The Research on Integrated Grain Supply Chain Management Based on Internet of Things

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Abstract: This paper first optimizes the grain supply chain based on internet of things and network technology, according to the theory of "pull" Supply Chain integrates the function of modern logistics and supply chain, in the use of information technology integrates the enterprises involved of grain supply chain and the link of grain circulation, and then builds integrated grain supply chain model and the whole structure based on radio frequency identification technology, obtains accurate prediction, calculates based on radio frequency technology providing large amounts data and processing power. studies integrated grain supply chain management under the support of internet of things, establish to track the quality of grain and the processed products, control and traceability, to ensure security of grain and the processed products, establish grain security early warning system of supply and demand according to the accurate prediction relying on integrated grain supply chain management based on internet of things, according to integrated supply chain management based on internet of things, reduces logistics costs of grain and the processed products, improves efficiency and effectiveness of circulation.

Keywords: internet of things, "pull" supply chain, integration, grain supply chain

1. Introduction

In the short-term consideration of grain safety of China, continues to strengthen the grain reserves. In the medium-term consideration, continues to improve the capacity of comprehensive grain production and enhance grain reserves. In the long-term consideration, builds perfect grain supply chain from the field to table based on strengthening of grain reserves and increasing grain production capacity, and implement integrated management[1]. Meanwhile, the fundamental problem of grain circulation system of China is that has not constructed a complete grain supply chain, It is a strategic issue to face that not deal with and solve the problem of grain circulation system under research all the nodes of grain industry and links as a whole. It is necessary that integrated consideration as a whole in the strategic planning of macroscopic grain supply chain system, the logistics management and the microscopic research and development of the key technology and information networks technology of grain logistics[2]. It is the trend and option to establish integrated grain supply chain management for establishing a complete grain supply chain.

2. The Content and Features of Integrated Grain Supply Chain

Integrated supply chain refers to a "virtual organization" formed by all members of the supply chain based on common goals, and the organization members optimize the whole performance through information sharing, coordination and cooperation aspects of financial and material. Integrated supply chain management is to integrated manage the entire supply chain, that is to plan, coordinate, organize and control the business flow, information flow and cash flow of suppliers, manufacturers, distributors, customers and ultimately consumers of logistics to form a seamless link. According to the ideology of supply chain integration, integrated grain supply chain management is through specialized division of work of the nodes enterprises in the supply chain of grain and the processed products, causing the grain supply chain node enterprises coordinated development through information sharing, benefit sharing and other aspects, to form link seamlessly of the processes and logistics functions of all the supply chain and
integrate the core competitiveness of nodes enterprises, to make that not easy to copy and imitate. Grain supply chain management is more complex than that of industry for the features, it requires more effective integrated management. Integrated grain supply chain management can reduce intermediate costs, increase profits of nodes, reduce uncertainties of market and production to ensure grain supply security and safety of grain and the processed products.

3. Integrated Grain Supply Chain Management Requires Support of Information Network Technology

In the process of integrating the grain supply chain management, information plays a very important role, it will be an empty talk to study integrated grain supply chain management if lacks of the support of information network and technology. There are many wastes in the traditional grain logistics, long cycle of logistics and high costs are all in touch with the distortion of information. From the past, we must sacrifice other goals for meeting a goal of the logistics system, in the use of advanced information technology and network systems, conflicting objectives can be achieved simultaneously[3]. Effective implementation of integrated grain supply chain management will ensure the requirement information, production and processing of information, order routing information, information of storage and inventory condition, the transit information of grain and the processed products of each node in the grain supply chain, to achieve a high degree of information sharing and integration, make a large number of scattered grain enterprises to link a dynamic, integrated, virtual network system of supply chain, cut off cost of the grain and the processed products from the update view. In order to reduce the uncertainties of grain market, grain production and the processed products, it is necessary for nodes of grain supply chain using the basic software and hardware technologies, so that information flow circulates smoothly in each node enterprise of the grain supply chain. Smooth flow of information is the basis of the grain supply chain management, which enables companies owning the ability of accurate forecasting of supply and demand, to some extent to eliminate the risks of production, processing, distribution and market, link production and consumption effectively, plays a guiding role in circulation.

4. Internet of Things Promotes Integrated Management of Grain Supply Chain

Current Situation of China's grain supply chain can be summarized as four major characteristics: the core nodes enterprises are small, the main bodies of market are scattering and processing sectors is weak, logistics enterprises develop slowly. At present, due to the market-oriented operation standard of grain circulation distribution has not yet formed, and lack market-oriented policies and legal system to run, so the policy level of the market is difficult to operate and specific implement, especially from intensive grain supply chain management and needs of integration to analysis, the grain is in the risk of double failure stage of government and the market, once a large number of poor infrastructure, low level of management to enter the market may be squeezed, leading to fracture the entire grain supply chain. Grain circulation, particularly grain contemporary logistics in the support of internet of things, will link grain production, purchase, transportation, storage, processing, distribution, information to integrate to intensive grain supply chain, from the radio frequency identification technology (RFID), infrared sensors, global positioning systems, laser scanners and other information sensing device of internet of things, according to the agreed protocol, connect grain and the processed products to the internet, to exchange information and communication, achieving intelligent identification, location, tracking, monitoring and management network[4], the government and the relevant units to master to the details timely and scientific predict, adjust and improve the policies and legal systems, promote scientific and rational way to run the grain distribution in the situation of diversification grain market bodies. As the links of grain supply chain are in the state of movement and loose, then information and direction are transfer as the actual of space activities, the results will affect the sustainability, sharing, real-time
and accuracy of information. Electronic tagging technology (EPC) of internet of things has the ability to read and write, particularly suits to the grain supply chain for changing data and content frequently, and its role is collecting data and communicating system commands, for warehouse management, transportation management, production management, material tracking, transport and shelf identification of the grain supply chain. At the same time it is able to control inventory, efficient customer response (ECR), improve efficiency and operational functions of logistics and reduce the bullwhip effect of grain supply chain. EPC system has improved the transparency of grain supply chain, grain and the processed products to be tracked in real time. The reader installed in the warehouse, logistics center, commodity shelf can record the flows of grain and the processed products automatically from production to consumption, make the entire grain supply chain more conducive to intensive management.

5. The Construction of Integrated Grain Supply Chain Based on Internet of Things

Aim at the current macro environment of China's grain circulation to be improved, integrated grain supply chain management is not perfect, the technology of internet of things and the theory of grain supply chain needs to be strengthened, this paper seeks to build an integrated grain supply chain management system, research the grain supply chain management information system based on RFID technology, trying to implement integrated grain supply chain management in the support of internet of things, to help the government's macroeconomic regulation and control grain supply and demand and food safety.

5.1 Construction grain supply chain system, implementation integrated grain supply chain management

Supply chain management is an integrated thinking and method of management, this is a new management strategy, it integrates different enterprises to increase the efficiency of the entire supply chain, focuses on cooperation among enterprises. Grain is a low value-added agricultural product, which determines the grain supply business with low margins profit, however, grain is daily necessity, the demand is relatively stable, grain is functional product, according to the characteristics of functional product, grain supply chain is an effective supply chain. The goal is through integrated supply chain management to achieve logistics services with low cost, high stability, timely and reliable to access raw material supply.

According to the principle of "pull" supply chain, based on information technology of internet of things, first of all, in accord with the idea and principle of inter-organizational business process reengineering and functional reorganization of business processes, restructure the business process of grain storage and transport, transformation procurement process of grain and the processed product. Establish grain logistics information system, from electronic data interchange system (EDI), material requirements planning system (MRP), online procurement system to achieve integrated grain supply chain management and information-based and systematic.

At same time, through adoption of MRP systems, implements real time and dynamic management as orders for the procurement and inventory. Integrated grain supply chain management enhances their competitive ability to obtain economies of scale.

In the use of information technology of internet of things, Integrated grain supply chain management melts farmers, grain logistics center, grain processing enterprises, grain and the processed products distribution centers, retail enterprises and other enterprises closely related with each other to a whole. To speed up grain from production to consumption of the process, shorten the sales cycle, reduce intermediate links, reduce farmers business risk, promote grain demand information to delivery accurately and rapidly. Furthermore improve the market competitiveness of the supply chain node enterprise. The core of integrated grain supply chain management is a coordinated whole based on three loop: the first one is the operating loop that composed of customer needs, integrated program, business
process reengineering and object-oriented process controlling, the second one is the strategic loop that
composed of customer strategy, information sharing, adjust adaptability and creative team, the third one
is the loop of corresponding performance evaluation of each operation process and elevated
performance evaluation. Integrated grain supply chain management is more complex than that of
industry, in order to achieve safety of grain supply and demand, food security, we must integrates the
whole from farmers (farm) to table and continue to optimize.

5.2 Integrated grain supply chain management information system based on radio frequency
identification technology (RFID)
In the use of radio frequency identification technology (RFID) to replace bar code technology, and put
into integrated grain supply chain to build management information system, and to achieve rapid
reaction among the four categories of supply chain members of all suppliers, manufacturers, distributors,
retailers from farmers (farm) to the table[5]. System uses network to integrate the distributing,
heterogeneous and dynamic computation resources, provides users with readily available, reliable,
consistent, standard, low-cost and powerful computing capabilities, puts applications and services of
different systems, different basis, different types of data sources of supply chain partners into a single
information platform in the use of portal, so as to provide a wide range of resource sharing and
functional integration for grain supply chain management, to ensure to realize the entire supply chain
optimization in the premise of self-interest. System takes grain processing enterprise or grain logistics
enterprise as its core enterprise, the whole structure includes planning, execution, reporting and business
intelligence, planning includes material procurement, production planning, sales forecasting and
distribution management. Third-party logistics assumes supply chain executives, receives logistics
outsourcing, and extended to provide tracking information, closely cooperates with supply chain
partnerships. Reports and business intelligence provide query, analysis, generating financial statements
and business reporting capability.
The main role of radio frequency identification and other information technology in the integrated grain
supply chain is connected node enterprises together closely, so that the information transferring
corresponds to the physical movement of grain and the processed products, coordinates behavior among
members of the supply chain effectively, and the breadth and depth of cooperation be strengthened,
enterprises of the grain supply chain establish faster, more convenient and more accurate electronic
contact, therefore, establishes integrated grain supply chain management information system in the
support of major information technology as RFID can regulate operation of each node enterprise and
government and financial enterprises, making the supply chain core node enterprise with core
information (resources, markets, technologies and services, etc.), in the use of management information
system develops marketing channel of highly efficient. Integrated grain supply chain network system
extends to the rural service organizations and urban retailers, whereby accesses to merchandise sales
information, consumers and the market demand and other information.

5.3 Integrated grain supply chain management supported by Internet of Things
At present, the operation processing of grain supply chain enterprise exists problems of data error and
delay, a lot of inventory data or delivery data are inaccurate, in addition, it can not make real-time
response to the change of the entire grain supply chain, leading to a certain difficulties in the control of
the supply chain, in the use of technology of internet of things allows logistics and information flow to
movement in-phase and can coordinate simultaneously, realizes the real identity of goods and can be
traced back and inheritable, improves integrated grain supply chain management to reduce cost. At the
same time, realizes logistics management to achieve a high degree of automation, in particular
Electronic Product Code system (EPC) and RFID System improve the transparency of the supply chain,
goods in any place can be real-time tracked. Readers installed in warehouses, factories, logistics centers
and the shelves of retail enterprises record the flow of grain and the processed products in the supply
chain automatically.
In the grain processing sectors, achieves to identify and track for raw materials, semi-finished and finished products of the production line, reduces cost and error rate of artificial recognition to help managers to issue replenishment information timely according to the progress of production, achieves to product balance and steady of the line, and enhances product quality control and tracking. In the transport management, goods of transport in transit and vehicles attach EPC tag, installs on the RFID receiver repeaters in the checkpoints of transport lines, suppliers, distributors and buyers can know the location and estimated time of arrival to realize tracking control in the grain and the processed products in transit. Throughout the warehouse management, the internet of things technology is widely used in the inbound, outbound, stocktaking and back positions and other sectors, through combining storage plan and shipping plan of the supply chain planning systems with technology of internet of things can complete all business operations efficiently, enhance accuracy and rapidity of operation, improve service quality significantly, save labor and improve the storage space utilization, reduce errors and losses. Real-time stocktaking and smart shelf technology based on technology of internet of things ensure accuracy and timeliness about shipping, return and replenishment, and can provide accurate information about inventory. Links in the distribution and allocation, when all goods pasted EPC tags enter into the distribution center, the reader installed to entrance reads and writes labels, internet of things system will check the information with the shipping records, detect possible error, and then update the EPC tags, so that managers only need to operate a computer can query the information of the number of goods, transit point of origin, destination and expected to achieve through the internet of things.

6. The Objective of Integrated Grain Supply Chain Management Based on Internet of Things

6.1 Establish the system of quality retrospective and security assessment of grain and the processed products "from the farmers (farm) to the table" based on the technology of internet of things
Inputs basic information from the grain harvest by using technology of internet of things, through processing, logistics, inspection, distribution to final consumers, writes every aspect of information to form a chain, tracks from upstream to downstream. From grain suppliers, processors, logistics business, sellers and consumers, looks for the cause of the quality problem. Consumers discover the quality security issues of the grain processed products, trace from downstream to upstream, recall the problem products. The security assessment of grain and the processed products is the low-cost electronic tags affixed to containers, is the reader integrated sensor of temperature, humidity and light intensity, builds the grain safety management system things by using the technology of internet of things. In addition, users can obtain the information of raw materials producing area, processors, producing date and cooking methods at the dinner table, supermarket shopping customers can obtain the flow and consumption safety information of the purchased grain. According to processing technologies, the recommending consumption deadline, circulation process, environmental parameters and the corresponding time provided by the manufacturer, make scientific judgments about the security level and rank of grain and the processed products automatically, and in accordance with the principle of "first in first out" issuing delivery order, the system turns' reassurance " to "expired" automatically if exceeds the shelf-life.

6.2 Build integrated supply chain management system to help the government's macro regulation and control, safety of supply and demand based on the technology of internet of things
Unlike other industries, the price elasticity of supply and demand of grain industry are relatively scarce, seasonality and dispersion of production and universality and persistence of consumption co-exist, market risks and uncertainty from climate and disasters of production co-exist, requiring government intervention through support, subsidies, reserves and other macro-control measures, only put the grain circulation into the grain supply chain, apply the technology of internet of things, learn from manufacturing supply chain management, implement integrated management can establish the grain
security early warning mechanism of supply and demand for stabilizing grain markets, and through optimization of the grain supply chain, strengthen the role of leading enterprises, promote the development of grain industry. To some extent to eliminate uncertainty of grain production, circulation and market, link the production and consumption effectively, and has oriented function to grain production, grain processing, grain distribution.

7. Conclusion

The internet of things building by the EPC hardware and software technology applies in the integrated grain supply chain management, the whole process of procurement, sales and consumption will change fundamentally, enhance efficiency and management of the grain supply chain greatly, it is not only a new technology, but the business model change for grain logistics management, will reduce the inventory costs of grain and the processed products, shorten product delivery cycles, improve storage and shelf availability and reduce total logistics costs.

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