

Research on Aquatic Products Supply Chain Management System Based on Technology

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Abstract: China is a big country in aquatic products production, consumption and trade, and its aquatic products output and export volume continue to rank first in the world. However, the aquatic products industry is facing many problems while developing vigorously. The low degree of industrialization, weak information ability and frequent quality and safety problems all restrict the development of aquatic products industry in China to some extent, which highlights the weak competitiveness of China's aquatic products supply chain(SC). Since it came out in 1990s, because of its incomparable advantages and characteristics, it can conveniently, quickly and efficiently collect and process data on the spot, and it has quickly become the main terminal acquisition equipment of mobile information system, laying a solid foundation for the integration of aquatic product information and data processing. With the improvement related technologies in the modern logistics industry, in order to improve the enterprises at various nodes of aquatic cold chain logistics, achieve seamless connection of various links in cold chain logistics, and improve the efficiency of logistics organization, IoT technology must be introduced into the aquatic cold chain logistics system. Therefore, this article mainly applies the relevant theories and technologies of IoT to build a highly integrated system A fully traceable cold chain logistics system for aquatic products.

1. Introduction

Personal Digital Assistants (PDA) embedded intelligent devices have been widely used in the industry, and they have also played an irreplaceable role in the intelligent data acquisition and information sharing of SC nodes in the traceability of aquatic products production [1]. In the context of increasing technological convergence, products are easy to imitate, but a competitive SC is not easily imitated. The SC includes all activities related to the transfer of goods from the raw material stage to the end user, including supply source and procurement, product design, production planning, material handling, order processing, inventory management, transportation, warehousing, and customer service [2]. EPC uses a set of numbers to represent manufacturers and their products. In addition, EPC also uses another set of numbers to uniquely identify individual items. It overcomes the drawbacks of barcode being unable to identify individual items, being only accessible for identification, and being prone to damage and loss of information [3]. The PFID electronic tag is the carrier of this encoding. When the PFID electronic tag is attached to or embedded in an item, it establishes a one-to-one correspondence between the item and the EPC information in the electronic tag. The electronic tag reader of the RFID system can read the memory information of the PFID electronic tag [4]. In addition, due to the backward aquaculture technology in China, the following problems have occurred. First, there is a lack of corresponding detection links and means in the process of seed sales, which is easy to cause the spread of diseases; Second, the investment in the cultivation sites is insufficient, and the overall production scale of the cultivation sites is small, the capacity is weak, the dispersion is uneven, the technology cannot be guaranteed, and it is difficult to supervise [5]. Third, the problem of seed production qualification is serious, most seed farms are in unlicensed production or the production license is expired, and the quality of produced seeds is not guaranteed; Fourth, the lack of new species development,

inbreeding leads to serious degradation of species quality, weakened fish disease resistance and high incidence, leading to frequent drug use [6]. widely used in logistics, medical care, State Grid and other fields, and has been listed as one of the five emerging strategic industries in China. Among them, the application, such as radio frequency identification technology (RFID), global positioning system (GPS) and geographic information system (GIS), in all aspects of cold chain logistics of aquatic products is very important to realize the position tracking, source tracing and electronic operation of aquatic products in processing, transportation, warehousing and sales. In particular, the collection and sharing of data and information in the whole process of logistics has incomparable advantages over other information technologies, so as to realize the systematic and management of cold chain logistics of aquatic products and achieve the purpose of effectively preventing the occurrence of aquatic products safety incidents [7]. Based on the perspective of the entire process of cold chain logistics for aquatic products, this article constructs a framework for the entire process of cold chain logistics for aquatic products based on internet of Things(IOT) technology, and analyzes the solutions of IoT related technologies in four stages: cold chain processing, cold chain warehousing, cold chain transportation, and cold chain sales.

2. Theoretical Overview of Cold Chain Logistics of Aquatic Products and Technology

2.1. Overview of cold chain logistics of aquatic products

Cold chain logistics of aquatic products refers to the use of cold chain technology, information networks, and other means to ensure that aquatic products represented by fish, shrimp, crabs, etc. are always in a specific low-temperature environment in the processing, transportation, storage, sales, and other links, which not only ensures the quality and safety of aquatic products but also reduces corresponding losses in a special logistics form [8]. In response to the current difficulties in the cold chain circulation of aquatic products in China and the shortcomings in logistics and SC management, an integrated management. The aim is to comprehensively apply key technologies of the to the entire process of cold chain SC management of aquatic products, achieve information transparency and seamless connection in all aspects of the cold chain, ensure the controllability and quality traceability of the entire cold chain logistics, and minimize the cost of cold chain logistics to the greatest extent possible, Improve the operational efficiency of the SC [9].

Regional differences show that the aquatic products in coastal areas mainly come from marine aquaculture, including fresh and frozen seafood, while in inland areas, freshwater aquaculture such as lakes and rivers is mainly used, supplemented by dried or smoked seafood. The existence of cold chain logistics of aquatic products can transport and sell aquatic products in coastal areas to inland areas through cold chain, so that people in inland areas can also taste fresh seafood. This link needs the support of refrigeration facilities such as refrigeration equipment, refrigerator and refrigerator [10]. Cold chain storage is an important process to ensure that aquatic products are always at the appropriate temperature and do not decay or deteriorate from cold chain processing to cold chain transportation. Therefore, this article mainly studies the storage of aquatic products from processing to transportation. For enterprises, monitoring during aquaculture, production, and transportation can be improved to prevent unexpected situations from occurring. At the same time, it can also increase the competitiveness of their own aquatic products, avoid significant losses for enterprises, and increase product added value. The traditional aquatic product SC refers to a chain that starts from the procurement of raw materials for aquatic products, undergoes processing, warehousing, transportation, distribution, and ultimately delivers the products to customers. The operation mode of the traditional aquatic product SC is shown in Figure 1.

It inherits the characteristics of the traditional SC, that is, production-oriented, around the core enterprises, through the control of information flow, logistics and capital flow, starting from purchasing raw materials, making intermediate products and final products, and finally sending the products to consumers through the sales network, connecting farmers, fishermen, processing enterprises, distribution centers, supermarkets, wholesale markets and consumers into a whole functional network chain.

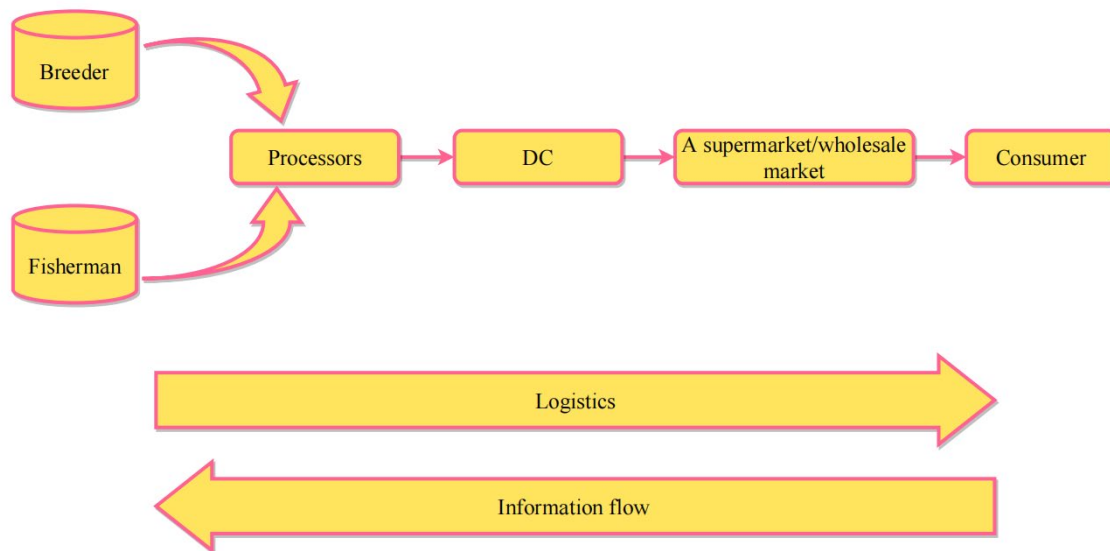


Figure 1 Traditional Aquatic Product Supply Chain Operation Mode

2.2. Operation Mechanism of Aquatic Products Cold Chain Supply Chain Integration System

To ensure the smoothness and operational efficiency of the cold chain of aquatic products, a project team composed of all node enterprises should be established first. According to the key business and resource integration capabilities, the core enterprise (which can be a production processor, wholesale market, retailer or third-party logistics) that will preside over the integrated management of the SC should be determined, and the core enterprise should build, manage and maintain a dynamic monitoring platform for the whole process of the cold chain based on the , At the same time, it is based on the Internet to achieve the integration and integration of processing industry IoT application systems, wholesale market/logistics center IoT application systems, logistics industry IoT application systems, and retail IoT application systems corresponding to other node enterprises. Including the information between aquatic product producers, processing enterprises and dealers, realizing seamless connection, improving the visibility of each individual to the overall real-time information of the SC, and effectively controlling the information flow in the SC, Improved flexibility in SC management.

By scanning the electronic tag on the temporary pond and establishing the corresponding relationship with the production batch in the production plan, the staff of the processing plant can conveniently and accurately find out the raw materials needed for the current production batch. Readers installed in workshops, distribution centers, warehouses and shelves can automatically record the flow of goods throughout the SC, so that goods can be tracked in real time anywhere in the SC. At the same time, members of the SC can also obtain the operation information of other members or business links in real time, which improves the transparency and management efficiency of the SC and makes the whole SC management process become a completely transparent system.

The main applications of IoT technology in the transportation process include: pasting RFID electronic labels on goods and containers in transit, installing GPS on transportation vehicles, and installing RFID reading devices on transportation lines (including temporary warehouses and transit parking lots). In this way, the IoT system can automatically scan the goods on trucks and send shipment information to relevant business parties after confirmation, Business personnel can track every shipment information from the warehouse information system, and even accurately understand how many containers are currently in transit, the origin and destination of transit, and the expected arrival time, ensuring accurate inventory control. By scanning the products one by one, we can achieve product inventory and in stock management, which not only requires a lot of manpower and resources, but also is prone to errors. Applying IoT related technologies to the warehousing process can achieve real-time monitoring and automation of warehousing operations while completing basic warehousing management functions, thereby improving the efficiency of

warehousing management.

3. Building a Full Process Cold Chain Logistics System for Aquatic Products Based on Technology

3.1. The goals and principles of system construction

The whole cold chain logistics system of aquatic products based on technology forms a coordinated whole among government supervision departments, cold chain logistics-related enterprises and consumers through the information chain, and realizes the intelligence and transparency of all aspects of aquatic products cold chain logistics operation through this system, ensuring the seamless connection and information sharing of all links. Through this system, the government supervision department can monitor the whole process of cold chain logistics of aquatic products in real time, enterprises can track and trace aquatic products. This section will not elaborate on it, but only analyze the of technology in supermarket sales. When aquatic products arrive at the supermarket, RFID technology is first used to connect with the onboard RFID label information of the same cold vehicle in the previous section to automatically verify the qualification of the arrived products. If they are not qualified, they will be rejected directly; Then, the product sales information (including shelf life, shelf life, sales amount, responsible person name, etc.) is written into the RFID tag through an RFID reader. Based on the previous analysis, it can be seen that cooperation between enterprises can maximize the interests of all parties. The technology is applied to the four links of cold chain logistics for aquatic products, and a monitoring system for the entire process of cold chain logistics for aquatic products based on technology is established to achieve the collection, transmission, and management of data information in each link, Thus achieving information sharing among enterprises.

As the central link in the traceability of aquatic products, PDA not only needs to be very strict in the processing and release of batch numbers, but also needs to be constantly tested and improved in the process of data transmission and communication with the server to cope with any problems in the complex environment on site. When consumers buy aquatic products with RFID tags, the cashier reads the product information through the hand-held reader and updates the product information to the sold state; The channel reader at the entrance of the supermarket can read the payment information of aquatic products with RFID tags, and the detector of aquatic products taken out of the supermarket store without payment will give an alarm to remind the staff to deal with it in time, effectively preventing theft; The comparison between the information read and written by the RFID reader at the supermarket exit and the information read and written by the small fixed reader on the supermarket shelf can effectively prevent customers from giving up buying the corresponding aquatic products for one reason or another before checkout, which will affect the quality of aquatic products, and facilitate the staff to return the products in time; The video monitoring system is installed in the store to monitor the sales process of aquatic products in real time and record relevant data.

3.2. Realization of data transmission and acquisition in service-oriented

When the aquatic product production traceability system is PDA oriented and entered into the database, the function that needs to be implemented is that the data can be fully returned to the server through WiFi based on Webservice services with low latency. The whole process takes wireless WiFi as the network environment, calls WCF network service and Webservice communication service, synchronizes SQLCE database and SQLServer database, and then generates DataBar barcode based on unique identification traceability code (similar to batch number, but with the increasing number of SC links. They should explore the suitable application mode of the according to their own actual situation, find the technical requirements according to the application, and reverse the technical development projects according to the needs. Establish the standard system framework of in various industries to support industrial development with standards; Explore the sustainable business model of applying the in various industries, promote

industrial scale development, and reduce application costs.

Lower cost barcodes can be used in the retail segment of the aquatic product SC, while safer IoT labels can be recycled upstream in the retail segment. Although the move increases the intermediate links, it also improves the speed and transparency of information flow in the SC. Many domestic IoT implementation cases have adopted this strategy. The entire system was tested about 100 times, and the corresponding time of all operations in each module was counted. The average of 1 * 100 times was taken as the delay duration of this operation. The test results are shown in Table 1.

Table 1 System Delay Test Results

TEST	Test operation	Test average delay
Login module	Trigger login button value login success duration	910ms
WebService based aquaculture information procurement module	The PDA side triggers the upload data button until the data is synchronized and enters the server SQL Server for a waiting time	1040ms
Based on WCF fishing/distribution information input module	The waiting time for the PDA end to trigger the upload data button until the barcode printing is completed	1220ms
Breeding information input module	PDA scans the barcode, loads the data successfully, and finally synchronizes the waiting time into the server-side SQLServer	1100ms
Aquaculture traceability information query module	Scan barcode to obtain traceability code, waiting time for traceability query interface	980ms
Conversion between modules	Triggering the menu bar module switch button greatly reduces waiting time through asynchronous invocation	700ms

From the delay data in the table, it can be seen that the longest delay is to operate the PDA to trigger the upload data button until the barcode printing is completed. On the basis of the simultaneous deployment of WCF and Webservice, the network has certain redundancy, and there will be a large delay, with an average delay of 1220ms, but it is also within the acceptable range of users.

4. Conclusions

In view of the current situation of weak information ability, poor management level, serious food problems and low competitiveness of SC in China's aquatic products industry, this paper studies the theory of and competitiveness of aquatic products SC, and verifies that the application of can enhance the competitiveness of aquatic products SC. The rise of technology has promoted the development of cold chain logistics of aquatic products. The integrated application of technology in the cold chain construction of aquatic products will help to solve the problem of aquatic products circulation in China and eradicate the "stubborn disease" of SC management in the cold chain of aquatic products, thus boosting the modernization development of fishery in China and upgrading the quality and efficiency of aquatic products circulation industry. This article studies the heartbeat packet and heartbeat mechanism based on TCP/IP communication protocol, thereby solving the problem of high network resource occupancy and high latency in the case of multiple PDAs or servers on site. It is a means to optimize Webservice and WCF network services. Studied the RDA synchronization technology for uploading and downloading data between PDA and server, as well as cross platform sharing of databases.

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