The Construction of Agricultural Products Traceability System Based on the Internet of Things-The Cases of Pollution-Free Vegetables in Leping of Jiangxi Province

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Abstract. With the problems of food safety happening increasingly, the demand of the public for agricultural products becomes stronger and stronger. This paper declared the status of the production process of pollution-free vegetables in Leping city of Jiangxi Province in detail. At the same time, it put forward the existing problems in the current process and the recommend for new system. In the end, based on the internet of things, it designed the Agricultural Farm System, including the process of purchasing, storage and outbound, planting, processing, sale and distribution.

Keywords: the internet of things, agricultural products traceability, information system

1 Introduction

Agricultural product is the necessity for people to survive, however, in recent years, the quality problem of agricultural product has exposed frequently in China, which has seriously influenced the healthy bodies and daily lives of consumers. The agricultural products with higher safety and higher quality are popular in consumer markets. Especially with the development of economy, the production and sale of agricultural product are increasingly separating, which made it more difficult to get safe information of agricultural product. So, in order to realize a traceable market requirement, which asks for the development and establishment of an Agricultural Product Traceable Information System directly, more effective measures must be taken to strengthen the management and supervision of agricultural production.

Since the 1990s, many developed countries already have traceability systems. The countries in European Union (EU) first apply agricultural products traceability system in the product of live cattle and beef. EU issued a White Paper on Food Safety in January 2000, and declared all relevant production operators' responsibility in the process of product circulation from farm to table. In the regulation No 179/2000 of EU, companies are stipulated to provide assurance measures on materials and date to ensure their safety and traceability in the process of production, processing and sales. In USA, government could farther to promote management functions based on

agricultural products traceability system. In 2003, U.S. food and drug administration (FDA) published the food safety tracking regulations, in which all enterprises, involved in food transportation, distribution and import, are required to establish and preserve the whole process of food distribution records. In order to promote the traceability of agricultural products, a series relevant laws and regulations are established in the field of agricultural products traceability. Domestic scholars emphasis the importance of establishing agricultural products traceability system to the quality and safety of agricultural products, and put forwards many countermeasures against the current problems.

2 The Problems and Present Situations of Vegetable Production in Leping

There are 20,000 hectares for vegetable planting in Leping in 2007. Its total output has broken through 600,000 tons; the vegetable planting area of the city is 17,000 hectares, and the total output is 620,100 tons. It covers the ten vegetable varieties of 100 major categories, of which more than 80% of the export of vegetables, by the end of 2010 the city's vegetable planting area has reached 22,000 hectares with an annual average increase of 4%; the total output of vegetable is 960,000 tons with an annual average increase of 12%; and the total output value of about 1180,000,000 RMB with an annual average increase of 17%. Vegetable wholesale market transaction volume reaches 701,000 tons with an annual average increase of 1.5%; turnover is expected to reach 1380,000,000 RMB, an increase of 17.4%. By 2011, the city's vegetable planting area is more than 25,000 hectares, and total output is 990,000 tons. Leping became the largest vegetable base and vegetable distribution center, price and formation center, information and Communication Center in Jiangxi province. It became the important distribution center of vegetables in the Yangtze River Basin, and has long enjoyed a good reputation of national dish country of the Yangtze River and the national pollution-free vegetables Demonstration County.

2.1 Existing Problems of the Vegetable Production Business Pattern

Problem 1: Pick up seeds. Due to the lack of the information of seed selection and source, the production of seeds planting cannot be adjusted to response to market demand in time, and cannot fit for the customer’s demand.
Problem 2: Breeding. The planning of breeding is not reasonable that leads the lack of production or too much of production.
Problem 3: Decide planting. In planting decisions, the processes cannot be precisely controlled due to non-complete historical information.
Problem 4: Field management. Don’t have complete record. So the field management cannot provide statistical information, and predict crop’s needs of fertilizer, water and sunshine to provide reference standard for plant operation.
Problem 5: Harvest. Harvest does not have the unity of records due to individual records. People cannot statistical the output of fields.

2.2 Existing Problems of the Current Mode of Vegetable Processing

Problem 1: Process management. In vegetable processing, such information cannot be recorded, including time when vegetables reach the machining center, weight, operation personnel. So the formation cannot be reversely traced.
Problem 2: Warehousing operations. No record the related information of each storage products, including the name, batch, quantity, storage time and warehousing operations et al. The information of the products in storage cannot be traced back.
Problem 3: The inventory query. Due to lack of inventory information, the inventory situation are present cannot been known in any time, so cannot provide and reference information to production, procurement and sales.
Problem 4: Scrap processing. Without a complete waste treatment process, at present the warehouse keeper will statistics the information about the scrapped productions according to scrap processing requirements, information will be summarized and reported to the superior leadership.
Problem 5: Outbound processing. No record about the reason of the outgoing products, including name, product batch number, storage products, delivery time, delivery etc. The detailed information of the outgoing products cannot be traced reversely.

2.3 The Problems Existing in the Sales Distribution Nowadays

Problem 1: Distribution management. The plan of distribution lacks of the distribution automatic plan system, nowadays the formulate of the plan about distribution is related to the forms and records of distribution, but very little of the members information can complete the tasks at the required time, so as you can see, it will be very difficult to complete the tasks when the member scale expanded.
Problem 2: Distribution statistics. We just have each piece of distribution plan, if you want to statistics one of the project targets, you need to do it by yourself.
Problem 3: Satisfactory of the statistics. Don't set completed satisfactory evaluation system, cannot give a completed statistics and analysis to the customer's evaluation, so it is very difficult to improve the operation of the product, plant, and distribute.

3 The Design of Function Modules

Through the analysis of the production process, at the same time, in order to make system exchange and share data with the related system better, especially in order to complete the system after the long and arduous system maintenance tasks in the operation, reduce the maintenance work in the development, on this basis, we can propose the component development according to the function of the system, as shown in Fig. 1. It is the core modules and the basic functions of the system.
According to the business process, we can design the parts of procurement process, storage process, planting process, processing flow, flow distribution in the agricultural products traceability system. In the follow sections, the design of each part and links of those parts will be respectively described in detail.

3.1 Procurement Design

Purchase link is the initial part of the production and processing. Through setting up a rigorous procurement process, we can avoid that inventory source become a problem. Purchasing module can be divided into four sub-modules, including the procurement plan, procurement process, sourcing and purchasing statistics. The node sets realize that the whole purchasing process can more be standardized, and the authentic data can be obtained.

In the procurement procedure of setting up purchase plan, each procurement plan number can corresponds to multiple purchase batches, and the information of each batch includes corresponding product and the relations information. Because a product's bar code corresponding to sole one purchase batches, we can quickly find the source of kinds of problems by inversely information tracing.

3.2 In-out Stock

In-out stock represents the link of the raw materials' procurement and the recipient of warehouse. In order to guarantee the accuracy of entering warehouse and alleviate the press on the audit, a link of audit can be set. Thus, not only can guarantee the accuracy of the data in stock, but also will make the process of structure more clear and easy. The efficiency of all works can be improved based on the accuracy of data. No matter what kind of storage types, including procurement warehousing and unplanned put in stock, all need to be handled in storage applications. This is the goods cannot be put in stock until they pass the audit.

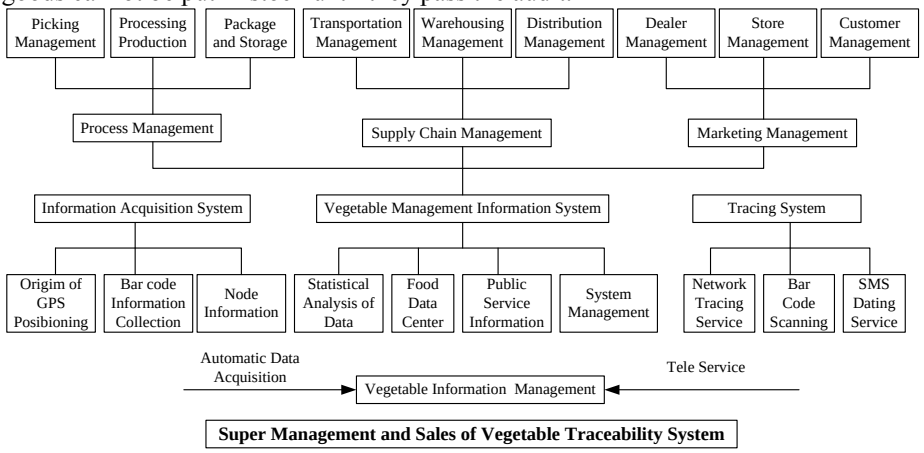

Fig. 1. Construction of vegetable traceability system

3.3 Planting Process

According to the demand analysis report, the main processes for planting include seeding, sowing, the field of management and harvesting link. Although the types of field management are far too many, these are just some of the operating records in the

system, namely the choice of the state. Therefore, the planting processes designed in the system sequentially include fielding, seeding, managing, and harvesting.
The module settings of the planting management in the system includes the planting of structure module, the field of management module, the record of harvest module, and the temperature field management module, etc. When users begin to run the system, the planting module chooses the large field or basement to plant and gets the seeds to be sowed. At the same time, the system will automatically calculate the planting area according to the basic data of the large field, while associating the information about sowing seeds of purchasing batch and supplier, etc. in the module of field management, the user can record the daily maintenance and the operation management. The later product traceability can be supported by the data provided from system module.

3.4 Processing Flow

With regard to fruit and vegetable products, the processing of agricultural products includes picking, weighting, packaging and printing barcodes. The detailed processes can be shown in Fig.2.
In view of the processing flow, there are three sub-modules in the system: the product to be processed, the processing order management and processing lists. The product information in process module comes from the module of picking operation. After completing pick operation in user management module, the system will automatically jump to the agricultural information management module and continued to process in cultivation of agricultural products.
The operators can be selected to develop a single process to agricultural products, and this process will be displayed in a single list processing module. The module will detail the various work orders to be processed and the total number that have been processed, the operator simply click the Print button weighing, bar code printers connected to the system will be based on the current situation of weighing products print out the appropriate bar code, At this point the product will complete the processing operations, Meanwhile, the agricultural information will jump to the finished products.

3.5 Sales and the Distribution Process Design

The business model is the integration of production and sales and distribution, so in the process, system can order from application to distribution, warehousing, distribution complete until the process monitoring.
For the sales and distribution of the module, the system set up the order management and distribution management the two modules respectively, an order, order review, order tracking, order record four modules including order management module, and distribution management module in distribution, distribution and delivery records specified on the three modules. Orders for information input module has two types, one is the company clerk keyboard added, another is the customer place an order on the official site, and then automatically displayed in the modules of the system. When

there is an order, staff and click “submit” button, the order will be submitted to the order review, for review staff review, through the audit, a database management module "plan library" module will have the invoice, the invoice is generated automatically according to the orders, the staff can do the picking operation the order here, open distribution interface, using scanning gun scanning distribution product bar code, distribution is completed, the invoice status displays distribution is completed, the message appeared “outbound” button, click the button to open the library, library editing interface, enter the appropriate information from the storage, outbound order, the product he completed the warehouse operation. Then, information of the order is shown in the distribution of the specified module, here, the staff want to edit the order distribution list, specify the distribution of personnel and vehicles, while the distribution process of the vehicle real-time monitoring, until the completion of the income distribution in the signature and date of receipt, the monitoring end.

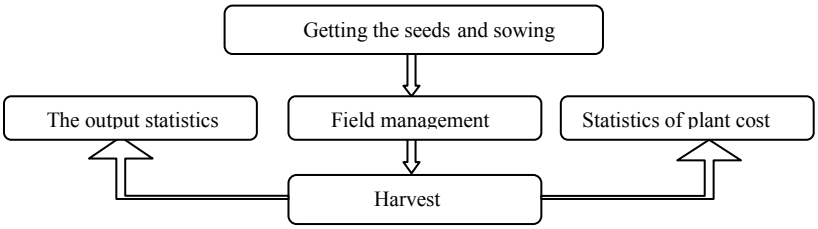

Fig. 2. The flow chart of planting process

3.6 Ascend Ways

There are two kinds of query methods of agriculture products traceability, the direct use of mobile phone or PDA to scan the bar code. Two-dimensional code affixed on the product packaging can query to the relevant information of the product. A product bar code on the official website can also be traced back to the relevant information of the product.

4 Conclusions

In the paper, on the background of frequent food safety issues, some related policy and technology application in the current domestic system is summarized firstly. The facing problem, the command of information system and agricultural production, processing and sales process flow are detailed analyzed. Finally, according to the recommend analysis, it built the Agricultural Information Tracking System which shows the optimization and improvement of production process, especially in the aspects of procurement and field management. The design of multi-node audit guarantees the authenticity of the data and the executive supervision.

Acknowledgment

This work was supported by a grant from the 2012 Science Foundation for Youths of the Department of Education of Jiangxi Province (No. GJJ12277), a grant from the 2012 Humanities and Social Science foundation of College of Jiangxi Province (No.GL1216), a grant from the 2012 Humanities and Social Science foundation for Youths of Education Department of China (No. 12YJC630263), a grant from the 2010Humanities and Social Science foundation for Youths of Education Department of China (No. 10YJC630255) a grant from the 2011 The national natural science fund projects of China (No. 71162012).

References

1. Ruiz-Garcia L., Steinberger G., Rothmund M. A model and prototype implementation for tracking and tracing agricultural batch products along the food chain [J]. Food Control，2010, 21(2): 112 -121.
2. Zhang Xiaoshuan, Lu Shunyi, Xu Mark et al. Applying evolutionary prototyping model for eliciting system requirement of meat traceability at agribusiness level [J]. Food Control, 2010, 21(11): 1556 - 1562.
3. Marshall Breeding. An Analytical Approach to Assessing the Effectiveness of Web-Based Resources [J]. Computers in Libraries, 2008, 10(1): 20-22.