With the continuous improvement of people's living standards, people's demand for fruit and vegetable agricultural products is increasing, and the freshness of agricultural products directly determines its own value, which requires that agricultural products remain in a low temperature state in the circulation link, and cold chain logistics can just meet this requirement. In order to rapidly develop the agricultural products logistics system, the local government should provide appropriate financial subsidies, strengthen the construction of agricultural products cold chain logistics infrastructure, and improve the cold storage system. Set up sufficient cold chain storage and transportation equipment [8] in the production areas of agricultural products or in poor mountainous areas, and actively equip advanced technology, strive to build logistics service system outlets, and ensure that each outlet can accurately receive and transmit information, so as to provide more convenience for the sales of local agricultural products [9]. At the same time, in order to ensure the freshness and quality safety of agricultural products, the Internet of Things technology and agricultural cold chain logistics can be deeply integrated [10]. RFID and GPS technology can be used on refrigerated trucks for agricultural products distribution. On the one hand, it can select the best route for agricultural products distribution vehicles, and on the other hand, it can monitor the temperature and humidity of fruit and vegetable agricultural products to ensure that fruit and vegetable agricultural products can be delivered to consumers with quality and quantity.

### **4.2 Improve the Informatization Construction Level of Logistics Distribution Platform**

In recent years, the Chinese government has paid close attention to the issues of agriculture, rural areas and farmers, and the development of rural economy is certainly inseparable from the development of agricultural products logistics. Among them, distribution service is not only the key link of agricultural product logistics, but also an

important link of direct communication with consumers. The good or bad of distribution service directly affects customer satisfaction and repurchase rate [11]. Therefore, it is very necessary to apply the Internet of Things, big data, cloud computing and other advanced technologies to the distribution of agricultural products logistics. Enterprises and platforms related to agricultural products logistics need to take the supply chain as the core, integrate existing resources and realize information interconnection, so as to improve the core competitiveness of agricultural products logistics and ultimately achieve a win-win situation [12]. With the penetration of Internet of Things technology into the field of agricultural products logistics, a large amount of data will be generated at any time during the circulation of agricultural products. How to collect, analyze, process and make decisions on these data efficiently and accurately is the key to ensure the freshness and quality safety of fruit and vegetable agricultural products [8]. GPS, RFID and other technologies can be used to optimize the distribution path of agricultural products. At the same time, the temperature and humidity of transport vehicles can be monitored in a timely manner to ensure that agricultural products are always in a suitable environment during the distribution process. Secondly, the traceability system of the Internet of Things can enable all information in the circulation process of agricultural products to be shared in a timely manner. While avoiding the “information island” phenomenon, it can also effectively solve the after-sales problems of agricultural products, providing convenience for consumers [13].

## 5 Conclusion

Industry development, technology first. With the rapid development of e-commerce models such as O2O, B2C and B2B, the traditional logistics and distribution of agricultural products such as fruits and vegetables can no longer meet the personalized needs of customers. The application of advanced technologies such as the Internet of Things and big data to the logistics and distribution path of agricultural products has become the trend of the times. With the deep integration of the Internet of Things technology and the logistics and distribution of agricultural products, it not only effectively solves the problems of information asymmetry and low distribution efficiency in the circulation of agricultural products [13], but also ensures the freshness and quality safety of agricultural products to a certain extent, thus creating a safe and harmonious eating environment for people.

**Acknowledgments.** Jinghuan ZHU was the first author, Shilong WANG was the corresponding author. Guangxi Science & Technology Normal University was the first author's unit. This work was financially supported by Youth Scientific Research Project of Guangxi Science & Technology Normal University in 2022 (GXKS2022QN056).

## References

1. Zhang Jingyu, Diana, Liu Yu, Fan Xiaoyan. Research on optimization of emergency logistics system for fruit and vegetable agricultural products [J]. *Anhui Agricultural Science*, 2017,45 (22): 242–243+255. DOI: <https://doi.org/10.13989/j.cnki.0517-6611.2017.22.072>

2. Wang Xuhui, Zhang Qilin. Construction of cold chain logistics system for fresh agricultural products based on the Internet of Things: framework, mechanism and path [J]. Journal of Nanjing Agricultural University (Social Science Edition), 2016,16 (01): 31–41+163
3. Wang Yahao, Zhou Yunxiang, Wang Jincan Research on cold chain logistics collaborative distribution of fresh agricultural products based on Internet of Things technology [C]// 2022 Proceedings of Social and Economic Development Forum (I) [Publisher unknown], 2022:36–38. DOI: <https://doi.org/10.26914/c.cnkihy.2022.052461>
4. Yin Yaxian. Research on the logistics and distribution mode of agricultural products based on the Internet of Things [J]. Rural Staff, 2020 (09): 32+51
5. Chen You, Chen Changbin, Tao An. Research on the application of Internet of Things technology in cold chain logistics of fresh agricultural products [J]. Value Engineering, 2020, 39 (20): 129-132
6. Zhou Baogang, Zhang Shuang, Zhang Manlin. Research on the operation and management of agricultural cold chain logistics based on Internet of Things technology [J]. Journal of Anshan Normal University, 2022,24 (03): 28-32
7. Tian Jing, Meng Fanting. The application of Internet of Things technology to the logistics and transportation of fresh agricultural products [J]. Internet of Things technology, 2020,10 (02): 77-79. DOI: <https://doi.org/10.16667/j.issn.2095-1302.202.02.021>
8. Sun Ting. Research on the problems and countermeasures of e-commerce logistics distribution in the context of new retail [J]. China Logistics and Procurement, 2022 (22): 48-49. DOI: <https://doi.org/10.16079/j.cnki.issn1671-6663.2022.2029>
9. Xie Shuxin. Research on the upgrading path of agricultural product logistics system under the background of big data [J]. China Logistics and Procurement, 2022 (08): 63-64
10. Dai Fei, Xu Yan. Competitive advantages, problems and optimization strategies of fresh agricultural products e-commerce in the context of new retail [J]. Price Monthly, 2020, (02): 21-25
11. Cheng Cheng. Analysis of the optimization path of e-commerce logistics distribution in the new retail environment [J]. Business Exhibition Economics, 2021 (15): 64-66
12. Li Jiaru, Wang Yuzhen. Research on the optimization of fresh food supermarket distribution path under the new retail background [J]. Journal of Shaoyang University (Natural Science Edition), 2019, 16 (03): 27-35
13. Liu Xiaocen. Logistics and distribution path optimization strategy of fresh agricultural products under the Internet of Things technology [J]. Shanxi Agricultural Economics, 2021 (17): 180-181. DOI: <https://doi.org/10.16675/j.cnki.cn14-1065/f.2021.17.079>

**Open Access** This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

