International Journal of Education and Humanities
ISSN: 2770-6702 | Vol. 1, No. 1, 2021

Intelligent Strategies to Improve Food Safety Supervision Model

-- A Case Study of Beijing, Tianjin and Hebei

Chengshuang Lv*, Jiaojiao Xu, Caihui Wang

College of Economics & Management, Tianjin University of Science and Technology, Tianjin, 300457, China
* **Corresponding author:** Chengshuang Lv (Chelsealv@mail.tust.edu.cn)

Abstract: Intelligent supervision effectively deals with food safety problems from four aspects: concept, subject, activity and object. This paper makes a qualitative analysis on the current situation of intelligent supervision of food safety in Beijing, Tianjin and Hebei, compares and studies the intelligent supervision modes of food safety in three coastal areas in eastern China, constructs the analysis framework of intelligent supervision of food safety, and improves the intelligent supervision mode of food safety in Beijing, Tianjin and Hebei. By studying the policy path of intelligent supervision of food safety, extract the three-stage three source stream model of supervision mode from standard cultivation, informatization to standard unification and intelligence, to better promote the intelligent supervision mode in the country. For the challenges still faced by food safety supervision, it is proposed to improve the top-level design and strengthen the intelligent supervision mechanism of cross regional coordination; Promote the cooperation and sharing of data resources and optimize the cross regional risk early warning mechanism; Consolidate the rural digital foundation and realize the integration mechanism of urban and rural food safety supervision.

Keywords: Food safety, Smart supervision, Model, Beijing-tianjin-hebei.

1. Introduction

Food safety issues have cross-regional, cross-industry and other characteristics [1], the Food Safety Law proposed that food safety to prevent the main, the establishment of scientific strict, social governance of the regulatory system. Especially in the post-epidemic era, food safety incidents are frequent [2], in June 2020, Beijing Xinfa district wholesale market salmon infected with the new crown virus incident [3], in 2021, Tianjin Bridge Road Food Co., Ltd. sent inspection of ice cream samples, three test results showed positive for the new crown virus; 2021 CCTV 315 evening reported that a farmer in Qing County, Hebei Province, when raising sheep to join the "clenbuterol" in order to seek higher meat rate. From a national perspective, since 2015, according to the statistics of the China Consumers Association [4], the number of food complaints and the proportion of complaints have shown a continuous upward trend, especially in 2020, showing an explosive growth (see Figure 1). From a world perspective, China's food safety index in 2019 is 71 points, ranking 35th in the world, which is in the upper middle level. In particular, my country ranks first in the world in the amount of pesticides and fertilizers [5], of which the amount of fertilizers per acre of crops is as high as 21.9. The kilogram is much higher than the world's average of 8 kilograms per mu. Food safety reasons and issues are complex, leading to high food safety risks and high supervision difficulties [6]. This has formed the necessity of smart food safety supervision, and it is also a practical need to improve my country's food safety smart supervision model.

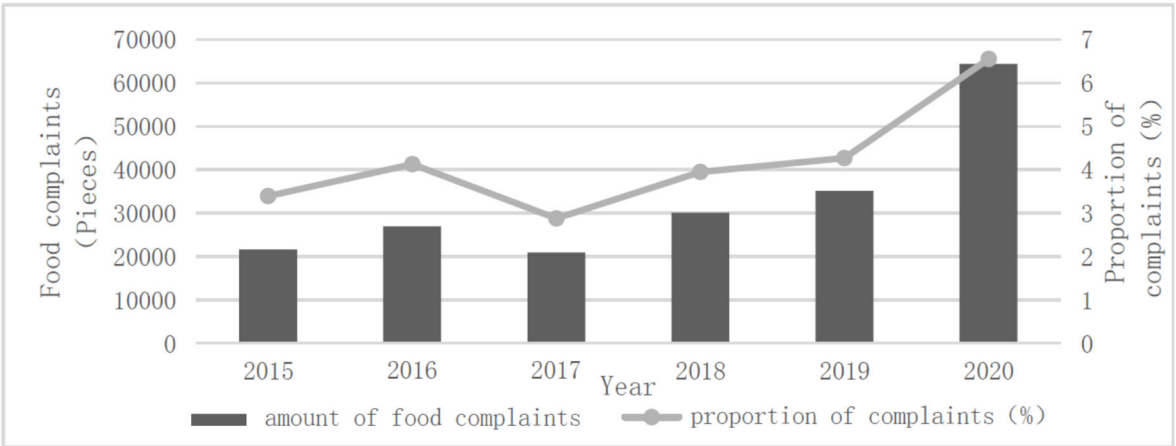

Figure 1. The volume and proportion of food complaints from 2015 to 2020

2. The Current Situation of Smart Food Safety Supervision in Beijing-Tianjin-Hebei

2.1. Advantages of Intelligent Supervision of Food Safety in Beijing, Tianjin and Fujian

The advantages of smart food safety supervision in the Beijing-Tianjin-Hebei region are the most prominent in two points: institutional advantages and smart innovation technology advantages. The first is the advantage of the system. The system is the guarantee mechanism for the food safety supervision of the Beijing-Tianjin-Hebei region [7]. Since the Beijing-Tianjin-Hebei coordinated development strategy was put forward in 2015, the governments of the three places have actively responded to coordinated supervision and issued numerous institutional documents for coordinated supervision. In 2016 and 2017, the Tianjin Municipal Market and Quality Supervision and Administration Commission successively issued the "Opinions on the Implementation of the Beijing-Tianjin-Hebei Coordinated Development Plan" and the "Opinions on Further Promoting the Coordinated Development of Beijing-Tianjin-Hebei Market Supervision". In 2017, the Beijing-Tianjin-Hebei three places jointly signed the "Co-construction of the "Beijing-Tianjin-Hebei Food and Edible Agricultural Products Quality and Safety Demonstration Zone" Cooperation Agreement." In 2019, the Beijing-Tianjin-Hebei region jointly signed the "Beijing-Tianjin-Hebei Food Inspection and Testing Technology Innovation Alliance Cooperation Framework Agreement." In 2020, Beijing-Tianjin-Hebei will coordinate the fight against the epidemic, and establish a mechanism to ensure the supply of daily necessities and key agricultural products during the epidemic prevention and control period. Therefore, the Beijing-Tianjin-Hebei Food Safety Smart Supervision has a solid system guarantee, and it is also exploring the establishment of a Beijing-Tianjin-Hebei food safety coordination legislative mechanism to further strengthen the system. The second is the advantages of smart innovation technology. Collaborative development and smart supervision require smart technology innovation. In 2019, the R&D expenditure in the Beijing-Tianjin-Hebei region reached 326.14 billion-yuan, accounting for 14.7% of the national R&D expenditure, and the technology market turnover was 70.04 billion-yuan, accounting for nearly 1/3 of the total national turnover. The city with the largest number of unicorn companies in the world is Beijing, with 82 companies in total. Therefore, Beijing has gathered scientific and technological innovation resources, the ability to radiate and drive has been continuously improved, and the vitality of scientific and technological innovation in the Beijing-Tianjin-Hebei region has continued to increase [8].

2.2. Limitations of Smart Food Safety Supervision in the Beijing-Tianjin-Hebei Region

The smart supervision of food safety in the Beijing-Tianjin-Hebei Region has shown many advantages and features and has achieved remarkable results. However, the application of smart technology to food safety monitoring is still in its infancy [9], and the coordinated development of Beijing-Tianjin-Hebei during the 14th Five-Year Plan period will also develop further. The limitations of food safety supervision still exist, but the limitations of food safety still exist. First of all, it is manifested in the misalignment of food safety supervision and the scope of economic entities involved in food safety. In particular, Hebei is the source of food production, information and technology. Laggard and low awareness of food safety [10], traditional supervision focuses on the supervision of the food safety market in Beijing and Tianjin, resulting in inaccurate food safety supervision, and smart supervision must be started from the source. Secondly, it is more difficult to integrate smart supervision information. Due to the long relevance of the food industry chain and numerous types, although Beijing-Tianjin-Hebei has established an information sharing platform, the three places have different levels of information processing capabilities, food safety information utilization efficiency is different, and information integration is more difficult. Finally, the urban and rural smart supervision technology is not synchronized with the business process. Smart supervision is based on high-tech technology and complete business processes [11]. At present, the level of urban and rural technology varies, and the flat management of regional government organizations has achieved initial results. However, the business process of smart supervision lags behind the pace of new technologies embedded in smart supervision [12]. For example, the handling of food safety issues is still in the management method based on punishment after the fact, and the early warning in the rural areas of the food source is still insufficient [13]

3. China's Food Safety Intelligent Supervision Model

3.1. Fujian Problem-oriented Intelligent Supervision Model

Fujian is a pioneering area for smart food safety supervision, and has broken down the barriers to cooperation between the government, merchants and consumers in terms of food business license approval, official intelligence systems, rights protection reporting systems, monitoring and tracking, and solved the problem of "less people, more things" The contradiction between the two has highlighted the problem, and the facilitation of services has been realized. In response to the lack of awareness of food safety responsibilities among merchants, Fujian Province took the lead in establishing a supervisory inspection and early warning center, a credit publicity platform, and the use of administrative punishment system technology to accurately supervise. Using "big data analysis + network platform" as a tool, companies are forced to enhance their awareness of food safety responsibility, and effectively solve the large and arduous problem of "lenient entry and strict management" of food companies. Food safety issues involve the characteristics of multiple industries, long industrial chains, and large amounts of information, which increase the difficulty of overall coordination among regulatory agencies. Therefore, Fujian Province independently innovates and develops the "Food Safety Information System" to realize the traceability of the entire food industry chain, the query of the circulation direction, the deep mining of transaction data, and the realization of integrated and intelligent supervision [14]. It can be seen that the Fujian model is problem-oriented and

innovative technology at the core to achieve the goal of smart food safety supervision (see Figure 2).

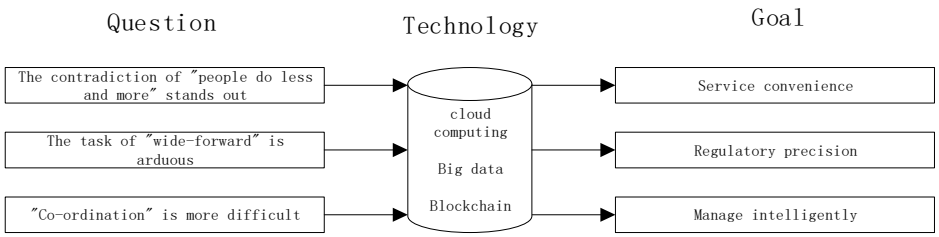

Figure 2. Fujian problem-oriented smart supervision model

3.2. Zhejiang Multi-subject Collaborative Intelligent Supervision Model

As a powerful province in the digital economy, Zhejiang has fully deepened the use of big data [15], cloud computing, artificial intelligence and other intelligent technologies to develop the "unqualified food comparison system" and the "food distribution traceability system", and upload food-related data of catering units in real time to achieve The safety information of food companies is fully transparent, which not only urges companies to operate legally, compliantly and self-disciplinedly, and promotes the healthy development of the industry, but also provides regulatory convenience to government departments. Government departments use the network "approval system", cooperate with the IoT management and control system and remote video intelligent inspection system, fully deepen the use of "cloud video" digital technology and IoT technology [16], comprehensively monitor and analyze potential risks and safety hazards of the enterprise in real time. Realize the upgrade from human supervision to intelligent supervision, facilitating and standardizing law enforcement by government staff. Smart food safety supervision is inseparable from the collaboration of citizens, social forces, and industry associations [17]. Ningbo City, Zhejiang Province adopts the simultaneous operation of the “government + public welfare” and “business + public welfare” modes, introduces insurance mechanisms, and comprehensively promotes regional food safety. Participate in the promotion of information exchange and collaboration among all parties in the society. It can be seen that the Zhejiang model is to make full use of smart technology to create a food safety smart supervision model with "government + enterprise + social forces" multi-subject coordination (see Figure 3).

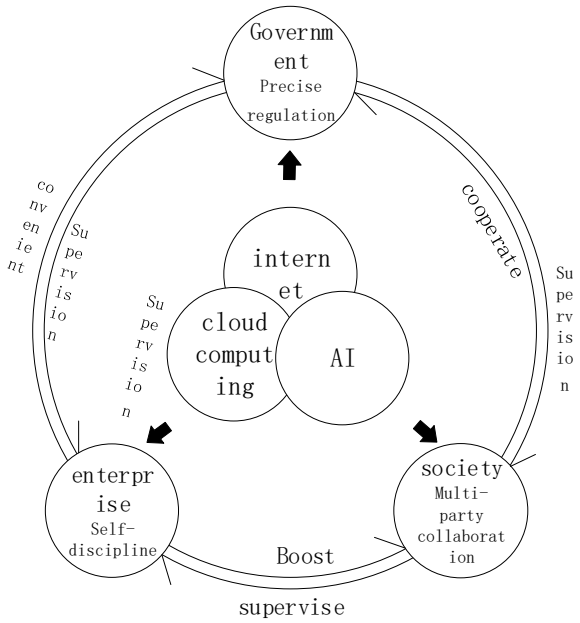

Figure 3. Zhejiang's multi-subject collaborative smart supervision model

3.3. Jiangsu "Full Cycle and Intelligent" Intelligent Supervision Model

Jiangsu Province focuses on major strategic decision-making deployments to help "intelligent supervision" of food safety blossom throughout the province, focusing on the "full cycle + intelligence" model. The full cycle covers the full cycle before, during and after the event. Prior to the event, Jiangsu Province focused on creating an integrated information platform for “smart supervision”, and realized food safety risk early warning through data empowerment and food safety-related data exchange; Promote the iterative upgrade of the “kitchen revolution”, coordinate and cooperate with the “online storage” and “online processing” of food, and establish the “three one” risk prevention and control wisdom of “one machine” supervision, “one station” interaction, and “one key” reporting Supervision mechanism. At the same time, based on the construction of the platform, the innovative development of "off-site + on-site" smart supervision and spot check mode, real-time dynamic grasp of merchant information; after the event, government departments intensified the use of "Internet +" and "cloud data" analysis to

target different regulatory objects Adopt sub-category and differentiated supervision. Once food safety violations are found, law enforcement officers will use mobile office software to promptly release risk warnings, deal with food safety unqualified issues, and actively promote smart food safety supervision to a new level. Intelligentization refers to the intelligent supervision of food safety through Internet technology, Internet of Things technology, automatic identification technology and automatic control technology to achieve full-cycle supervision of the entire food safety industry chain in an intelligent way. Therefore, consumers and law enforcement officers of Jiangsu Province cooperate online and offline to supervise, create a tripartite coordination and governance of "operators + consumers + law enforcement", constitute a food safety network intelligent supervision "social network", forming a "one response, all A full-cycle intelligent and intelligent supervision model based on "Internet perception" (see Figure 4).

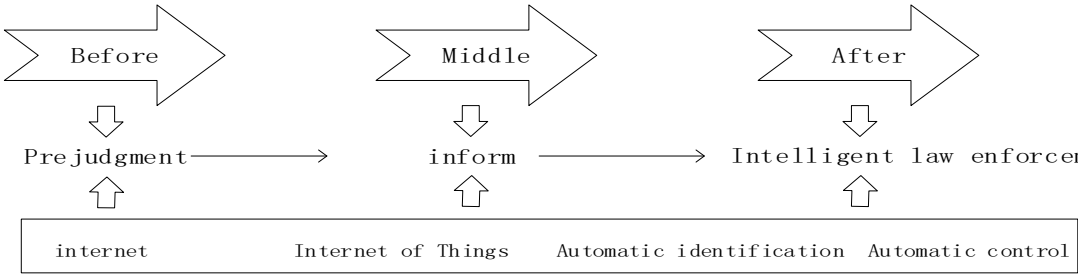

Figure 4. Jiangsu "full cycle + intelligence" smart supervision model

4. The Analytical Framework for Intelligent Regulation of Food Safety Is Built

The "Food Safety" law of China also defines: Food safety refers to food that is non-toxic and harmless, meets the required nutritional requirements, and does not cause any acute, subacute or chronic harm to human health [18]. There are many types of food and the complexity of cross-sectoral and cross-departmental supervision. Therefore, to solve food safety supervision problems, it is necessary to understand its attributes and use the concept of smart supervision. Based on the smart supervision theory and the attributes of food safety proposed by Gunningham [19], this research constructs an analytical framework for smart supervision of food safety, and explores the relationship between smart supervision and food safety attributes (see Figure 5). The study found that smart supervision can effectively supervise food safety issues in terms of supervision concept, supervision subject and supervision activities. It is embodied in the following aspects:

First, the regulatory bodies are diversified. Reasonable choice of policy tools, policy formulation should include the participation of multiple subjects and social governance, rather than a single tool and subject. Reasonable multi-agent policy tools can effectively supervise food safety issues involving multiple types of diverse attributes in a wide range of industry chains. Second, the supervision methods are intelligent. Use smart information tools, including big data, blockchain, etc., with incentives to achieve policy goals. Intelligent methods have changed the traditional extensive, single and low-efficiency delayed supervision, and can accurately detect the process by which companies with food safety issues transform their own costs to the outside, which reflects the externalities of food safety. Third, the policy tools are flexible. When traditional policy tools fail, they should quickly find alternative flexible and efficient policy tools, and do not abuse policy tools. To reduce government interventions to avoid policy failure or adverse effects, policy formulation and implementation should be based on actual conditions. The solution of food safety problems is guaranteed by the government and laws, and the core is political. Therefore, the flexibility and flexibility of policies can effectively guarantee the solution of food safety problems. Finally, multi-party cooperation and win-win. The concept of smart supervision emphasizes multi-party win-win and coordination mechanism, which brings positive benefits to economic entities in all links of the food chain. The disclosure of food safety information is non-exclusive and non-competitive, conforms to the common interests of most people, and has the attributes of a public product. The concept of smart supervision effectively fits the public nature of food safety.

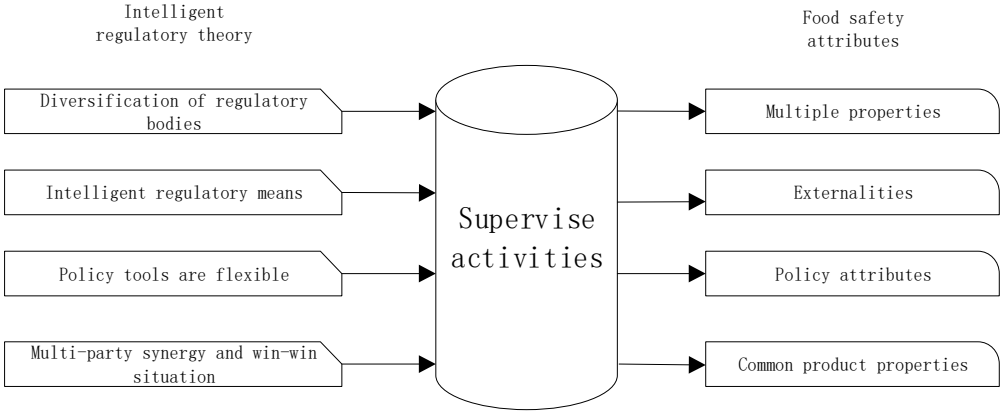

Figure 5. Analysis framework of intelligent supervision of food safety

5. Food Safety Intelligent Regulatory Model Construction

Through in-depth analysis and refinement of the smart supervision models in the three regions of Fujian, Zhejiang, and Jiangsu, we found that the main orientations of the three pilot regions' regulatory models are different, and smart supervision methods can be fully utilized. The theoretical model of the four aspects of the object is still not perfect. Therefore, based on the characteristic case analysis of the advantages and limitations of the Beijing-Tianjin-Hebei food safety smart supervision, compare smart supervision models in other regions of my country, and actively construct and improve the Beijing-Tianjin-Hebei food safety smart supervision model, which can be used for reference and promoted nationwide.

5.1. Pattern Analysis and Design

Under the concept of smart supervision, the mode of smart food safety supervision is divided into three parts of coordinated interaction activities of supervision subject, supervision activity and supervision object [20]. The specific model design is shown in Figure 6. Among them, according to the theory of smart supervision and the "Oxford Planning Manual", the regulatory bodies are divided into the first body government, the second body enterprises and commercial organizations, and the third body is non-commercial organizations [21]: International Organization for Standardization (ISO)), industry associations, social forces and citizens, etc. [22].

The object of smart food safety supervision includes all links of the entire industrial chain of food from farmland to table [23]. From the primary agricultural products at the source, the illegal use of pesticides and fertilizers and other unsafe factors; to the food production and processing links, the blind pursuit of economic benefits by enterprises leads to food safety problems; the distribution and storage links, the level of distribution of distributors at all levels requires strict food preservation Conditions, circulation without food preservation conditions will lead to food safety issues; sales and consumption links, after the food is in the hands of consumers, the consumer's cooking methods or catering companies' food management loopholes, leading to food poisoning and other issues. Each link of the entire food industry chain must arouse the great attention of regulatory bodies.

Supervision activities need to be based on the joint establishment of a smart supervision platform by multiple governments [24]. The platform must achieve two functions: First, unify food supervision standards, including food inspection parameters, methods, and judgment basis. Inspection reports issued have uniform information and format requirements. The results of key food inspection indicators should be mutually recognized. All food The inspection process of the industrial chain is traceable. There must also be legal protection and a high degree of administrative coordination between the government. Second, resource sharing. The Beijing-Tianjin-Hebei region must complement each other's advantages. On this platform, resources such as inspection and testing resources, technological innovation resources, and talent equipment must be shared to promote a win-win situation for smart supervision. At the same time, there must be a guarantee of innovative technology and comprehensive services.

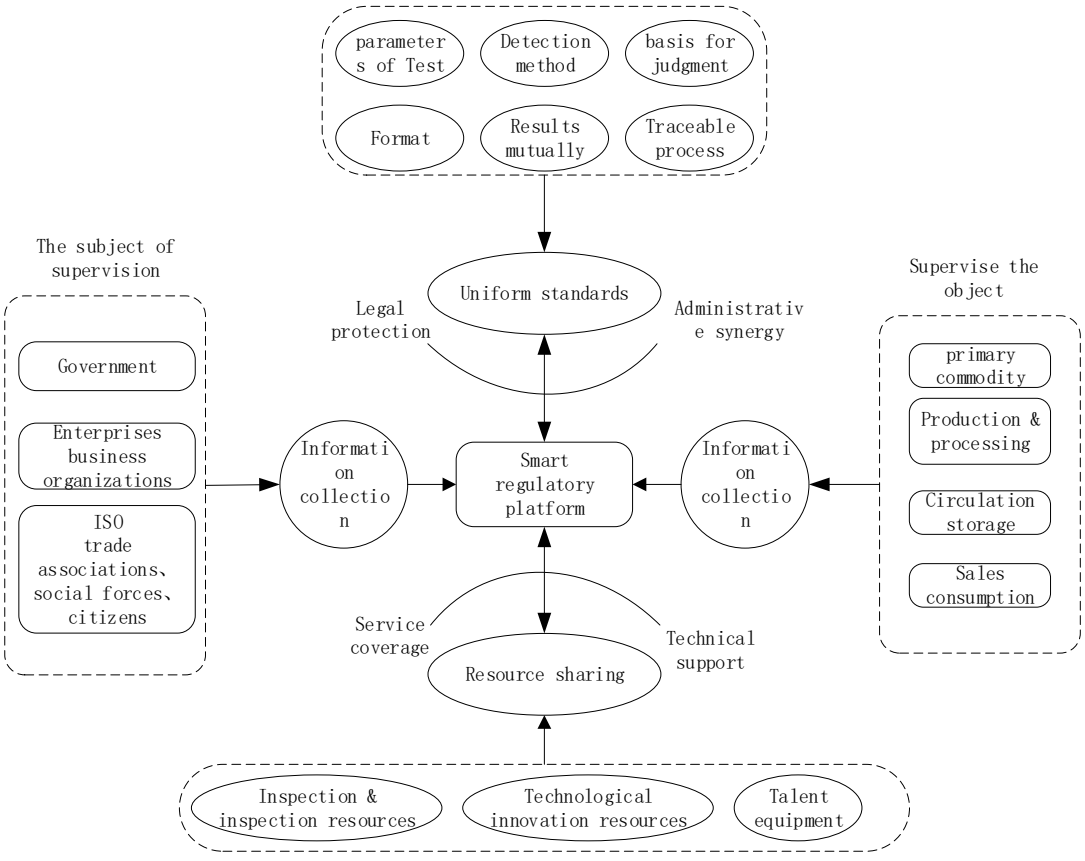

Figure 6. Design of smart food safety supervision business mechanism under the collaborative environment of Beijing-Tianjin-Hebei

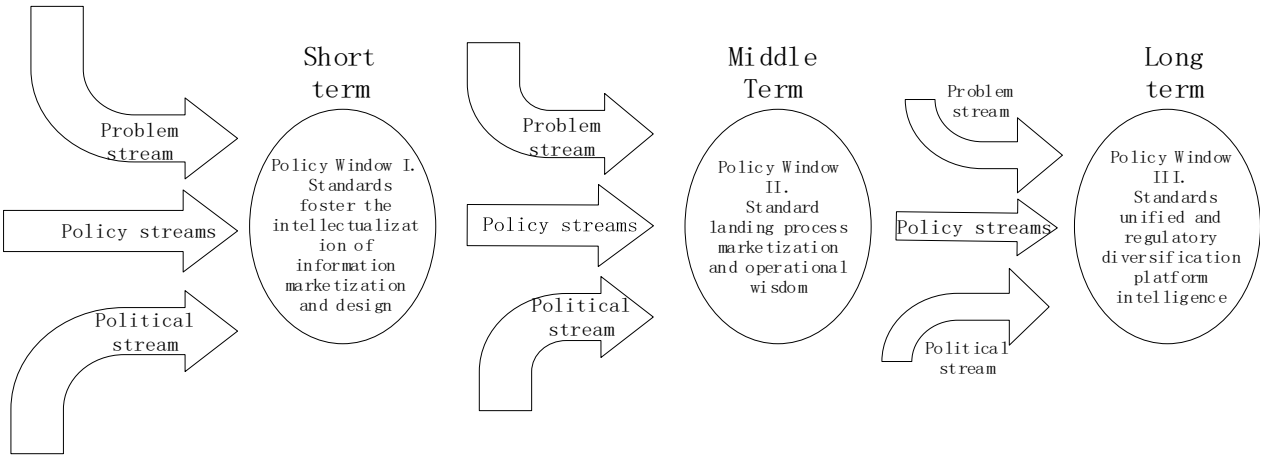

Figure 7. Three-stage and three-source stream analysis model for smart food safety supervision

5.2. Policy Path Pattern Analysis

In-depth analysis of the policy path of smart supervision, and found that the development trend and law of smart food safety supervision is toward a unified standard, a three-stage three-source stream model of supervision diversification and a smart platform (see Figure 7). The model is based on Kingdon [25] Based on the classic three-source stream model. The classic three-source stream model has many extended modes, which provide a useful analysis framework for the design of specific policy paths and decision-making processes in practice. The model believes that the new policy decision originates from problem streams, policy streams, and political streams. The three streams are independent of each other and have an impact on the policy agenda. When the three streams converge at a certain key time node, then the possibility of the project entering the decision-making agenda Will be enhanced, and this critical time node is called the "policy window", which means the opportunity to take action based on a given motion, and the emergence of these opportunities will lead to major changes in public policy.

Specifically, the problem stream in the three-stage three-source stream model of the Beijing-Tianjin-Hebei food safety smart supervision refers to the large gap between the theoretical state of food safety smart supervision and the practical supervision state. The unified food standard under the coordination of Beijing-Tianjin-Hebei is difficult to promote and the market mechanism is insufficient. Perfect, and this writing problem urgently needs to be changed. Policy streams involve policy solutions, which come from government policy makers, experts, and policy research institutes. Political stream refers to internal and external factors such as structural adjustment of government departments, legislative changes, and public opinion fluctuations. The "policy window" will only be opened when the three streams converge. The "policy window" in the latter stage is based on the previous opening. Each time a "policy window" is opened, the problem will be partially solved.

6. Conclusions and Recommendations

By establishing the framework of intelligent supervision and analysis of food safety, this study qualitatively analyzes the advantages and limitations of intelligent supervision of food safety in Beijing, Tianjin and Fujian, and compares and studies the intelligent supervision mode of three typical southeast coastal areas in China. On this basis, to build and improve China's food safety intelligent supervision model. The results show that the flow rate of three-source stream will be reduced, its flow rate will be affected by the external environment, and the gradual and gradual policy path will promote the unification of intelligent supervision to the regulatory standard, the diversification of regulatory subjects and the intelligent development of the regulatory platform, and provide ideas for the national promotion of the intelligent supervision model of food safety.

At the same time, China's food safety supervision is still faced with the inefficiency and targeting of traditional supervision, the dynamic game between social forces and citizens' interests, the interests of various departments and the interests of various regulatory objects, the mismatch between the rapid development of intelligent information technology and business processes, the cross-sectoral and cross-regional institutional barriers of food supervision, the lack of information sharing, and the large gap between urban and rural intelligence. In this regard, put forward three aspects of the proposal: First, improve the top-level design of food safety intelligent supervision, strengthen the overall view, scientific design, overall layout, strengthen cross-regional cross-sectoral coordination of intelligent supervision mechanism. Second, to promote the cooperation and sharing of data resources, at all levels of government, government and enterprises, urban and rural areas and other levels of synchronization. Improve the information sharing mechanism, develop unified food safety data standards, can be more accurate food safety intelligent supervision. Third, optimize the cross-regional risk early warning mechanism and assessment system, accurately identify the ternary stream, for the "policy window" to open to provide a reliable basis.

Acknowledgment

This work was financially supported by Major Social Science Project of Tianjin Education Commission (2017JWZD22).

References

[1] B. Andrea, S.S. Teuber and C.L. Keen (2010). Food safety. Clinical reviews in allergy & immunology, vol. 39,no.2,p. 95-141.

[2] Y.Y. Luo, L.J. Chen, F. Xu and X.X. Gao(2019). Investigation on knowledge, attitudes and practices about food safety and nutrition in the china during the epidemic of corona virus disease 2019. Public health nutrition, vol.24,no.2,p.267-274.

[3] R. An (2020). Always tighten the string of epidemic prevention and control , and make every effort to ensure the food safety of farmers' markets-the state council's joint prevention and control mechanism holds a press conference on the work of epidemic prevention and supervision of farmers' markets. Chinese food, vol.14,p.20-23.

[4] China Consumers Association. Analysis of complaints accepted by the national consumers association in 2020. (2021-02-03) [2021-04-15].http://www.cca.org.cn/tsdh/detail/29923.html.

[5] Y. T. Shao, Y. P. Wang and Y.W. Yuan(2021). Food safety and government regulation in rural china. Journal of agriculture and food research, vol.5,no.100170.

[6] Z. Liu, A.N. Mutukumira and H. Chen(2019). Food safety governance in china: from supervision to coregulation. Food science & nutrition, vol. 7,no.12,p.4127-4139.

[7] G. Han and S. Yan(2019). Does food safety risk perception affect the public's trust in their government? An empirical study on a national survey in china. International journal of environmental research and public health, vol.16,no.11,p.1874.

[8] X.Y. Li and Y.X. Xu(2020). A summary of the new trend of sharing of scientific and technological conditions in the coordinated development of beijing-tianjin-hebei. Tianjin sci technol,vol.47,no.10,p.5-9+12.

[9] J. Li and B .Zhang(2021). Food safety risk intelligent monitoring model based on big data mining. Food ind,vol.42,no.04,p.384-387.

[10] Y. Wang, H. Wang and B.Q. Zhu(2019). Problems and countermeasures of rural food safety in hengshui city. Modern agr techno,vol.23, p.229+231.

[11] chen t, ding k, yu z, et al. Smart supervision for food safety in food service establishments in china: challenges and solutions. Journal of food protection, 2021, 84(6): 938-945.

[12] J.H. Zhou,K. Li(2020). Improve the effectiveness of smart food safety supervision. China food safety news,2020-02-15(a02).doi: 10.28737/n.cnki.nspzl.2020.0001

[13] W.L. Lv(2019). Research on rural food safety supervision system. Nanjing: nanjing agricultural university.

[14] Z. Liu, A.N. Mutukumira and H. Chen(2019). Food safety governance in china: from supervision to coregulation. Food science & nutrition, vol.7,no.12,p. 4127-4139.

[15] J. A .Donaghy, M. D. Danyluk and T. Ross(2021). Big data impacting dynamic food safety risk management in the food chain. Frontiers in microbiology, vol.12.

[16] S. Yadav, S. Luthra and D. Garg(2020) . Internet of things (iot) based coordination system in agri-food supply chain: development of an efficient framework using dematel-ism. Operations management research, no.2020,p. 1-27.

[17] Y. Jun(2012). Studying on china food safety supervision system in view of synergetics. Chinese health service management, vol.2012,no.07.

[18] Y.F. Deng and Y. Deng(2021). Construction of food safety supervision system under food safety law. Food industry,vol.42,no.05,p.484-488.

[19] N. Gunningham and P. Grabosky(1998). Smart regulation: designing environmental policy. Oxford: clarendon press.

[20] F.Y. Ren(2019). Research on the synergy mechanism of food safety supervision based on the theory of holistic governance.food mach,vol.35,no.04,p.72-75+79. doi：10.13652/j.issn.1003-5788.2019.04.014

[21] The oxford handbook of urban planning[m]. Oxford university press, 2015.

[22] G.C. Tao,H. Tan and Y.F. Song(2018). Exploration and practice of a social co-governance model for food safety based on big data.food sci, vol.39, no.09, p. 272-279.

[23] X.J. Yu(2018). Research on smart food safety supervision strategies in the "internet+" era.food ind,2018,39(08):244-246. yu xj. Research on smart food safety supervision strategies in the "internet+" era.food ind,vol.39, no.08, p.244-246.

[24] Q. Zhang,T. Huang and Y. Zhu(2013). A case study of sensor data collection and analysis in smart city: provenance in smart food supply chain. International journal of distributed sensor networks, vol.9, no.11, pp.382132.

[25] M. Howlett, A. Mcconnell, A. Perl(2015). Streams and stages: reconciling kingdon and policy process theory. European journal of political research, vol.54, no.3,pp.419-434.