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Research on the application of Internet of Things (IoT) in supply chain management

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Abstract. As an emerging technology, the Internet of Things has attracted widespread attention as soon as it was proposed and has been widely used in various fields. Internet of Things technology provides a unique advantage for supply chain management. It can intelligently manage the supply chain and, at the same time, transmit information to customers in real-time, allowing customers to quickly obtain information about goods, making the entire supply chain more efficient. Chain management has become more scientific and reasonable. This article first gives a brief introduction to the Internet of Things, and then conducts an in-depth analysis and discussion of its application in supply chain management, hoping to promote the development of SCM in our country.

Keywords: Internet of Things technology, supply chain, management, application.

1. Introduction

The Internet of Things is a new concept derived from the concept of the Internet. Its fundamental purpose is to track and monitor goods in order to manage all aspects, from products to logistics to inventory to sales. By collecting and transmitting basic project information, a computer-based intelligent supply chain management system has been established, which also makes traditional work ideas unable to adapt to the development needs of the enterprise. On this basis, a wireless communication technology based on RFID/RFID, GPS, QR, Wifi, etc., is proposed to achieve optimal control of all aspects of the supply chain. All functional links of the supply chain system represented by EPC/RFID have been widely used.

2. Literature Review

2.1. Characteristics of IoT applications in supply chain management

2.1.1. More timely response

In the face of increasingly fierce market competition, whether an enterprise can provide customers with more convenient and efficient services will directly affect the overall strength of the enterprise. Enterprises can take advantage of the advantages of IoT technology in supply chain management to effectively improve the transparency of the supply chain management system and optimally allocate the overall information resources in the supply chain management system, which will promote the improvement of the entire system. Management information resources are more precise and specific,

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and in this case, not only can the management company reduce operating expenses, but it can also allow supply chain managers to respond faster and more accurately to customer requirements to Provide efficient services to customers[1].

2.1.2. The overall monitoring level has been improved

Since the supply chain management system involves various aspects, the types and quantities of its products are also different, which brings various complexities to the entire supply chain management system[2]. Through the Internet of Things technology platform, companies can share information resources more efficiently with internal employees in supply chain management and better coordinate their work, thus promoting the work of each member in the supply chain and adding to the company's existing Problems dealt with in a timely and reasonable manner, thereby achieving integrated management of the supply chain and improving the level of monitoring and management[3].

2.1.3. Further realize intelligent management

After applying the information identification function and location tracking function of the Internet of Things in the company's supply chain management, the company can efficiently identify key raw materials and product manufacturer information in its products and can also identify essential vehicle models and roads in the company's goods distribution., time and other information for positioning and tracking[4]. The company's intelligent management of production, logistics, distribution, and supply chain ensures high-quality products for its users.

2.1.4. Further improve consumer satisfaction

At the same time, the Internet of Things can also bring greater cost performance and convenience to users. Through the automatic control of the Internet of Things, users can easily find the products they want, and set the best customer routes and shelf layouts based on the information obtained, helping consumers complete shopping more conveniently and quickly[5].

2.2. Application of EPC/RFID technology

It provides three parts of data information: domain name administrator, classification object, and serial number. However, EPC technology is very different from barcode technology. This technology is mainly used for each commodity, so each commodity must have a number to identify it, as well as the production place, manufacturing time, shelf life of the specific commodity[6]. In order to ensure efficient logistics and circulation of goods, it is crucial to improve the accuracy of circulation links and related information continuously. This will enable the tracking of the geographic location and movement trajectory of the commodity at any given time. RFID is a two-way communication identification technology with radio frequency technology as the core. It can enable companies to identify products more conveniently and deeply in logistics and supply chain management. After using EPC/RFID technology to build the Internet of Things operation process, logistics supply chain management has achieved unprecedented development[7]. EPC technology is used to physically code products, and each product has its own identity. The whole process of products, from production to sales, must have a unified logo. It also facilitates people to use a unified logo to find the logistics information of the goods and promotes the development of the entire logistics industry. Currently, in the sales process of goods, after being equipped with RFID technology, as long as the goods pass through a certain control range, they will be displayed. Electronic notes are numbered, and the labels inside are used to convey information[8]. Then, the Internet of Things system will receive the item's information, then transmit it to the computer through the modulator, and finally transmit it to the backend host to manage it. After determining the legality of the information[9], it can be processed and controlled. Instead, manufacturers and managers establish a system. Radio frequency identification technology is used to track products in all aspects of the supply chain. Each item is tagged with an RFID tag, and devices like RFID readers can scan items throughout the supply chain[10]. When the goods are scanned,

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the identification code of the goods will be loaded into the database, and the product information will be filled in by the relevant supervisor[11].

3. Methodology

The topic discussed in this article is the application of IoT technology in supply chain management. From the perspective of research methods, this article mainly uses the following methods:

1. Literature review and argument analysis. The article first defines and outlines the Internet of Things technology and supply chain management, and explains the basic concepts and characteristics of the two. Then the main application characteristics of Internet of Things technology in supply chain management are analyzed[12].

2. Case analysis. This article uses specific application cases of EPC/RFID technology in supply chain management to explain how IoT technology can realize tracking and monitoring in the supply chain process.

3. Classification explanation. The article starts from different links of the supply chain (purchasing, production, warehousing, distribution, sales, after-sales), and explains the application methods and implementation effects of the Internet of Things in each link.

4. Propose strategies. Based on an in-depth explanation of the application of Internet of Things technology in each link of the supply chain, the article summarizes and proposes strategies such as improving the Internet of Things information system, simplifying the supply chain, paying attention to market demand, and improving personnel quality, in order to optimize the application of the Internet of Things in supply chain management[13].

5. This article summarizes and analyzes the content described in the previous article, points out the current advantages and disadvantages of the application of the Internet of Things in supply chain management, and summarizes the future development trends[14].

This article utilizes several methods, including literature research, case analysis, classification elaboration, and strategy, proposing to systematically explain the application model and optimization strategies of the Internet of Things technology in each link of supply chain management. The article combines theory and cases to demonstrate how the technology works and its benefits. The information provided in this article helps discuss this topic[15].

4. Results

4.1. Application of Internet of Things in Supply Chain Process

In this era, in order to pursue higher added value and higher profits, our companies will select their favorite products based on market needs. However, hot-selling products often only last for a short period of time because of the company's excess production, resulting in an increase in inventory, which cannot be sold in time, and part of the cost can be recovered through price reduction. However, the company does not need to lower prices. It can also use different methods to compete with the best-selling products to occupy more market share. This is the long-tail effect. Therefore, in order to effectively exert the "long tail effect" and improve the operating income of enterprises, we must focus on real-time monitoring of commodity circulation in the product supply chain, apply Internet of Things technology to the entire supply chain management system, and ensure the disclosure of every link ,transparent. The traditional supply chain is a supply chain that integrates raw materials, information, services, and processes. It is a complete supply chain.

4.1.1. Procurement link

During the procurement process, the Internet of Things technology can be used to quickly distinguish between different manufacturers, different commodity raw materials, and different production dates. According to the needs of the market, scientific and reasonable arrangements can be made for the number of purchases to ensure the production quality of the products. Improve procurement efficiency. At the same time, enterprises also need to conduct unified registration and management of raw materials

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and accessories, which will be beneficial to the enterprise's future production quality management and product certification management, so as to better provide services for future products. In addition, the Internet of Things also requires monitoring of supplier information, classifying suppliers according to actual conditions, and formulating corresponding product measures according to the actual needs of suppliers, thereby ensuring the company's product quality and the supplier's supply. Effective supervision of quality.

4.1.2. Production link

Internet of Things technology enables visualization of the production process, innovation in production management, production control, system optimization of production, and realization of sustainable production. After adopting EPC/RFID technology, during the production process, on-site production equipment with automatic quality control can be guaranteed, and the raw materials and auxiliary materials required for production can be accurately found through radio frequency identification technology, which greatly reduces the cost of human decisions. It can also help enterprises allocate production management responsibilities, determine the progress of products, and decide whether to add goods based on actual conditions. In addition, the Internet of Things can also assist in scheduling mechanical equipment used in production, improve the efficiency of equipment use, thereby improving the efficiency of the company's fixed assets, and achieve stable balance and quality control of products.

4.1.3. Warehousing link

With the advancement of technology, the "Internet of Things" has emerged. Internet of Things technology has been introduced in warehousing, and e-readers are stored. When goods are put into the warehouse, an inventory list is automatically generated. At the same time, the latest commodity data can also be transmitted to the data warehouse to monitor the precise time of goods entering and exiting the warehouse in real time, and track the number of goods in the warehouse, allowing logistics companies to quickly grasp their inventory usage. By introducing IoT technology, it is possible to effectively monitor cargo inventory information, greatly improve the accuracy of goods entering and leaving the warehouse, reduce the chance of false alarms of goods, and improve the safety and reliability of the entire supply chain. In addition, using platform interfaces built with technologies such as RFID tags and Wifi, warehouse supervisors can monitor the goods in the warehouse in real time and obtain basic data about the goods without requiring additional unpacking steps. At the same time, information sharing is realized during the storage process in the warehouse, making inventory management more accurate.

4.1.4. Delivery link

Applying IoT technology to the logistics and distribution process can effectively improve the efficiency of logistics and reduce the chance of errors. The Internet of Things uses sensors and networks to provide accurate and on-time delivery services. Even more convenient is the use of smartphones, which can reduce the time for scanning and recording. EPC technology can be used to identify the authenticity of goods and achieve automatic customs clearance. This can effectively ensure the safety and visibility of goods in the logistics link of the supply chain, and can ensure the safety and visibility of goods in logistics circulation. The whole process is tracked. In the logistics process, goods need to be classified, packaged, transported, stacked and other operations require strong high-tech support to ensure product quality and accuracy and minimize losses. The use of Internet of Things technology can effectively reduce the labor costs of cargo loading and unloading operations. At the same time, the application of GPS technology makes the logistics and transportation process more accurate and scientific, improves the accuracy of logistics transportation and distribution operations, and minimizes possible capital losses.

4.1.5. Sales link

When a customer picks up a product with an EPC electronic label on the shelf, a system report will automatically be generated, allowing the IoT management system to provide timely replenishment. The

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company can also use the IoT to calculate the sales status of the product, thereby expanding the market. The scope of use can help manufacturing companies better understand the sales status of goods, thereby determining targeted marketing strategies.

4.1.6. After -sales service

In the after-sales stage, after customers buy the goods at home, they will also confirm the goods based on their labels and inquire about the details of the entire process from production to sales, so that consumers are more satisfied with the quality of the goods. In addition, companies can also make timely corrections to the shortcomings of the products by tracking customers' after-sales comments on the products, thereby making the products more competitive in the domestic market. At the same time, old products can also be sold according to the development of the city. Re-enter the market with demand, thereby achieving economic recycling and reuse.

4.2. Optimization strategies for Internet of Things applications in supply chain management

4.2.1. Pay attention to the personalized development needs of the market

In today's increasingly fierce market competition, companies are increasingly realizing that if they want to quickly improve their overall competitiveness, they must meet the personalized requirements of customers in the shortest possible time. The application and development of IoT technology in supply chain management enables companies to transmit and share information through the IoT, thereby establishing a more convenient company production and information feedback system, enhancing the transparency of supply chain management, and thus It can use resources more efficiently and respond quickly to customer requirements while controlling costs, thus achieving the integration of enterprise production and management.

4.2.2. Appropriate simplification of the supply chain

Supply chain management has become more complex due to the complexity and diversity of its components. In order to ensure the healthy and sustainable development of the enterprise, it must be appropriately streamlined to reduce its complexity. The biggest role and function of the Internet of Things is to share and transmit information in real time, guiding each member of the supply chain to work according to their own needs, thereby enabling the integrated and standardized management of the supply chain, and being able to timely respond to members in the supply chain. Provide feedback and evaluation. At the same time, you can also choose a company or organization that suits you according to your own needs, and use a unified specification to manage various parts of the entire supply chain, thereby forming a complete enterprise supply chain operation model.

4.2.3. Improve the Internet of Things information system

While using Internet of Things technology, an Internet of Things management information system suitable for enterprises can be established, and a more efficient and convenient supply chain information management system and model can also be established; through automated production and operation systems, It can grasp the situation of the entire supply chain in real time and provide timely feedback on the information, thereby building a balanced production operation system. In addition, a sound Internet of Things information system can make timely judgments on market demand, thereby reducing the company's inventory, thereby reducing the company's production costs and accelerating the company's capital operation.

4.2.4. Improve the quality and ability of employees

Because the Internet of Things is a brand new technology, it takes a process for practitioners to go from understanding to becoming familiar with it. Therefore, how to quickly master and reduce or avoid errors in the short term is an important issue faced by supply chain companies. Especially in recent years, the fresh food supply chain sector has developed rapidly. In comparison, farmers' education level is not high,

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their ability to accept emerging things and their mastery of high and new technologies are relatively poor, which can easily hinder the development of the Internet of Things. Promotion and application of technology. Therefore, it is vital to improve the overall quality of employees. Enterprises can cultivate the quality and ability of employees, recruit technical talents, and try their best to create opportunities for communication and cooperation with cutting-edge professional and technical talents in relevant fields, so as to improve the capabilities of employees and finally realize the supply chain optimization.

5. Discussion

There are several controversial points worth discussing in the application of IoT technology in supply chain management. First of all, technology maturity is a key issue. Internet of Things technology is still in the early stages of development, especially due to the high cost of RFID tags and the limitation of identification distance that has yet to be solved. Therefore, promoting an app too early can be risky.

Secondly, security issues have also attracted much attention. If the large amount of data generated by IoT technology cannot be effectively protected, it may face the risk of privacy leakage and business information theft. Therefore, establishing a complete network security protection mechanism is crucial for the application of IoT technology, which also brings certain uncertainties.

Cost-benefit issues are another point of contention. Internet of Things technology requires a lot of investment in supply chain management, including the purchase of hardware equipment, system construction and updates, and personnel training. Whether it can bring value returns in the short term still needs to be verified in the long term. How to weigh costs and benefits is a controversial issue.

Unification of standards is also an important issue. Currently, different enterprises and industries have differences in IoT standards and technical solutions, which will affect the interoperability and compatibility of information. Promoting the unification of standards is a long-term task that requires coordinated efforts from all parties.

Finally, privacy issues also need attention. In the Internet of Things environment, various personal and enterprise data will be better integrated and recorded, which will bring certain pressure on the privacy of individuals and enterprises. How to find a balance between information fusion and privacy protection is also a question worth discussing.

To sum up, the above issues are critical controversial points in the application of IoT technology in supply chain management. Through in-depth demonstration of practice and research, we can find better solutions. The solutions to these problems will directly affect the application prospects of the Internet of Things in the field of supply chain management.

6. Conclusions

The use of Internet of Things technology for supply chain management can realize real-time tracking and monitoring of all aspects of commodity production, circulation, and retail. It enhances management transparency, allowing supply chain companies to quickly adapt to market trends and improve overall competitiveness. At present, the application of IoT technology is not very good. It will take some time to apply IoT technology to supply chain logistics management, and the core technology will also need to be further improved. With the rapid development of our country's economy and the continuous innovation of science and technology, the modernization of logistics will also follow. With the popularization of Internet of Things technology, the supply chain logistics management system has also made great progress, providing enterprises with more transparent information management methods. However, the current Internet of Things is still in development and requires researchers to conduct in-depth research.

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