Research on E-commerce Logistics Information System Based on Big Data Technology

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Abstract—With the in-depth research and rapid development and application of "Internet +" big data technology, it has a positive and far-reaching impact on e-commerce logistics, but how to use the advantages of big data technology to serve e-commerce logistics innovation and satisfy the society and customers for its application demand is the focus of current e-commerce logistics service companies. With the support of the Internet of Things technology, it can realize the unified command of the emergency logistics management system, coordinate the deployment of emergency materials, vehicles, and personnel, ensure the efficient development of emergency rescue work, and minimize the impact of sudden disasters on the society and the people.

1. Introduction

Big data, also known as huge amounts of data, is a distinctive symbol of the era of cloud computing. How to use effective technical measures to effectively increase the processing efficiency of this kind of big data to the highest point is particularly important and necessary. In fact, after a long period of development, China’s e-commerce industry has gradually matured [1]. Under the influence of this maturity, more and more transactions are realized based on e-commerce platforms, which will inevitably lead to the amount of logistics information is booming. Therefore, while fully facing such a huge amount of logistics information, it will be of great practical significance to borrow existing logistics processing strategies to formulate and propose optimal processing strategies in the best state.

2. Literature review

The national "Internet +" action plan puts forward 11 key actions such as "Internet + efficient logistics". The key to the success of major e-commerce companies lies in efficient logistics. With the economic and social development and changes in consumer behaviors such as online shopping, logistics demand has greatly increased, and the requirements for logistics service quality have also been continuously improved. In the era of big data, a large amount of information data has been generated in all aspects of logistics. With the continuous improvement and development of computer technology, people have conducted a series of studies on the innovation and development of logistics industry led by big data. Some scholars analyze the purpose and process of logistics service innovation and believe that logistics innovation is the application of new ideas and new technologies to improve and transform existing service models and methods in the operation process of logistics enterprises, in
order to improve the existing service quality and service efficiency. The process of expanding the scope of services, updating the content of services, meeting consumer needs, and improving the added value of logistics services. Some scholars have explained the connotation of big data. Big data is a data collection with complex structure, large volume and many types. It can select and manage data for enterprises, and provide enterprises with scientific, fast and effective data. Analysis and suggestions have high commercial value and application value, and are a new type of intellectual resource. Some scholars have put forward several salient features of big data: one is that it can store massive amounts of data; the other is that big data can capture and collect multiple types of data; the third is that big data analysis has high commercial and application value; four It is big data processing data and fast calculation speed [2]. People will leave traces in the Internet world when they tap the keyboard, move the mouse, browse information, etc. These will be extracted and transformed into data, extracted into information, and sorted into resources. Some scholars have pointed out in the study of the impact of big data on e-commerce logistics distribution that the application of big data in e-commerce logistics is conducive to the realization of information docking, improving customer loyalty, and increasing the value of data. Some scholars have studied the feedback mechanism of e-commerce logistics information in the era of big data, and proposed that the market competitiveness of e-commerce logistics enterprises in the feedback economy era depends more on the effective integration of big data information. It can be seen that, as the second climax of the information revolution, big data provides a broad space for the development of e-commerce logistics industry.

Some scholars have proposed that in the context of big data, the use of big data knowledge to analyze the relationship between customer clicks, browsing time and sales, predict customer needs and analyze customer location data to predict the best delivery time for customers. It can be seen that there are more studies on the logistics service innovation of traditional enterprises in academia, but there are relatively few studies on the innovation of e-commerce logistics services based on big data. The driving influence and innovation of e-commerce logistics service model are studied.

3. E-commerce logistics feedback characteristics

3.1. Electronic feedback information

Logistics informatization and electronation are the basic requirements of e-commerce logistics. The management method of logistics information formation, transmission and storage with electronic computers as the main and various electronic equipment as auxiliary tools is different from the logistics information feedback before the birth of computers Delivery and storage through written and oral forms. Logistics information is an important part of enterprise informatization. Electronic logistics information reduces the travel expenses of enterprise organizations, improves work efficiency, reduces labor intensity, and reduces pollution and congestion. However, electronic information has problems such as proliferation and difficulty in discrimination. At the same time, damage to computing equipment may result in the loss of a large amount of information. In the era of e-commerce, to provide the best service, the logistics system must have a good information processing and transmission system.

3.2. Comprehensive feedback content

The emergence of cloud computing provides a technical method for processing a large number of irregulars "unstructured data". The logistics technology based on cloud computing can cheaply and effectively store a large amount of comprehensive and changeable data content in logistics activities, and analyze and calculate at any time. These technologies mainly include data collection technology, data storage technology, data exchange technology, and data processing technology. Acquisition technologies include sensors, scanners, etc. In logistics, mobile data collectors (MDE) are often used for inventory irregulars or shelf reservation data acquisition [3]. This technology also has important value in the transportation department or external services. In addition, electronic data carriers such as chips, programmable data carriers (PDP), mobile data storage (MDS) and satellite receiving and
sending devices can be read, edited and stored beyond a distance of several meters; electronic data interchange (EDI) can save time, improve quality and reduce costs. Logistics information technology is an important symbol of logistics modernization.

4. **Innovation of e-commerce logistics service process based on big data**

4.1. **Disadvantages of traditional e-commerce logistics service process**

Under normal circumstances, the e-commerce logistics process is: customer orders → merchants prepare goods to logistics outlets → logistics company packaging → delivery to customers (as shown in Figure 1). However, when such a process is faced with massive orders on festivals such as "6.18" and "Double Eleven", it is likely to cause problems such as overstocking of goods, warehouse explosion, slow delivery, slow collection and delivery, and may eventually be extended. Delivery time reduces delivery efficiency and affects customer satisfaction.

![Fig.1. Process of traditional e-commerce logistics service](image-url)

4.2. **Optimization of e-commerce logistics service process based on big data**

In the context of big data, the e-commerce platform predicts sales by using big data. Before the customer places an order, the merchant can sink the goods to the logistics outlet closest to the customer in advance, so as to achieve "goods go first before the order is placed". After the customer places the order, it will be delivered to the nearest location, thereby improving delivery efficiency (see Figure 2). In this process, the traditional process can be optimized and improved from three aspects:

![Fig.2. The optimization process of e-commerce logistics services under the background of big data](image-url)

4.2.1. **Merchants sink goods to logistics outlets in advance**

Traditional merchants have a certain degree of blindness in stocking, which often causes unsalable goods and bears higher inventory costs [4]. However, the use of big data to predict results has become more accurate, allowing merchants to stock the predicted products to logistics outlets in advance,
reducing the problem of unsalable products caused by inaccurate market grasp, and reducing inventory costs. As mentioned earlier, JD.com uses big data to help customers prepare and deliver goods to nearby locations through warehouse simulation technology.

4.2.2. Establish a dense logistics network
At present, some e-commerce platforms and new retailers are promoting store-warehouse integration strategies with the aim of establishing a dense logistics network to achieve fast delivery. For example, Cainiao and Watsons Tmall flagship store have in-depth cooperation in the logistics field to develop store delivery models. At present, more than 200 Watsons stores have been transformed into "front warehouses", which can be delivered within 2 hours within 3 kilometers. Consumers can also choose timed delivery services; Hema Xiansheng uses store integration to achieve within 3 kilometers It's extremely fast in half an hour. Take Cainiao Network as an example to analyze its e-commerce logistics service process based on big data, as shown in Figure 3.

![Fig.3.Cainiao Networks e-commerce logistics service process based on big data](image)

First of all, the Cainiao network data platform uses big data to predict sales based on past sales conditions, informs the relevant Tmall stores to stock up, and the store stocks the goods to the Cainiao warehouse nearby to achieve "the order is not placed, the goods go first". After the buyer places the order, The Tmall platform submits the order information to the Cainiao data platform, and then the Cainiao data platform issues sorting and outbound instructions to the Cainiao warehouse. After receiving the instructions, the Cainiao warehouse notifies the logistics company cooperating with Cainiao to pick up and deliver the goods. In the "last mile" delivery link, three methods are used to complete the delivery: one is traditional home delivery; the other is pick-up by the buyer through a pick-up point such as a rookie station; the third is for campus parcels, through crowdsourcing Delivery will be completed by the campus parcel man. It can be seen that in this process, big data prediction has become the premise and foundation of e-commerce logistics services.

5. E-commerce logistics information system design

5.1. System architecture design
The e-commerce logistics management system designed by this research includes four parts: infrastructure layer, resource layer, application support layer and application system layer. Among them, the infrastructure layer is composed of the middle layer, system and basic equipment; the resource layer uses the database as the main component to provide data resources for the data processing of the server; the application support layer uses the Web server as the main component to realize the data access function; the application system The layer is responsible for encapsulating the application system. Figure 4 shows the overall technical architecture of the warehouse logistics management system.
The e-commerce logistics management system designed by this research institute provides the basis for the realization of various functional modules with electronic tags provided by the RFID technology institute [5]. The relevant management information of each item is stored in the label, and the manager can use the e-commerce logistics management system to grasp the basic information of the goods in time, such as the specifications of the goods, the date of the goods warehousing, and the quantity of each type of goods.

5.2. Overall E-R Diagram of Database
This research uses the E-R diagram to illustrate the action flow of the logistics management system. This diagram can show the relationship between the various links of e-commerce logistics management. The specific design plan is shown in Figure 5.

5.3. System function module
The Mobile Agent of the logistics information system consists of mobile agents developed in the customer management module, inventory management module, distribution management module, transportation management module, financial management module and decision support module. Figure 6 shows the system function modules.
5.3.1. Customer Management Module
The main function is to receive the Mobile Agent from the customer (customer server or supplier server), and coordinate to complete the work including adding system users, operating authority management, password management, review of customer instructions, filling in item allocation instructions, instruction query, coding maintenance, etc.

5.3.2. Inventory Management Module
The main function is to dispatch information collection agents to related modules regularly, form information reports and send them back to the original system for storage. According to the stored information, carry out comprehensive control and management of the daily work such as the inbound, outbound, and inventory of inventory materials. Through this management function, the initialization of inventory materials is completed, and functions such as the input and review of general warehousing lists are completed to achieve the purpose of reducing inventory, reducing backlogs and shortages.

5.3.3. Distribution management module
The main function is to dispatch an information collection agent to related modules, form an information report and send it back to the original system for storage [6]. According to the stored information, manage a series of activities such as customer application acceptance, distribution operation generation, actual distribution out of the warehouse, etc., to meet the needs of the distribution business.

5.3.4. Transportation Management Module
The main function is to dispatch information collection agents to related modules regularly, form information reports and send them back to the original system for storage. According to the stored information, the dynamic tracking of all materials in the logistics network, dynamic distribution query, management and automatic reminder of information, including information dynamics, material transportation dynamics, storage distribution, etc. According to comprehensive information (distance, road conditions, tolls and tolls) and other factors, provide optimal selection of driving routes.

5.3.5. Financial Management Module
The main function is to dispatch the information collection agent to the inventory management module,
the distribution management module, the transportation management module and the bank server on a 
regular basis, form an information report and send it back, complete the setting of various expense 
items based on the collected information, and calculate various transaction costs. It can also generate 
and output a series of reports such as inventory summary reports and warehouse weekly reports to 
achieve data consistency and sharing. At the same time, control the waybill, freight rate, cost and order plan. Calculate, analyze, and compare the cost of each unit in the system to form a report.

5.3.6. Decision Support Module
The main function is to regularly dispatch work inspection agents to each business module. Each work 
inspection agent works in the corresponding business module and works with the relevant agents 
within each module to process the internal data of the business module, and generate the work report 
of the business module. Send back to the decision support module for storage; send strategic, tactical plans and business plans for each business module to different business modules from time to time.

6. Conclusion
The effective use of resources not only involves a certain enterprise or individual links in the 
enterprise, but also requires the use of supply chain ideas and various technologies including 
information technology to coordinate relevant participants in business activities and their internal 
activities. The basic e-commerce logistics information system provides guarantee for the coordination 
of logistics enterprises and other business activities in the era of e-commerce, which is conducive to solving the problem of logistics bottlenecks in e-commerce, and is of great significance to the construction of logistics enterprise informatization and e-commerce.

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