Research on the Design of Food Safety Supervision Information System in Beijing

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Abstract. Currently, there are still many problems in food safety supervision of Beijing, more than 80% of the foods are depending on the outer supply which has increased difficulty in the effective control from the source of food safety. The planning levels of food safety management are still in need, the food safety risk evaluation and warning are scarcely used. With the development of the investment to the outer supply base, the food safety supervision mechanism should be perfected while the food input risk should be controlled. This paper build the food safety supervision information system in Beijing by using the HACCP theory based on the intelligent information processing technology and the food safety data platform, in order to improve the management level and efficiency, and then to realize the overall monitoring of food safety through the all-process supervision of the outer supply and food circulation.

1. Introduction

Beijing is the political center, cultural center, and international center of China. In the process of building Beijing into an international first-class harmonious livable city, it is a difficult and urgent task to ensure food safety and resolutely govern issues on the table [1]. Recently, frequent food safety incidents reminded us to oppugn our country's food safety supervision system, and also exposed serious vulnerabilities in our country food safety information monitoring [2, 3]. It has become the focus of government departments' work to promoting food safety supervision information construction.

At present, domestic and foreign scholars have carried out the relevant research for food safety supervision information platform, Wei Xiaoming [4] proposed to establish food safety monitoring platform based on remote monitoring technology. It made an external evaluation comparing intervention effect after the policy implemented with the situation before the policy implemented through GIS and statistical analysis method; Li Mengxiao et al.[5] proposed to establish food safety supervision system based on RFID technology to achieve the collection, transmission and processing of food information; Tian Henan et al. [6] proposed to build an Internet public opinion monitoring system for product quality and food safety to achieve the functions of automatic monitoring about the quality of Chinese products and food safety information.

However, the function module of current food safety supervision information platform is too simple, it can't be completely present to the public in many aspects of the food information from the origin to the dining table [7-9].In addition, there are many problems in Beijing food safety supervision system including low level of organization in agriculture production, consumers are in low awareness on food traceability system, lack of systematic food safety monitoring system, lack of public participation, feedback is not much and so on [10,11]. Existing research doesn't fully apply to the food safety supervision in Beijing. So, this paper presents to establish food safety risk database to collect food related information through network information grab and food safety cases. The information includes such as food type, production origin, enterprise information and data information about food safety. On this basis, Beijing food safety supervision information system is

established by HACCP [12], the system collects and summarizes all information about food from farm to table and sales. Through analyzing the information and rational using management resources, it's possible to achieve early detection, early settlement on food safety issues. Beijing food safety will be guaranteed.

2. Overall concept design

The information system introduced in this article is aiming at the establishment of food safety input risk controlling mechanism which covers processes like the manufacturing, circulation and consumption; participants like government supervision institutions, manufacturing enterprises, media and social organization etc. The food safety information on account of the whole food industry is supervised on the basis of multidisciplinary theoretical system. The overall concept scheme is shown as Fig. 1:

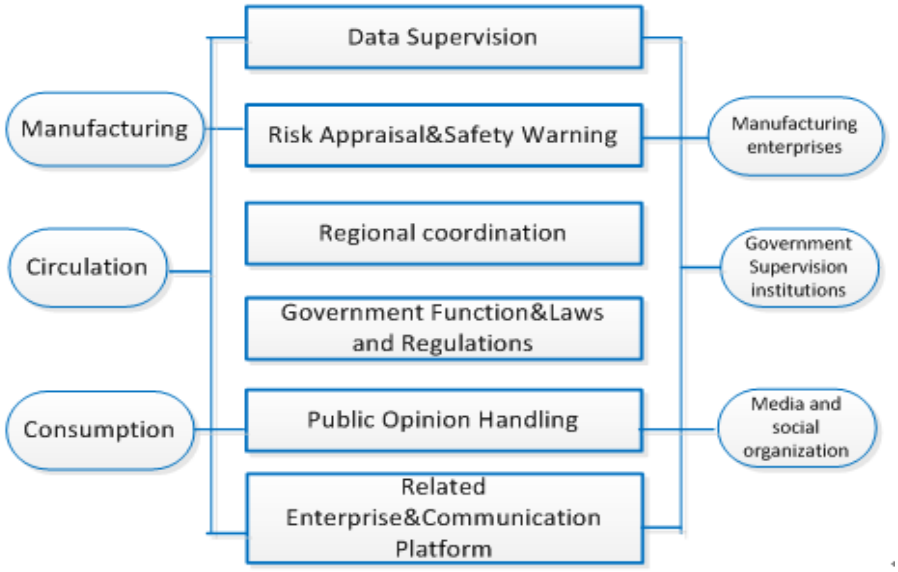

Fig. 1 Overall concept scheme

This information platform which obeys the logic of supervision, evaluation, notification, management, feedback and public sentiment dealing is divided into nine first level modules. The system collect the data and information of the whole process through the supervision module and safety evaluation based on the risk evaluation model. If risk is involving the safety case, the safety warning module would deal at the first time. Harm reduction and region coordination are responsible for the safety of the whole food processing. At the same time, the government function and policies would analyze the current situation of safety rules and supervision system which shows the leader role it plays. The public sentiment dealing module is focusing on the establishment of the food safety comment dealing in Beijing which would be convenient for Beijing citizens have a better known about the food safety and at the same time it could control the public comment as well. The last are the relevant enterprises and communication platforms which are the communication channel between customers, enterprises and government; The 9 module of the information system integrate and analyze all information throughout the three processes of manufacturing, circulation, and consumption which have comprehensively shared all the relevant information between consumers, government and enterprises.

3. System Framework

This information platform is mainly composed of information collection stratum, information service stratum and information application stratum. Through the functional module of service stratum, it integrates and analyzes the food information collected in information collection stratum.

Finally, it provides information for consumers, governments and enterprises in the application stratum so as to ensure food safety. The system architecture diagram is shown in Fig. 2:

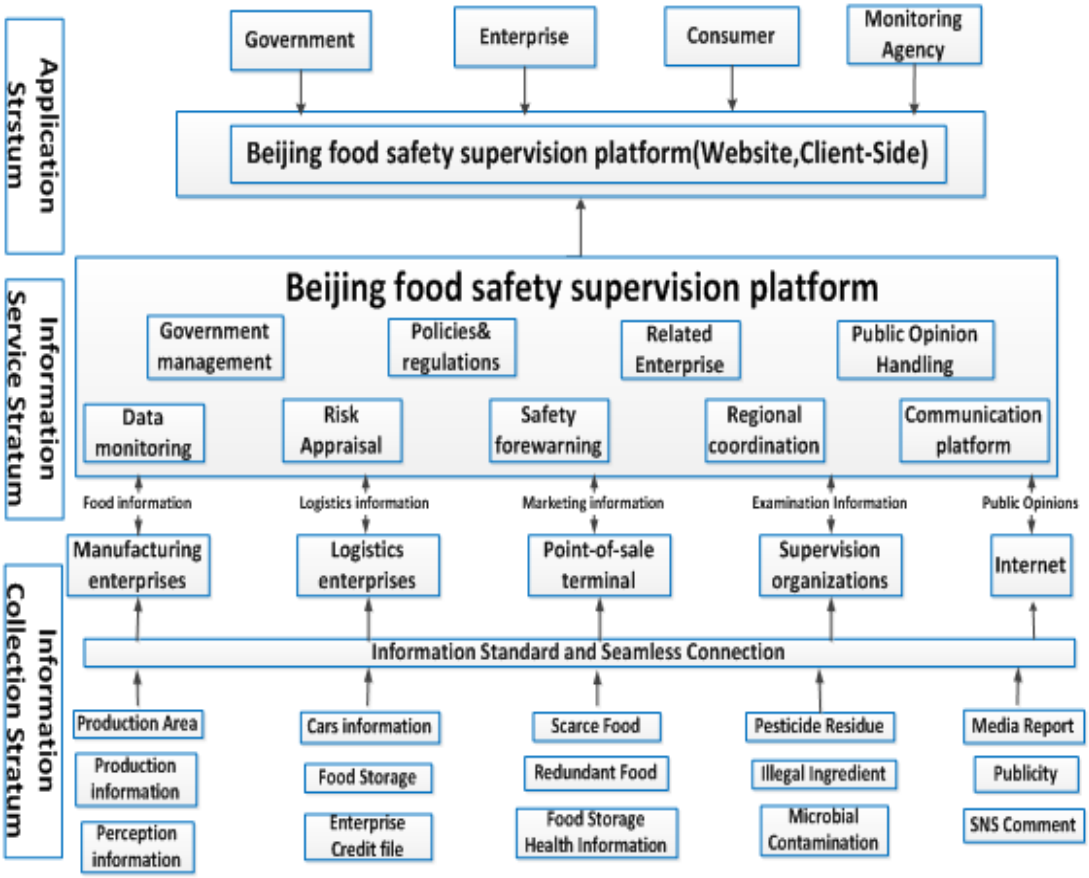

Fig.2 System architecture diagram

3.1 Information Collection Stratum

Information collection stratum is essentially the platform database based on the index system. Through questionnaires and the resources from data center of supervision organization, data statistical department of governments as well as data information bank of enterprises, it makes statistics of the basic data of food information, logistical information and market information and combines it with the functional module of the platform so as to construct according food safety appraisal index system.

3.2 Information Service Stratum

Information service stratum is mainly composed of nine modules and is the function realization part of the entire food safety information supervision platform.

3.2.1 Data Supervision Module

The main function of data supervision module is to integrate the data of the supervision stations and standardize the data to be supervised. It includes five second-class modules: data supervision, data upload, data download, supervision standards and related websites. The module chart is shown in Fig. 3:

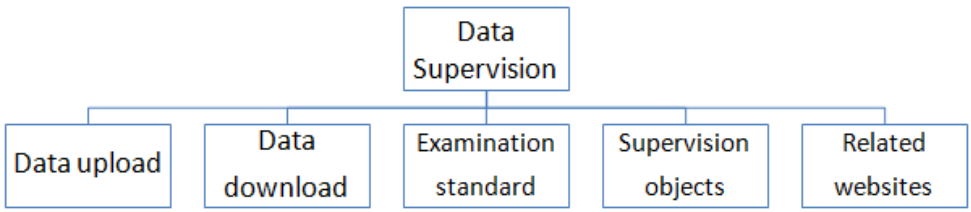

Fig. 3 Data Supervision Module

Data upload: supervision organization can supervision the data uploaded through this interface; enterprises can also provide the feedback of the product problems through this interface.

Data download: supervision organizations, related food enterprises or some professional consultancy companies can download the reported food safety data of a certain region or at a certain time period through this interface so as to make real-time and favorable decisions etc.

Interlink to related supervision websites: cooperate with other similar websites or organizations and include the data supervised by them into the website database so as to realize information share and avoid the resource waste caused by repeated information acquisition.

3.2.2 Risk Assessment Module

The function of this module is mainly on the risk assessment of food safety, then you can take protective measures in advance to avoid major food safety accidents. Here is the main working principle: by analyzing data monitoring module,researchers can get the data of food contaminants (bacteria, viruses, etc.), and learn the nodes where the foods might be contaminated in the process of production, transportation, storage, processing and so on, then input these information into algorithm models to draw conclusions on which nodes could take specific measures to prevent the occurrence of contamination. We divide the module into four secondary module as follows: working principle introduction, risk source, risk assessment, risk control and management. As shown in Fig. 4:

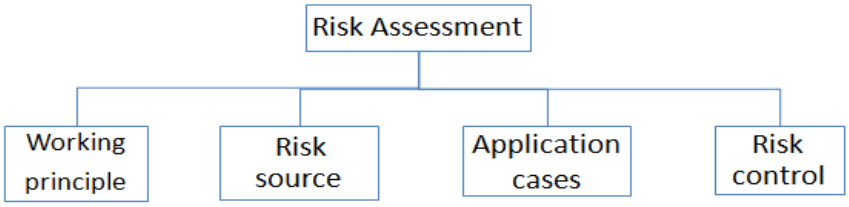

Fig.4 Risk Assessment Module

Working principle introduction：The evaluation process, the evaluation module and the algorithm mechanism should be introduced in detail, so that all kinds of users can clear its principle, and then can have their own estimates at the authenticity and validity of assessment.

Risk Source: explain each risk source of production and transportation in detail, and propose to take possible preventive measure for each risk source.

Risk Control: the decision-making body makes decision according to the suggestion expert group provided, and displays the result. Its worth nothing is that risk management and risk assessment must be separated, and should have independence in decision making, so as to ensure assessment objectivity and avoid related interest groups and authority to protect each other.

3.2.3 Safety Warning Module

The module is mainly to deal with food safety incidents, and analyzes and deals with the suspected incident, so that the safety incidents can be processed in first time, which can minimize the loss of enterprise and the harm for public and the society. The module diagram is shown in fig. 5:

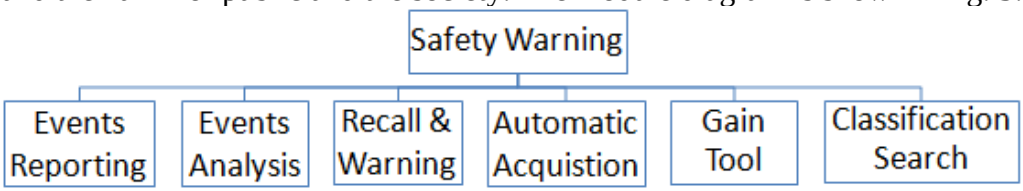

Fig. 5 Safety Precaution Module

Event Reporting: it is the channel for food safety information to report. By this channel, customers can upload the food problems they understand or improper food handling event; by this channel, enterprises can report some food safety accidents due to their error handling.

Event Analysis: analyze and deal with the reported incidents, according to certain standards and the extent of possible damage, classify the reported incidents, and in accordance with the damage grade to decide the published scope of the incident and the processing level.

Recall& Warning: display the result from event analysis module on this module, as well as the production information of recent recall and the penalties& warnings for related enterprises, and also show processing results of risk assessment module on this page.

Automatic Acquisition: customers can subscribe this module's information through mail, the mobile phone terminal APP, RSS reader, according to food types(vegetables, fruits, dairy products, meat products and so on), subscribed customers can select the information they want to know in time, and select the receive frequency (once a day, once a week and so on).

3.2.4 Regional Coordinated Module

The function of this module is mainly on the risk assessment of food safety, then you can take protective measures in advance to avoid major food safety accidents. Here is the main working principle: by analyzing data monitoring module, researchers can get the data of food contaminants (bacteria, viruses, etc.), and learn the nodes where the foods might be contaminated in the process of production, transportation, storage, processing and so on, then input these information into algorithm models to draw conclusions on which nodes could take specific measures to prevent the occurrence of contamination.

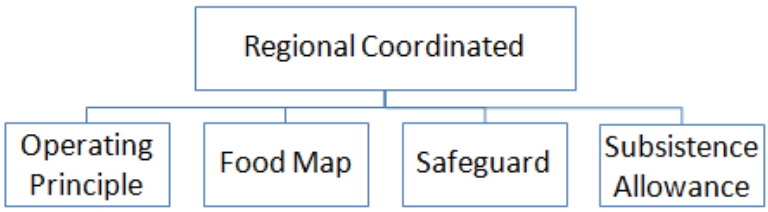

Fig. 6 Regional coordinated model

Operating principle: the mechanisms operating principles should be introduced, including restriction mechanism led by downstream food industries, the basement construction, fiscal subsistence and regulations in source of agricultural productions cross-district safety.

Food map: food producing areas, detecting stations, logistics transfer stations, wholesaler stations and marketing terminal marked in the map, and users can find related information and routes in the model.

Safeguard: food producing areas and food demanding areas publish some supply and demand information respectively, but there needs a set of standard to safeguard true and effective information.

3.2.5 Government Functions Module

The models mainly show the role of government and introduce the system of detection, regulations and emergency. The models include warning and punishment, detection organizations, regulations system and emergency responses. The model is following as Fig. 7.

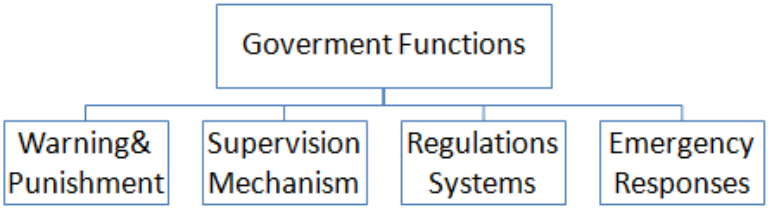

Fig. 7 Government functions model

Warning and punishment: the government sends the letters of remaining, warning and fines according to the degree of illegal and harm for society. The model will be demonstration.

Detection mechanism: the brief introduction of all institutions from producing to consumption, and these institutions 'results and how to share these.

Regulations systems: the government regulates the food markets and food businesses, and regulation departments are how to operate the right and other issues.

Emergency responses: to emergency food safety accidents, and publish the results, for example: food safety how to safeguard in earthquake areas and how to do with the epidemic situations.

3.2.7 Public Opinion Handling Medules

The establishment of the this module is mainly based on the study of food safety information issuance mechanism of Beijing Municipal Government and the media framework imported food

safety risk events in Beijing. It aims to establish public opinion processing system of food safety which is suitable for Beijing area, in order to grasp the citizens' opinion direction, which is conducive to the government to guide public opinion correctly and avoid extreme events. Therefore, the module consists of four sub-modules, namely, news, public opinion analysis, and public opinion processing and security logs. Module chart as shown in the Fig. 8:

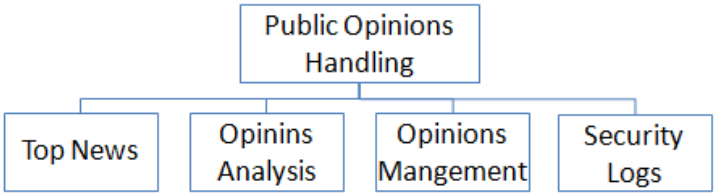

Fig. 8 Module of public opinion management

Top news: it reports on important events related with food safety, publishes comments about the related events and provides a platform of understanding of food items for public citizens. This module can classify all kinds of news which is based on users' type and so on, set up discussion board, meanwhile; make relevant links about major events exposed on the websites.

Public opinion analysis: This module timely tracks hot issues, including food safety reports and the promulgation of the new regulations; it statistically analyzes the attitude and public comment on food events of various popular sites and the media, then obtains public opinion direction conclusion after data processing.

4. Conclusion

In recent years, frequent food safety problems fully exposed the loopholes and problems of our country's food safety supervision work. Strengthening the supervision of food safety is increasingly becoming the hotspot and focus of attention. Beijing, as a political and cultural center, because of its limitations of low level of agricultural production organization, almost 80% of the food is supplied by outgoing, however a kind of food from farmland to dining table, will go through the production, processing, storage, transportation and sales, and many other links, food supply system is grinding to be complicate and international. In such a long industry chain, each link has the possibility of contaminating food, if we do not use advanced informatization management means, it is not possible to achieve the food safety control. At the same time as the capital, the information construction processes not only directly related to its own food safety, but also play a pilot and leadership to other cities. In recent years, Beijing has also made a lot of beneficial attempt in the food safety information management, but still have larger gap with developed countries.

In this paper, the food safety supervision information platform which is based on big data, by embedding algorithm for data analysis, achieves the purpose of risk assessment and monitoring. Data is complete, monitoring results are accurate, decision method is effective. It can be applied to Beijing food safety regulation well, so as to realize the function of the supervision information platform optimization. At the same time, it includes data monitoring to the early warning and assessment and a series of process, In addition, it also includes the policies and regulations, regional coordination, such as part of the food safety related matters. Compared with the previous food safety regulatory information platform, this platform covers a wider coverage, has more refined process, and its followed standard is more strict. The construction of the information platform for food safety information provides the information sharing between the government, enterprises and consumers. Therefore, the government management function will increase its transparency, facilitate enterprise supervision and propaganda. Consumer can also get the latest information and timely response. Scattered human behavior fused into information platform, all the process can be electronical, modernization, and save time and effort.

Acknowledgements

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Reference

[1]. Zhang Boyuan, Sun Dongyue, Zhao Ran. Analysis on law enforcement status of food safety supervision in catering service in Beijing [J]. Soft Science of Health, 2011, (5).

[2]. Li Lei, Zhou Shengsheng. Status of the Establishment for Chinese Food Safety Information Exchange Platform [J]. The Food Industry, 2011, 12(12):78-82.

[3]. Chi Weidong Shi Yuyue Tian Wei. The reviews for evaluation of food safety[J]. Food Engineering, 2007,(2):3-5.

[4]. Wei Xiaoming, Gu Furong. Platform-building Research on Food Safety Based on Remote Monitoring Technology [J]. Shanghai Food and Drug Information Research, 2012, (1):18-24.

[5]. Li Mengxiao, Gu Ping and GE Jinghuan. Research of Food Safety Supervisory System Based on RFID[C]. 2013CACFP. 2013.

[6]. Tian Henan Du Junping. Design of Internet Public Opinion Supervisory System for Product Quality and Food Security [C]. CIEIT 2010.2010.

[7]. World Health Organization. Safe Food Handling—A Training Guide for Managers of Food Service Establishments [Z]. Geneva: World Health Organization,1989.

[8]. CHEN Yuan. Issues and Countermeasures on Import Food Security in China [J]. Food Research and Development, 2007, 28:183-187.

[9]. Ren Fazheng Luo Yunbo Jiang Qingli. Status of Research and Management for Food Safety in Developed Countries [J]. Review of China Agricultural Science and Technology, 2001,(6):25-29.

[10]. Men Yufeng. System Construction Research on Food Safety Warning of Food Safety in Beijing[J]. Foreign Economic Relations & Trade，2012(9).

[11]. Men Yufeng. Management System Construction Research on Food Safety Informatization of Food Safety in Beijing [J]. Foreign Economic Relations & Trade, 2013, (8):73-76.

[12]. Zhou Bo, Chen Ying, Qiu Fangyan. Design and Implementation of Food Safety Management Information System Based on HACCP [C]. The 2013 Academic Conference of ACM in Guangxi.