Cold-Chain Logistics Big Data Problems
Based on Food Safety Research

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Abstract. Cold-chain logistics "information island" and "food security" problem, this article through the analysis of the connotation and the present situation of cold chain logistics big data, fusion beidou navigation, Internet of things, cloud computing, big data, advanced information technology such as mobile Internet, establish a food safety data management platform, through the chain of logistics information, realize the logistics information fully traceable, promote logistics information and public service information effective docking, encourage regional and industry logistics information sharing platform, realize the connectivity, fundamentally solve the problem of food safety.

Introduction

Food regulatory functions and regulatory gaps exist in our country, the scattered resources configuration to form resultant force, food quality and safety related data stored separately in different places, such as the food of plant and animal food to enter the market before the competent department of agriculture, after entering the market by the drug regulatory department, the department of industrial and commercial management regulation, and by the quality inspection, food quality, standardized information standardization department management, etc. At the same time in China also has a huge number of large and various food inspection institutions, including national and local governments, universities, research institutions, enterprises and the third party inspection institutions, etc., every organization for frequent food safety related inspection, testing, have a lot of testing data. Independence between the departments and agencies, however, has yet to implement the data integration, data connectivity, unable to become a "information island", not only caused huge waste of resources, and hard "from field to table" full uniform data statistical analysis \cite{1}. Predictably, how to make use of big data theory and technology, strengthen the food safety data processing analysis of food safety in our country big data fusion innovation and development, will become a work of important direction in the field of food safety in China \cite{2}.

Cold Chain Logistics Connotation of Big Data

Cold-chain logistics big data refers to the meat, poultry, aquatic products, vegetables, fruits, eggs, fresh agricultural products from the origin of harvest or slaughter, fishing, in product processing, storage, transportation, distribution, retail and so on each link to produce a variety of data, these data information, the efficiency of management, the real-time control of these data, and analyze the data processing, ensure the quality of food quality and safety to the greatest extent, reduce loss, prevent pollution.

Data management implementation of cold chain logistics, through collecting, analyzing from the
field to the table of each link of business data in real-time, and will be dispersed in different
departments and agencies "information island" huge amounts of data in the collaborative
integration, formation of multi-source heterogeneous data comprehensive perception, analysis,
sharing technology and system architecture, is advantageous to the food safety information sharing
and business collaboration multi-level and multi-level data analysis, will help decrease the cost of
information collection, better monitoring, evaluation and early warning of food safety problems,
and meet the needs of the public on food safety concerns.

Food Safety Status of Big Data Analysis

After the big data is the cloud computing, Internet of things in human history and a profound
information technology revolution. Gartner research pointed out that the global IT industry in 2012
was $96 billion, more than $232 billion in 2013.Big data has become a promote the development of
IT industry engine, and form a new data industry.
The federal government, defense, energy, health administration and other seven ministries jointly
promote, at the end of March in 2012 issued a $200 million investment in Big Data special research
plan (Big Data Initiative), the Big Data from business level rose to national strategy level. The
British government in 2013 to invest 2013 pounds, Philanthropic investment funds 750000
established the Open Data Institute (ODI).This is the world's first big data research institutions, to
strengthen the business community, enterprises and researchers, government and social public
cooperation, emphasis on the characteristics of the independent, non-profit, and non-partisan.
China’s 2012-2013 is the big data market incubation period in China, the global level IT companies
and local companies to launch their own big data products and solutions, 2014 and 2015 large data
products and solutions will bring great value, 2016 China large data size of the market is expected
to close to ten billion yuan.
Food safety as the big data of 4 typical v (Volume, Velocity, Variety, Value), the first large
amount of data, our country has thousands of food safety monitoring and the sentinel hospitals
reported every day food contaminants and foodborne disease data, include food safety
environmental monitoring data at the same time, gathering together large data capacity; Second
update speed: contains a large number of food safety information online and real time data
processing requirements. For example: grab the Internet blog public opinion information related to
food safety. Three types: food safety data often contain various structured data table and (half) a
structured text documents (XML and narrative text), remote sensing images, and other forms of a
variety of data storage. From food safety data resources from the food of plant breeding, production,
processing, storage, transportation, sales and consumption[3]. The whole food chain, including food
contaminants monitoring, food-borne diseases, food Zhong YangShi pollution of the environment
information, laboratory test and field investigation data, etc. Fourthly, value the value but low
density analysis application: food safety massive amounts of data, there are many useless and
redundant information, but the value of the mining analysis application, because it is not only
related to our personal life, also with the whole food industry, and even the country's political
economy are closely related.

The Constructure of cold Chain Logistics Big Date Management Platform

According to the theory of big data method, combining with the characteristics of large data of
cold chain logistics for food safety, the fusion of beidou 3 s technology, the Internet, mobile
Internet, cold-chain logistics technology [4], docking state "a library siping station", combine
existing national food safety risk monitoring system [5], including a food medicine, agriculture,
quality supervision, inspection, industry and commerce, public health, such as cold chain logistics
early warning platform for real-time monitoring of large data, implement a nationwide food safety
unified monitoring, unified storage, unified management, resource sharing [6]. Overall architecture
from the perspective of system, the platform is divided into: cold chain logistics data analysis center
and multiple business subsystem, its structure as shown in figure 1.
Figure 1. Cold-chain logistics management platform architecture of large Numbers.

Big data analysis center

Aiming at the characteristics of large data of food safety, using Hadoop and graphs system architecture, data management technology, based on no application Hive ETL data processing, mainly composed of data acquisition, data processing, data analysis and data display and application of four modules (see figure 2), and each module function is as follows:

1) Data acquisition: breakthroughs in agriculture, quality supervision, inspection, industry and commerce, public health departments "fence" and "islands" of data, implement the data of the "liquidity" and "availability". Data collection includes not only daily monitoring of foodborne disease monitoring data, food contaminant monitoring data, cold chain temperature and humidity, and other structured data, but also includes food safety and environmental pollution related remote sensing data, food safety and public opinion monitoring data and other unstructured data.

2) Data processing. The ETL tool is responsible for the distribution of the data, such as the relationship between heterogeneous data sources, such as graphic data files extraction to the temporary middle layer after cleaning, conversion, integration, finally is loaded into the data warehouse or data mart, become the basis of on-line analytical processing and data mining. Using RDBMS and no (their respective advantages, the use of structured and unstructured data stored in the form of mutual remedy defects, to achieve the purpose of the flexible and efficient IT infrastructure using cloud storage, distributed file storage, etc.
3) Data analysis. Using the method of spatial statistical analysis, to explore various kinds of influence factors and the relationship between all kinds of food safety risk, establish a role model in the influence of multiple factors, identification of various kinds of influence factor's contribution to the food safety risk, thus play a key role to identify the natural and social environmental factors; Using complex network technology, the intrinsic relationship between multiple factors and exploration on the interaction and modeling, build multivariate complex network model of impact factor, revealing the impact factors of nonlinear function law of food safety risk; Based on the unified framework of space and time, according to the impact factors and complex correlation function between the law of food safety risks, establishing the spatial and temporal reasoning model based on multiple factors, etc.

4) Data display and application. the application of GIS by ArcIMS, ArcPAD dynamic maps and data access network, the food safety incident site information back to the data center, the real-time data change trend and related resources distribution in basic spatial geography graphic vividly demonstrated, by analyzing the spatial distribution and time history curve analysis, buffer analysis, the shortest path analysis of events such as the space-time distribution and development trend of the analysis, decision making, early warning and forecast [7].

Business subsystem

Big data analysis center is sharing part of each business subsystem, implements the effective data sharing between each business subsystem and utilization, and the internal and external provide good openness and standardization of software interface, this way to guarantee the basic of the entire platform, openness and extensibility. From food safety monitoring the actual task, the subsystem including subsystems of cold chain security situational analysis, tracking, traceability, time and space early-warning subsystem, emergency disposal subsystem, the comprehensive analysis subsystem.

1) Cold chain security situation 3 s analysis subsystem. Cold chain security situation 3 s analysis subsystem, using spatial statistical model of multi-source data in intelligence analysis, and visualization analysis technology, combined with the large data analysis platform for cold-chain food safety situation replay back, interactive visualization analysis.

2) Tracking tracing subsystem. Tracking tracing subsystem research establishment conforms to big data feature tracking cold-chain food safety traceability technology system, application of big data, beidou navigation, such as the Internet of things technology to realize "three full" (the whole process, all factors and comprehensive) food safety traceability.

3) Space-time early-warning subsystem. Based on the analysis of a variety of early warning model, building the cold-chain logistics, chemical pollutants and harmful factors, foodborne diseases, natural environment and social environment as well as the network public opinion multi-source heterogeneous information integration, such as food safety forecast early warning model, based on beidou 3 s space-time location analysis and the ability to predict its change trend, real-time control state food security.

4) Emergency disposal subsystem. Emergency disposal subsystem implementation after received food safety alarm, emergency disposal for scheduling command, leadership in the process of real time record disposal instructions and all kinds of feedback, and to command in the process of some auxiliary route selection process, provide dynamic real-time monitoring, control and direct support, real-time control of emergency logistics operation process status and schedule, deal with the problem in time, ensure the realization of the expected goal.

5) Comprehensive analysis subsystem. Comprehensive analysis subsystem comprehensive analysis of the source data can get more comprehensive and more even more novel, the same data in combination with different auxiliary information can get a higher value. If the food safety monitoring data and geographic information data, meteorological data, the environmental monitoring data, remote sensing data and social economic data, using the system of ecological analysis model, a comprehensive analysis, can obtain more systematic, comprehensive and scientific knowledge.
Conclusion

This article first to the cold chain logistics connotation of big data is presented, and analysis of the status quo of cold chain logistics big data, according to the theory of big data method, combining with the characteristics of large data of cold chain logistics for food safety, fusion beidou 3 s technology, Internet, mobile Internet, cold-chain logistics technology, including a food medicine, agriculture, quality supervision, inspection, industry and commerce, public health, such as cold chain logistics big data management platform, completely solve the cold-chain "broken" and "information island" problem, realize "from field to table" the whole visual monitoring early warning and ensure cold-chain food security.

References


