Food and Agriculture Organization
of the United Nations

Food safety indicator pilot project in China
Final report

Food safety indicator pilot project in China

Final report

Food and Agriculture Organization of the United Nations
Bangkok, 2021

Required citation:
FAO. 2021. *Food safety indicator pilot project in China – Final report*. Bangkok. https://doi.org/10.4060/cb6634en

ISBN ISBN 978-92-5-134905-2

Abstract

Food safety and food security have significant impact on public health and they influence the stability and sustainability of the whole society. With the largest population in the world, China is simultaneously one of the largest food exporters and importers. These years, dozens of approaches were implemented to improve food safety in China, to address the critical food safety issues and concerns, including contaminations in food, obesity and malnutrition, antimicrobial resistance, food fraud and so forth.

China launched the food safety indicator pilot project in 2019. During the kick-off workshop, six indicators were selected from a proposed set of areas to be piloted, and five technical working groups were established to work on these pilot indicators. Data and information were collected to analyse and evaluate leading food safety agencies, legal and regulatory framework, risk analysis competence, notification mechanism, foodborne illness report and accessibility of potable water.

A concrete progress was observed with the established and measured data, indicating that China improved its food safety control system from 2009 to 2019. More efforts and interventions made to the national food control system will further contribute to the improvement, including implementation of better organizational structures, integration of working mechanism in regulation development and implementation, risk assessment, risk management, risk communication, as well as activities to control and prevent foodborne diseases, and improving safety of potable water. Various follow-up activities were suggested and included in the plan of actions to verify and pilot other indicators in the next few years.

Keywords:
Food safety, indicator, measuring, capacity development, national food control system, China, Codex Alimentarius, standard, Food and Agriculture Organization of the United Nations (FAO)

Contents

Acknowledgments

Food and Agriculture Organization of the United Nations (FAO) would like to express its appreciation to the many people who contributed to the report. This report was prepared for FAO by Hao Ding under the overall direction of Yongxiang Fan from China National Center for Food Safety Risk Assessment (CFSA). The umbrella project and the report development process was coordinated by Masami Takeuchi, Food Safety Officer (FAO). The drafting process involved many people namely, Jianbo Zhang, Jing Tian, Hanyang Lyu, Wei Shao, Chen Zheng, Xiaoya Dan, Huilian Che, Na Zhang, Boyi Lu, Chunbao Li and Huhu Wang. Report editing was provided by Masami Takeuchi. During the project implementation and reporting, technical contributions from several FAO colleagues, namely Vincent Martin and Fu Rong (FAO China) are gratefully acknowledged.

Acronyms and abbreviations

CAC	Codex Alimentarius Commission
FAO	Food and Agriculture Organization of the United Nations
FBO	food business operator
GHP	good hygiene practices
GMP	good manufacturing practices
HACCP	Hazard Analysis and Critical Control Points
SOP	standard operating procedures
WHO	World Health Organization

1 Introduction

1.1 Overview

The idea of a pilot project on food safety indicators was introduced by Masami Takeuchi from the Regional Office for Asia and the Pacific of the Food and Agriculture Organization of the United Nations (FAO), together with examples and cases in other countries. The idea was presented during the workshop of Codex Strategic Plan 2020-2025 for the Codex Alimentarius Coordinating Committee for Asia (CCASIA) held in November 2018 in Beijing. After hearing about the introduction on the project, and about the examples from Belgium and South Korea, Yongxiang Fan from the China National Center for Food Safety Risk Assessment (hereafter referred to as CFSA) showed great interest in carrying out the similar pilot project in China.

In the follow-up discussion, there was general support to launch the pilot project. The participants who were supportive mentioned that 1) from 2009 to 2018, the China Food Safety Law has been published and come into force over ten years (NPC, 2009), and the stakeholders are willing to know whether the food safety control system developed based on the Law is functional; 2) the pilot project has covered different aspects in food safety control, therefore it will provide a good opportunity for all stakeholders to work together and examine throughout the whole food chain; 3) after the melamine crisis, the public confidence in China food industry shrank tremendously, and that the result can be used in the future communication to the public.

According to the discussion, the participants expected to obtain the following outcomes from the pilot project:

1. a picture of current food safety status in China;
2. an analysis of the performance of current food control system;
3. the identification of the gaps and deficiency in the system; and
4. the provision of advice and recommendations to improve this system in the next five-year national strategic plan.

CFSA showed great interest to initiate this pilot project for China to develop a set of food safety indicators. The food safety indicators would help to examine the efficiency and effectiveness of China food control system, which has been renovated by the Food Safety Law which came into force in 2009. Since its establishment in 2012, CFSA has been one of the pillars in national food control system. It provided scientific advice on risk assessment and risk surveillance to the National Health Commission (Former Ministry of Health), and it developed China national food safety standards, which performed as the baseline of food control at the national level. Being one of the key players in the national food control system, it was better for CFSA to work with a third party out of the system to make a neutral, unbiased judgment on the performance of the system. Therefore, the Chinese Institute of Food Science and Technology joined the pilot project as a co-worker.

While deciding which agency or institute would take this work, there were several options, which included departments in the national food control ministries, scientific institutes like CFSA, universities, third party consulting company, etc. The aim of this project, the content of the indicators, the evaluation methods, data accessibility and the stakeholders involved in the project were taken into account during the decision-making process. Without any doubt, an independent, unbiased evaluation result was desired. And the project team should have the capability to reach out to not only ministries and agencies, but also industry, private sectors, as well as laboratory, academia and food consumers, etc. so as to join their effort to carry out the evaluation of all the indicators. At this time, the ideal option appeared.

The Chinese Institute of Food Science and Technology, held forums or symposiums on general or specific food safety topics, and always maintained close relationship with government agencies, food industry, and consumer groups. They institute also showed interest in this pilot project, and contributed to it with a group of young scientists and experts. These young scientists and experts were mainly from government agencies, scientific institutes, universities and leading private sectors in food or food related business. They were full of hope and sense of responsibility for the future of food safety in China. And they were also witness of the tremendous changes in China food control system, since most of them had been engaged in food related work for more than 15 years. When the idea of developing food safety indicators for China was raised, the Chinese Institute of Food Science and Technology expressed its willingness to help the launch of this pilot project, by providing advice from its think tank, and a platform for all interested parties to join this work.

With the support of Jiang Lu, Director General of CFSA, and Wei Shao, Secretary General of the Chinese Institute of Food Science and Technology, it was also decided that CFSA and the Chinese Institute of Food Science and Technology would work hand in hand to launch this pilot project. Meanwhile, it was also noticed that support from ministries in the China food control system, especially the National Health Commission (NHC), Ministry of Agriculture and Rural Affairs (MARA), State Administration for Market Regulation (SAMR), the General Administration of Customs (GACC), Ministry of Industry and Information Technology (MIIT) would be optimal. In addition, joint effort from other stakeholders, e.g. food related social groups, either food industry or customer associations, would largely improve the quality of data and information collected, thus was considered essential to this pilot project.

In 2019, the pilot project team worked on six out of 40 indicators. In summary, the indicator package was valuable in evaluating the China food safety control system. There is also room for improving the evaluation result through cooperation with other domestic programs, and to design together sub-indicators and sharing data. It was agreed that the project should continue, and the remaining indicators would be evaluated step-by-step in future.

1.2 Background

China has the largest population in the world: nearly 1.4 billion people are living in this country on the east coast of Asia (UNDESA, 2020). With a steady growth around eight percent per year, China had the gross domestic product (GDP) of CNY 90 030 950 million (approximately USD 12 804 700 million) in 2018, and per capita GDP of CNY 64 644 (approximately USD 9 200, World Bank, 2021). China made a balance in international food trade in 2018, according to the report of China National Bureau of Statistics, the food export and import were USD 65 472.62 million and USD 64 800.71 million respectively.

Similar to other countries in the East Asia, the staple food in China is rice served with meat, fish, vegetables and fruits. However, dietary patterns varied from north to south, from east to west in China, other foreign dietary patterns also had impact to Chinese people, especially the young generations.

In spite of that, the critical issues and concerns related to food safety were contaminations (chemical, biological, toxicological) in food; obesity and malnutrition which provoke risk to the public health; antimicrobial resistance which has drawn attention globally in recent years; and food fraud, especially those caused by distribution through E-commerce.

The melamine crisis in 2008 gave birth to the China Food Safety Law, the concepts of risk assessment, risk management and risk communication were introduced to the food safety regulatory framework. From 2008 to 2018, the top structure of food safety regulatory system has been changing and evolving, from nine ministries to four ministries involved in the system, with some of the regulatory functions explicitly streamlined and merged. The current food safety regulatory framework at the national level in China included: Food Safety Commission of the State Council, which is the coordinator, and the office of the Commission is located in the State Administration of Market Regulation; the Ministry of Agriculture and Rural Affairs, the State Administration for Market Regulation, the National Health Commission, the General Administration of Customs, which are the four pillars under the Commission. Responsibilities are shared within the four ministries, while the Ministry of Agriculture and Rural Affairs takes care of agro-food, pesticide and veterinary drug residues, and genetically modified food, the State Administration for Market Regulation monitors the food production, distribution and catering industry, the National Health Commission is responsible for food risk surveillance, food risk assessment, establishing food safety standards, and novel food authorizations, and General Administration of Customs of the People's Republic of China regulates food import and export.

2 Food safety indicators for China

2.1 Preparations

Based on above mentioned principles and expected outcomes, the following time table was designed.

Phase	Activities	Time
A. Preparation	1. Selection of experts to join the pilot project from the recommendation lists proposed by stakeholders, identify the project coordinators to manage and supervise the progress of the pilot project. 2. Provision of background information, including result of regional consultation, introduction of similar pilot project of other Asian countries to the selected experts. 3. Translation of the 40 indicators from English to Chinese, reach consensus on the meaning and understanding of each indicator.	November 2018–February 2019
B. Preliminary consultation	1. Consultations with the selected experts, ask each expert to choose five or six pilot indicators from the set of 40 food safety indicators for Asian region. 2. Two rounds of general discussion/debate on the selection of pilot indicators. 3. Selection of five or six pilot indicators for further verification, including minor changes to the selected indicators in the China context.	February 2019
C. Pre-verification of the pilot indicators	1. Establishment of five or six horizontal working groups to verify the pilot indicators chosen in preliminary consultation, each working group be responsible for one pilot indicator. 2. Identification of the type and source of data for the pre-verification, start data collection and analysis for the pre-verification, by the working groups. 3. Exchange regularly on the progress and inform the project coordinator if data gap exists. 4. Draft of the report of each working group.	March 2019–May2019
D. Advanced consultation	1. Collection of the drafts reports from working group. 2. Identification of significant problems or difficulties in the pre-verification of the selected five or six pilot indicators. 3. Organization of advanced expert consultation to solve the problems, and improve the verification on next stage.	June 2019

E. Follow-up work	Follow-up work and amendment of the draft reports. * If the result of pre-verification is not satisfying, more resource, including time, will be allocated, therefore this phase may be extended.	July 2019–September 2019
F. New work and plans	If the result of pre-verification is satisfying, new work on selecting and verifying another five or six indicators will be initiated, the new work will follow the sequence of phases for the previous verification, from phase B to E. It is expected to complete phase B. "preliminary consultation" for the new work by the end of October 2019. Otherwise, this phase will be postponed.	October 2019–November 2019
G. Year-end summary	1. A regional workshop to share the result of pre-verification, share the experience with other members in the region. 2. A summary of the work of 2019, and a plan for work in 2020.	End of 2019

There were over 100 candidate experts who would like to join the project. Considering the relevance of background, working experience, regional balance, etc., one third of the candidates was selected to join the pre-consultation. Fan and Ding from CFSA, Chen and Dan from the Chinese Institute of Food Science and Technology have been nominated coordinator and contact person of the pilot project. A package of reference documents was then provided to the selected experts in the project start training, including:

- "Principles and Guidelines for National Food Control Systems (CXG 82-2013)", (FAO and WHO, 2013);
- "Principles and Guidelines for Monitoring the Performance of National Food Control Systems (CXG 91-2017)" (FAO and WHO, 2017), developed by Codex Alimentarius Commission (CAC);
- "IHR (2005) Monitoring and Evaluation Framework, Joint External Evaluation Tool-International Health Regulations (2005)" (WHO, 2005), published by the World Health Organization (WHO);
- "Meeting Proceedings-Regional Consultation on Food Safety Indicators for Asia and the Pacific, 6-8 December 2017" (FAO, 2018), provided by FAO;
- "Capacity Development on Food Safety Indicators", the presentation material by Masami Takeuchi from FAO; and
- "Food Safety Indicators, A Belgian Case: Barometers for the Safety of the Food Chain", provided by Belgian Federal Agency for the Safety of the Food Chain (FASFC).

The first three documents are a guidance developed by FAO and WHO, the last document is a successful case study of setting food safety indicators to examine the safety of the food chain in Belgium. The Singapore meeting proceedings demonstrated the process of selecting the set of 40 food safety indicators for Asia and Pacific region out of the total 139 indicators based on the Asian context. In Takeuchi's presentation, besides the examples in the South Korea and Bhutan, the 40 indicators had been further divided into sub groups, according to the subjects, which were:

- food safety competent authority(-ies) and partners (indicator 1-3);
- policy and legal and regulation framework (indicator 4);
- principles of the national food control system (indicator 5-7);
- Codex and functions with other international bodies and platforms (indicator 8-11);
- food inspection (indicator 12-15);
- food safety certification (indicator 16);
- testing and analysis (indicator 17-18);
- notifications (indicator 19-20);

- support to self-checking system (indicator 21-23);
- food monitoring, health surveillance and epidemiology (indicator 24-27);
- data collection, collation and interpretation (indicator 28);
- food safety emergency preparedness (indicator 29);
- information, education, communication and trainings (indicator 30-31);
- shared responsibility-industry producers, processors, food business operators (indicator 32-35);
- access to potable water (indicator 36);
- public trust in food safety (indicator 37-38); and
- food and feed trade (indicator 39-40).

2.2 Kick-off stakeholder workshop

In the project kick-off and training workshop at the end of January 2019, the selected experts sat together to translate the 40 food safety indicators from English to Chinese. Although all the experts were able to work in English, it was still considered necessary to do the translation, since the interpretation of each indicator might be various for different individuals, and the harmonized Chinese version of these food safety indicators would be optimal for future work. Even fierce debates on the interpretation and implication of some indicators were happened sometimes in the workshop.

For instance, as to the food inspectors, some believed it referred to a person in the food manufacturing or processing facility to test and analyse the food products, and ensure the quality and safety of the food products, while others believed it had to do with a professional certification/qualification issued by the Ministry of Human Resources and Social Security which could be acquired by a university student, while having nothing to do with his real job. After the seven hours' intensive discussion, the workshop came up with a harmonized Chinese version of the 40 food safety indicators (see Annex 1), and due to the thorough discussion, the experts reached consensus on the understanding of each indicator. The question was, would there be any ambiguity in China context, what kind of data might be required, and whether sufficient data would be easy to access. The Chinese version of indicators have provided a solid base for work on the next stage.

Experts were then asked to bring back home the 40 indicators, both English and Chinese version, and try to choose five pilot indicators for the pre-verification independently. They were required to choose the pilot indicators based on their food safety knowledge and working experience, and most importantly, they were asked to apply the following principles for selecting pilot indicators:

- The description in the indicators must be clear, without ambiguity.
- The expected outcome should be relevant and meaningful to the food safety managers.
- The indicator should be practical, amenable to independent validation, those with data already available would be prioritized.

Replies were received in mid-February 2019 in two opposite forms. For most of the replies, five or less pilot indicators were selected and proposed for pre-verification. Only one of the replies eliminated several indicators which were regarded as improper or unsuitable for further work. Experts were also asked to indicate the rationale of their decision, which were provided in a very detailed manner. Rationale had to do with the relevance between selected indicators and goal of the project, which aspect of food safety situation or food control system was the indicator tried to examine, the required type of data, as well as the expected source of data. Indicator 1, 4, 7, 14, 19, 26, and 36 were the most popular choice according to the replies.

A round-table discussion was organized after collection and analysis of the replies. Experts were gathered for a free debate on their choices. In order to defend their choice, they would have to elaborate, explain and persuade their dissidents. The way of hosting Codex committees have been adopted in the discussion, the pilot indicator would be selected only when consensus was reached. Through a long and tough discussion, indicator 1, 4, 7, 19, 26, and 36 has been selected as pilot indicators for pre-verification:

- **indicator 1**: presence of a leading food safety agency (entity) to drive the coordination work to ensure food safety;
- **indicator 4**: presence of enabling national policy and legal and regulatory framework are consistent with international standards, guidelines and best practices (including legally embedded criteria for executing food recall and traceability) and they show government commitment to protect public health and ensure fair practices in food trade;
- **indicator 7**: use of risk analysis paradigm by the competent authority to inform and support risk-based, science-based and evidence-based decision-making and establish food safety control measures with a mechanism for expert consultation to advice government on food safety risk assessment;
- **indicator 19**: presence of notification mechanism on food safety incidents and outbreaks.
- **indicator 26**: number of outbreaks of foodborne illness reported
    - a. Salmonellosis in humans,
    - b. Listeriosis in humans; and
- **indicator 36:** percentage of the population with access to potable water.

According to the stakeholders, all the 40 indicators were more of less relevant, however, considering the workload and the resource at hand, it was recommended to be not too ambitious and to divide the work into several years. To better understand the indicators, the project team got together and translated all the indicators from English to Chinese, not only translated the indicators, experts were required to identify the necessary information or data required to carry out the work on each indicator. With the guidance and working principles provided by Masami Takeuchi, and considering the data availability and the work load, 6 indicators have been chosen for the pre-verification, which are indicator 1, 4, 7, 14, 19, 26, and 36.

2.3 Technical working groups and resource people workshop

Five horizontal working groups were then established, four of them taking care for each of indicator 4, 19, 26, and 36, and one group would look at indicator 1 and 7 at the same time. Each working group had a contact person, to coordinate the work within the group and contact with the project coordinator, to report the progress of working group and problems they encountered in process. All the technical working groups worked independently, and draft mid-tem working group reports have been received in early April. In the next section, work of each technical working groups will be introduced.

A round table discussion was held in mid-April to update with the stakeholders about the progress of the pilot project. Taking advantage of this opportunity, the FAO China office managed to reach out to other important stakeholders in other ministries and agencies. During the discussion, experts from Belgium, the Philippines and Bhutan introduced their work, and Yunbo Luo briefed the workshop on their work of China food safety index developed by China Agricultural University. The idea of food safety culture introduced by experts from Food Standards Australia New Zealand (FSANZ) also inspired the participants, which has some impact on the future work plan of this pilot project in the upcoming years.

Several teleconferences/virtual meetings of the technical working groups and resource persons were held during April to October. The progress and the possible problems of the work were shared and discussed on-line, and the coordinators focused on the difficulties faced by each technical working group and tried to reach out to other resource group or person to solve the problem. Most of the problems encountered by the technical working groups were data gap. At the beginning of the project, each indicator had to represent data collected and evaluated from 2009 to 2019. However, due to some systematic reasons, including the institutional reform, data confidentiality, etc. some kind of data, or data of certain years or period, could not be found or used in the evaluation. After several attempts and thorough discussion among the technical working groups and coordinators, including consulting the resource persons, some of the technical working groups modified their method and data collection scope.

Supported by Junshi Chen, academician of Chinese Academy of Engineering, another workshop was held in mid-November in Wuhan, inviting colleagues from Bhutan, Cook Island, the Philippines to introduce the pilot project in each country and other countries which were interested in launching the similar project were also participating the workshop. After the workshop, the China pilot project team were working together to prepare the report of 2019.

3 Six selected food safety indicators

3.1 Food safety indicator one

3.1.1 Overview

Indicators 1-3 were designed to evaluate the structure of the national food safety control system, in which indicator one focused on the top entity of the structure and its function. The technical working group of food safety indicator 1 was composed of two researchers/professors, one research associate and two students from CFSA. The same group also undertook the work of food safety indicator 7. The technical working group carried out its work from late February to early July. Not only the top level of the system was examined, but also the whole structure and the dynamic changes of the system were observed.

3.1.2 Methodology and data collection

Since the technical working group was to look at the national food safety control system and its leading entity, the website of each ministry which involving in the system was the main source of data. The records from 2009 to 2019, on the establishment of the system, especially the leading entity-the Food Safety Commission of the State Council, the dynamic changes, the documents on food safety control, including notifications, departmental decrees, regulations, etc. issued by these ministries and its subsidiary bodies, and their activities on food safety control were collected.

The method used in the evaluation of this food safety indicator was literature review, assisted by several expert interview and consultation. The data collected was first categorized by source and theme, and then sorted by time. The latest structural picture of the China national food control system was also prepared by the technical working group to illustrate the current situation, including all ministries and their responsibilities in the system.

3.1.3 Results

Based on the China Food Safety Law implemented in 2009 (NPC, 2009), the China national food safety control system has been reformed. The food safety commission of the state council founded in 2010 became the coordinator of the system. In order to ensure the food safety along the food supply chain, there were in all nine ministries involved in the national food safety control system. Ministry of Health (MOH), Ministry of Agriculture (MOA), Ministry of Commerce (MOC), State Administration for Industry and Commerce (SAIC), State Food and Drug Administration (CFDA), General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ), Ministry of Industry and Information Technology (MIIT), and Ministry of Public Security (MPS), each of them was responsible for one part in the food supply chain. Although most of the main ministries had been involved, in the food safety management there was still a lot of conflicts and overlaps. This brought trouble to the coordinator, and more problems to the industry, as well as the people work on the frontline. Learning from this experience, several changes have been made to streamline this system. After several rounds of merge and modification, the structure of current China national food safety control system is shown in Figure 1.

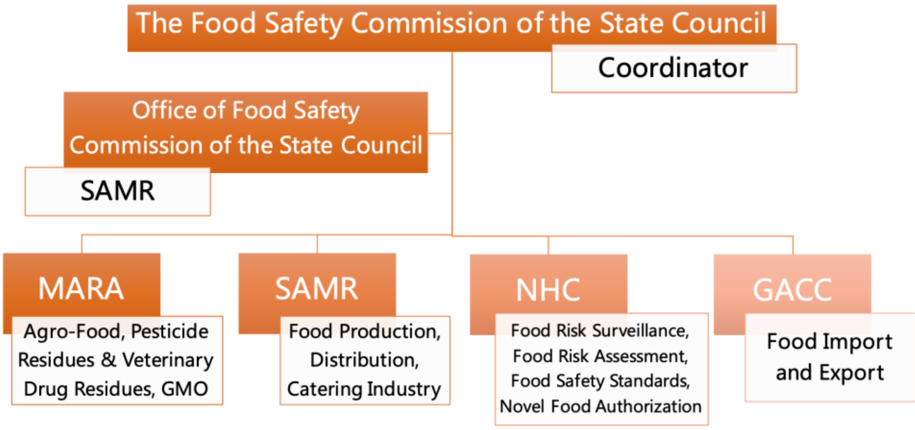

Figure 1. Structure of the Current China National Food Safety Control System

The Premier was the head of the Food Safety Commission of the State Council, which reflected the country's emphasis on food safety control, and also guaranteed the commission's effectiveness of its coordination among the Ministry of Agriculture and Rural Affairs, the State Administration for Market Regulation, National Health Commission and General Administration of Customs of the People's Republic of China. The Office of the commission was located in the State Administration for Market Regulation, which was responsible for the safety in food production, distribution, catering industry in the food supply chain. The Ministry of Agriculture and Rural Affairs was responsible for developing the policy of agro-food, pesticide residues and veterinary drug residues, and genetically modified food; while the National Health Commission undertook the work of food risk surveillance, food risk assessment, food safety standards, and novel food authorization; and General Administration of Customs of the People's Republic of China was taking care of food import and export testing and certification.

At the top level, in addition to high-level discussion and coordination, the food safety commission of the state council has three other main responsibilities: 1) to analyse the food safety situation, research and deploy, and coordinate and guide food safety work; 2) to put forward major policy measures for food safety supervision; and 3) to supervise and implement food safety supervision responsibilities.

The strategic documents published by the commission included: Opinions of the State Council on Deepening Reform and Strengthening Food Safety Work (2019), Notice on further strengthening the management of pesticides and veterinary drugs to ensure food safety (2017), Notice of Food Safety Work Evaluation and Assessment Measures (2016), Notice on Further Strengthening Work on the Quality and Safety of Infant Formula Milk Powder (2013), Notice on Adjusting the Administrative Management System of Industrial and Commercial Quality Supervision Below the Provincial Level and Strengthening Food Safety Supervision (2011), plans and key work in food safety management of each year, and Notice on issuing the Eleventh, Twelfth five-year plan of the national food safety supervision system, etc. Most of these were guidance documents which illustrated the strategic plan and key areas in national food safety control system.

3.1.4 Preliminary conclusion

It was recognized that since the implementation of China Food Safety Law in 2009, the national food safety control system has been reformed, and strengthened gradually. The Food Safety Commission of the State Council has been performing as the leading entity and the coordinator in this system.

Through segment administration and cooperation, now five ministries under the commission were working together to ensure food safety from farm to fork.

3.1.5 Suggestion for future work

Learning from the similar program, it is suggested to develop several sub-indicators under this food safety indicator, to evaluate the efficiency and effectiveness of the China national food safety control system, and to examine the management and coordination of the leading entity as well. At the same time, the interaction mechanism among each entity was recommended to be figured out and evaluated. In addition, according to the result, sometimes the responsibilities of each ministries overlap with those of others. Sub-indicators were suggested to develop, in order to identify the overlaps or gaps.

3.1.6 Limitation of this work

Except the administrative documents and activity record, there was rarely other data to quantitatively evaluate the work efficiency and effectiveness of China national food safety control system. To improve this work, sub-indicators should be developed, and survey might need to be designed and implemented.

3.2 Food safety indicator four

3.2.1 Overview

The technical working group of Indicator 4 was leaded by China Agricultural University. The regulatory framework for food safety in China, especially the food standards system was analysed. The China Food Safety Law took care of the food safety control all over China, by regulating stakeholders' activities form farm to table along the food chain. China food standards system developed based on the Food Safety Law set up detailed requirements or limits to regulate the food industry. China food standards system was compared by category, content and procedure with Codex Alimentarius, since Codex was the internationally recognized food standard setting body and has been the most important reference for developing food standards in many countries including China. With regard to the category of standards, in China, divided by the legal force, there were mandatory standards and voluntary standards; and by the setting up body, there were national food safety standards published by the National Health Commission, local standards published by provincial government, and trade standards developed by food industry, group standards by food related groups and associations, and corporate standards for private sectors.

With regard to the content, Codex and food standards in China controlled food contaminants, pathogenic bacteria, veterinary drug residues, pesticides residues in food, and covered food additives, nutrition, code of practice, food commodity, food labelling, genetically modified food, food irradiation. Besides that, China food standards also regulate the food contact material and novel food. Up to July 2019, nearly 1300 food safety standards have been published in China, which included more than 20 thousand numerical limits. In general, China food safety standard system has been established from 2009 to 2019.

Admitting the achievement of establishing a food safety framework in China, during the analysis, the technical working group has identified some gaps and come up with recommendations. To begin with, the role of risk assessment, risk surveillance and other scientific research should be emphasized in the development of food safety standards. In addition, communication is necessary for all stakeholders, especially who use the standards and regulations in their real life, that is to say, the regulations should be practical. Last but not the least, creativity is beneficial in improving work efficiency, e.g. in some cases, the accelerated procedure should be followed, the mechanism of adopting international standards in China scenario when necessary, and the procedure for developing provisional tolerable daily intake, etc.

In order to improve China's food safety standards system and strengthen food safety supervision, the technical working group conducted a systematic comparative analysis between the International Codex Alimentarius and China national food safety standards. Through this work, the technical working group may further understand the characteristics of food regulations and standards in different countries and regions. Therefore, finding out the similarities and differences between China's food safety standards and international Codex standards and other national food regulations, and proposing further work recommendations for possible gaps and deficiencies. This work is critical for improving the formulation and implementation level of China's food safety standards and actively affecting the development of international food standards.

3.2.2 Methodology and data collection

This report introduces the food safety standard systems and the setting of main indicators in different countries and regions according to the content of food safety standards covered by the Food Safety Law, including chemical contaminants in food, pathogens bacteria in food, food additives, and nutrient supplement. Eleven professional fields, such as pharmaceuticals, nutrition labels, special dietary foods, and food contact materials, food production and operation regulations, food inspection methods and procedures, pesticide residues in food, and veterinary drug residues in food. The materials and information data come from the websites and publications of CAC and national food standard setting and management departments.

The technical working group compare nearly 300 000 indicators of nearly 8 000 regulations or standards of the CAC, the United States of America, the European Union and other countries or regions. The comparison content covers all aspects of national food safety standards, including all international food code standards, 96 chapters of the United States of America's Federal Regulations (CFR), and nearly 30 European Union regulations and directives.

According to the food risk factors, risks were divided into six categories: food additives, pollutants, pathogenic bacteria, pesticide residues, veterinary drug residues, and nutritional supplements. According to the risk substances matching domestic and international relevant standards, the technical working group then select several risk substances from the scope of risk material related standards and the standard limit. In all, 821 food safety factors in China National Food Safety Standards and Codex Alimentarius were compared, including 239 food additives, 18 chemical contaminants, seven pathogens, 417 pesticide residues, 90 veterinary drug residues, and 50 nutrients and food supplements.

3.2.3 Results

China and foreign countries all have basic standards for chemical contaminants. However, due to the differences in food processing patterns and environmental pollution factors, the number and indicators of pollutants controlled by different countries are different. But compared with the CAC standard, the compliance rate of indicators with the same items and food categories reaches 88 percent, and the degree of consistency with CAC is relatively high. In general, the basic standards of chemical contaminants in China are relatively consistent with CAC.

Due to the diverse ways of microbial control in food, there are differences in the types and indicators of pathogenic bacteria in China and other countries. Most of the developed countries attach great importance to the control of pathogenic bacteria in the food production process, but not all the pathogens are included in the requirements of the product. The requirements for microbial indicators in the final product, especially the health indicator bacteria in the supervision, are usually managed by the food company itself. For example, CAC has only formulated four indicators of three pathogenic bacteria, which are less than the pathogens concerned in the Chinese regulations. As for the specific indicators, because the "pathogen-food" combination set by China and other countries is different, the specific indicators are not comparable.

At present, China does not have a veterinary drug limit standard. The veterinary drugs which are allowed to use in China are included in an announcement of the Ministry of Agriculture. Up to now, China has published 1 548 indicators of 94 kinds of veterinary drugs, which are equivalent in quantity to international standards, but there are differences in the setting of indicators. China should improve the standard revision mechanism for veterinary drug residues and speed up the development of veterinary drug standards.

At present, most of the countries control the use of food additives by making a positive list system, but they have different definitions and scopes for food additives. The difference in the range of food additives, leading to a significant difference in the number of food additives which allowed to be used in different countries. For example, the category of food additives in China includes flavours, gum-based substances and the processing aids for food industry, while the category of CAC food additives does not include these substances. For specific indicators, the limit indicators of food additives in various countries are based on the results of risk assessments. Different dietary patterns of residents in different countries cause differences in the limit indicators, so it is not practical to make a simple comparison.

The national standard includes 3 650 limit indexes of 387 pesticides in 284 kinds of food, which covers 12 types of crops and products, including vegetables, fruits, grains, oilseeds, sugars, beverages, seasonings, nuts, edible fungi, mammal meat, eggs, poultry viscera, and meat. On the other hand, there are 4350 CAC standards for maximum residue limits of pesticides in food and agricultural products, involving 208 kinds of pesticides.

Compared with the provisions of CAC, the regulations in our country about the nutrient supplement are more explicit, which including more kinds of nutrient supplement, especially in the aspect of nutrient supplement in special foods.

3.2.4 Preliminary conclusion

The standard system and indicator principles of different regions are basically consistent. These results indicate that the formulation of food standards in China and in major developed countries both based on the basic purpose of protecting human health and ensuring food safety in production and operation, and follows the general principles of food safety risk management. In addition to protecting the health of consumers, the Codex Alimentarius Standards also takes the important purpose of coordinating international food trade, which is very different from the starting point of standards set by various countries. China's food safety national standard system framework, formulation procedures, and scientific basis are basically consistent with CAC and major developed countries. The standards cover all areas that are closely related to consumer health, such as pollutants, pathogens, food additives, pesticide residues, veterinary drug residues, and so on.

There are some differences in the specific content and limit levels of national standards. The basic tenet of food standard formulation in China and most developed countries are protecting human health and ensuring the safety in the food producing process. This work shows that in addition to protecting consumers' health, the International Codex Alimentarius also takes coordinating international food trade as an important purpose, which is quite different from the starting point of establishing standards in other countries. The framework, formulation procedures, scientific basis and other aspects of China's national food safety standard system are basically consistent with CAC and most developed countries. In terms of the content and rationality level of standards, China's standards for food pollutants, food additives, food contact materials, and special diet food are equivalent to international standards, some of them have even led the development of international food standards. Due to the different food safety regulatory systems, regulatory concept and development level of food industry, the content of national standards is different. So International Codex Alimentarius are the results of compromise among the food standards of various countries, not the most advanced system.

Compared with developed countries, some standards in our country are insufficient. Although China has established a national food safety standard system which covering basic standards, production and operation specifications, inspection method standards, etc., but due to the differences in the development level of the food industry and national conditions, there is still a certain gap of standards between China and other developed countries. There is still no systematic risk assessment and management basis for food safety issues such as nanotechnology, recycled materials and allergen management. Food safety issues caused by various adulterations also impose urgent requirements on the relevant test method standards. In the existing standard system, there is also a lack of standards for food production and management, pesticide residue standards and veterinary drug residue limit standards, also, the standard indicators do not match the inspection methods and quality specifications.

3.2.5 Suggestions for future work

Based on the lack of domestic risk assessment data in many standard indicators, China government can only simply quote or copy international or developed country standards, so the ability of independent risk management needs to be strengthened. On the other hand, due to the complexity of food safety supervision object, weak supervision system and strong public awareness of food safety, the current evaluation method of single result index is not suitable for China's national conditions, and the relevant parties do not recognize the food qualification rate index.

According to this, the technical working group suggest that a food safety comprehensive index system should be established. This system can clearly reflect food safety status from different perspectives, which can simplify and improve the understanding of food safety of all walks of life, alleviate the public's conflict and panic on single evaluation indexes such as food qualification rate, and leave room for government risk exchange activities. At the same time, the establishment of a scientific food safety comprehensive evaluation index system and the regular comprehensive and objective evaluation and reflection of China's food safety situation are conducive to the understanding of the development trend of national food safety, finding out the weak links of national food safety supervision, strengthening the rational distribution of social resources in food safety, and effectively improving the level of food safety.

3.2.6 Limitation of this work

In this work, the technical working group conducted a systematic comparative analysis between the International Codex Alimentarius and China national food safety standards. The focus of comparison is mainly between China and some developed countries, but the food safety indicator systems of many developing countries are also worthy for our study. These developing countries should also be included in our study.

3.3 Food safety indicator seven

3.3.1 Overview

The technical working group of indicator 1 also undertook the work of indicator 7. Since CFSA was conducting risk assessment and providing scientific evidence in the national government decision making process, the technical working group focused on collecting data and information internally. The technical working group has been working on this indicator from late February to early July. Two consultation meetings have been held to ask for help from risk assessment and food-borne disease surveillance departments.

3.3.2 Methodology and data collection

Most of the data on the national food safety risk assessment and its function in the governmental decision-making process has been collected from the official web-page of CFSA, together with the scientific reports and annual work reports prepared by CFSA, a clear mechanism and diagram of evidence-based decision-making process could be observed.

Literature review and expert consultation were two main methods in the evaluation of this indicator. The data collected was first sorted and categorized by theme and then by time sequence. Quantitative and qualitative data has been sorted separately. According to the information confidentiality regulations, some confidential data and information was first noticed and then screened out during analysis.

3.3.3 Results

It was noticed that CFSA has been playing a key role in the food safety risk assessment at national level, the technical working group made their effort to analyse the structure, responsibility, and its role in the science-based national food safety decision-making process.

The CFSA was established on 13 October 2011 with the approval of the State Commission Office for Public Sector Reform (CFSA, 2021). CFSA is a public health organization that is managed by a Steering Council which provides policy and general supervision.

As the national level technical institution in charge of food safety risk assessment, CFSA provides technical support for food safety risk management covering the entire food chain, i.e. "from farm to table". CFSA not only advises the government on risk management matters, but also provides public information and science-based education on food safety issues for a range of audiences including consumers. CFSA also serves to address the scientific needs of innovative industrial development.

CFSA provides technical support for food safety risk management in order to promote food safety and protect public health. Under the Steering Council's decision-making oversight, CFSA scientifically evaluates current and emerging food safety problems and provides risk assessments and other scientific advice in a timely manner. In addition, CFSA maintains constant food safety emergency surveillance and if a problem is identified provides scientific evaluation on the potential risks to public health, as well as advice on efficient and effective responses to the problem. Motivated by the protection of public health and domestic and international concerns, CFSA has launched an ambitious project to harmonize and consolidate the multitude of national food safety standards that had been established by different Chinese agencies.

Employing the research capabilities of its advanced laboratories, CFSA focuses on the key problems in food safety risk surveillance, risk assessment, and tracing and alert of foodborne diseases, thus contributing to the effectiveness of China's food safety program and playing a lead role in the various scientific areas supporting food safety.

The major responsibilities of CFSA were:

- Risk assessment: to carry out the basic work for food safety risk assessment; to undertake specific tasks including the collection, processing and analysis of data, technical information and testing results; to prepare and submit risk assessment analysis reports to the China National Expert Committee of Food Safety Risk Assessment for review. Subsequent to approval by the National Expert Committee of Food Safety Risk Assessment, the National Health Commission will release the report to the public.

- Risk surveillance: to undertake relevant technical work for risk surveillance, participate in related research, make proposals for national surveillance plans, and summarize and analyse surveillance information and data.
- Food safety alert: to study and analyse food safety risk trends and patterns and detect emerging threats, and put forward risk alert advice to relevant departments, including suggestions for possible measures to control or reduce the risk to consumer's health.
- Risk communication: to carry out food safety information dissemination activities and risk communication to policy makers, risk managers, the industry, the media and the general public.
- Research and training: to carry out relevant scientific research on food safety surveillance, risk assessment and communication, organize and conduct relevant professional training on food safety risk surveillance, assessment and communication at the national level.
- Emergency response: to provide technical guidance and support for the emergency response to food safety incidents with the cooperation of Chinese Center for Disease Control and Prevention.
- Technical guidance: to provide operational guidance to branch centres and offer technical guidance to local institutions for risk assessment and appropriate risk management strategies.
- Secretariat: to undertake the routine support for the Secretariats of the China National Expert Committee Food Safety Risk Assessment, the National Food Safety Standard Review Committee and the International Scientific Advisory Committee. CSFA also serves as the host for the Codex Committee on Food Additives (CCFA).

The Steering Council is the policy- and decision-making body of the CFSA. It is responsible for reviewing the development strategy and financial budget and the handling of major affairs, the preparation and revision of the regulations. It also undertakes various management duties, such as personnel management and the supervision of CFSA's operations.

The lead Ministry of the Steering Council is the National Health Commission and its representative chairs the council, the vice chair ministries includes the State Administration for Market Regulation. Other members of the Steering Council include the National Development and Reform Commission, the Ministry of Education, the Ministry of Science and Technology, the Ministry of Finance, the State Administration for Industry and Commerce, the General Administration of Quality Supervision, Inspection and Quarantine, as well as experts and service-end representatives in the fields of medicine, agriculture and food. The current Steering Council is composed of 23 members, including a chairman, two vice-chairmen and 20 members. The National Health Commission acts also as the CFSA's host organization and undertakes the Centre's routine functions, i.e. administration and logistics, etc.

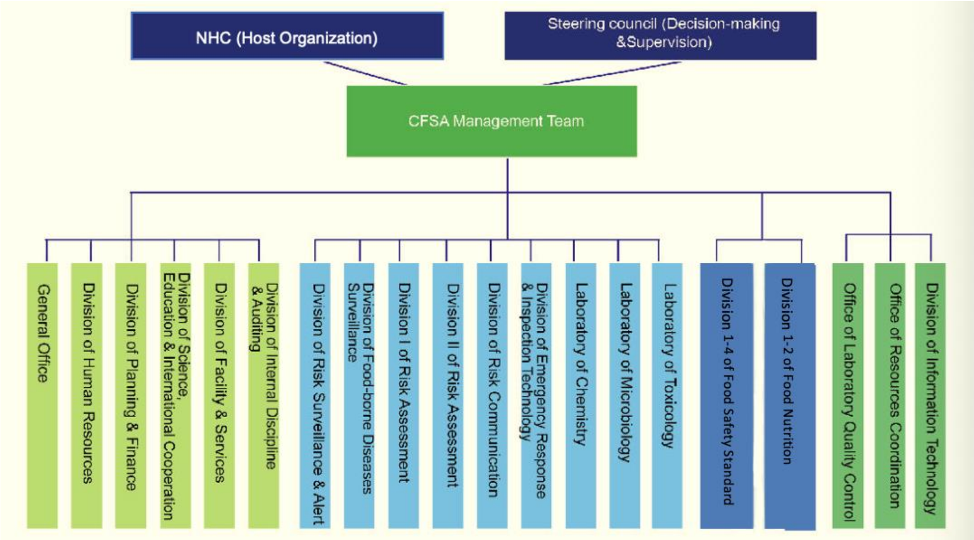

Figure 2. Organizational Structure of CFSA

Figure 2 shows the organizational structure of CFSA. CFSA's structure allowed it to fulfil its task on science research, laboratory verification, risk assessment, food-borne disease surveillance, food safety standard development, risk communication. It also provided evidence and scientific advice to the National Health Commission and other ministries in the steel council in their decision making.

3.3.4 Preliminary conclusion

According to the collected data, China has been using the risk analysis paradigm by the competent authority (CFSA) to inform and support risk-based, science-based and evidence-based decision-making and establish food safety control measures with a mechanism for expert consultation to advice government on food safety risk assessment.

3.3.5 Suggestion for future work

During the work on this food safety indicator, the technical working group collected dozens of scientific reports drafted by CFSA on different element in food safety control, some of them have been reflected in the governmental decision making, while others not. To improve the result, the impact of the scientific advice and reports on food safety control measures was recommended to be measured.

3.4 Food safety indicator nineteen

3.4.1 Overview

China's food safety situation is closely related to the international food safety situation. It is an important means to understand the current situation of China's food risk monitoring, analyse the existing food safety risks, carry out food safety risk assessment and early warning, and provide data support for better food safety supervision. Therefore, the technical working group believe that the indicator: use of risk analysis paradigm by the competent authority to inform and support risk-based, science-based and evidence-based decision-making and establish food safety control measures with a mechanism for expert consultation to advice government on food safety risk assessment in principles of the national food control systems is effective.

3.4.2 Methodology and data collection

The technical working group go through data collection, data sorting, data analysis, results summary, deficiencies found, next step plan, this process makes a comprehensive summary of the indicators of "Use of risk analysis paradigm by the competent authority to inform and support risk-based, science-based and evidence-based decision-making and establish food safety control measures with a mechanism for expert consultation to advice government on food safety risk assessment".

Since taking over the project at the beginning of 2019, the technical working group have started to sort out various materials related to food risk assessment in China, including relevant laws and regulations, organization reports, national standards, policy requirements, relevant literature in the past 20 years, news reports and the popularity of risk assessment by visiting the masses. In this paper, the current risk assessment process in China is sorted out, the main high-risk conditions of food are found, and three risk factors of pollution sources are listed. Good support for food safety in China.

3.4.3 Results

3.4.3.1 Relevant laws and regulations, organization reports, national standards, policy requirements, visits to the masses

In order to find out the adverse effects of harmful factors in food on human health in time, and considering that food safety risk assessment is currently internationally recognized to formulate food safety policies, regulations and standards, China needs to establish relevant food safety risk monitoring system, develop and implement national and regional monitoring plans, plans and implementation. The law of China on the quality and safety of agricultural products, which was promulgated and implemented in 2006, introduced the concept of risk analysis and risk assessment for the first time, and determined the legal status of risk assessment. Article 6 of the law stipulates that "the competent administrative department of agriculture under the State Council shall establish an expert committee of agricultural product quality and safety risk assessment composed of experts from relevant parties to conduct risk analysis and assessment of potential hazards that may affect the quality and safety of agricultural products".

The assessment mainly focuses on the hazardous factors related to the planting and breeding of agricultural products, including agricultural inputs such as pesticides, veterinary drugs, fertilizers, feed additives, etc. the law also clearly stipulates the role of risk assessment, that is, "the agricultural administrative department of the State Council shall take corresponding management measures according to the results of the risk assessment of agricultural product quality and safety", and explains the risk assessment conclusion Results should be the scientific basis of management measures. The Food Safety Law of China issued in 2009 requires that risk assessment must be carried out in China. The revised Food Safety Law of China in 2015 once again emphasizes the necessity of carrying out food risk assessment in China.

According to the provisions of the Food Safety Law, in November 2009, the Ministry of Health established a national food safety risk assessment expert committee composed of 42 experts in medicine, agriculture, food, nutrition and other fields. The expert committee will undertake the national food safety risk assessment, participate in the development of monitoring and assessment plans related to food safety risk assessment, formulate technical rules for national food safety risk assessment, explain the results of food safety risk assessment, carry out risk assessment exchange, and undertake other tasks related to risk assessment entrusted by the Ministry of health.

On 13 October 2011, the CFSA was officially established. Since the implementation of the Food Safety Law, China has gradually improved the supporting management system of food safety risk assessment, successively issued more than ten risk assessment technical specifications, such as the work guide of food safety risk assessment, the data requirements and collection requirements of food safety risk assessment, the application guide of food microbial risk assessment in food safety risk management, etc., which are all inclusive China provides scientific guidance for food safety risk assessment. In the work, a set of working procedures for risk assessment proposal collection, project determination and implementation, report review and release has been formed.

On 26 March 2019, Li Keqiang presided over the executive meeting of the State Council and passed the regulations on the implementation of the Food Safety Law of China (Draft), which detailed the main responsibilities of producers and operators, the responsibilities of government supervision and accountability measures, increased the punishment on the enterprises in violation of laws and regulations and their legal representatives in accordance with the procedures, and improved food safety full standard, risk monitoring and other systems to ensure food safety and safeguard people's health. It can be seen that China's attention to food safety has been gradually strengthened, and the voice of citizens' demands for healthy products has become increasingly strong. It is very necessary to establish a reasonable risk monitoring system.

3.4.3.2 Collation of literature and news reports in the past twenty years

Since the twenty-first century, there have been many food quality and safety incidents in China. Many scholars have studied food safety risk identification based on a certain scale of food safety incidents. The results show that abuse of additives or non-edible substances, use of substandard raw materials, improper use of inputs and other factors are the key risks that cause food safety problems in China Processing is the weak link of high risk in the supply chain. Food enterprises, especially small enterprises and small workshops, are the main responsible bodies for food safety events. Unlike China, food safety problems in developed countries are caused by microbial pollution, chemical pollution and non-active fault of enterprises. In addition, manual statistics or direct use of the existing food safety event database (such as "throw out the window" network) is a very widely used data acquisition method. In recent years, some scholars try to obtain and analyse the food safety events exposed in the mainstream media through web big data mining technology, but the relevant research needs to be further improved.

China's risk assessment work has been fully penetrated into a series of processes from production to consumer's mouth, including production, processing, packaging, transportation, storage and sales. Through the retrieval and collation of the China National Knowledge Infrastructure database (CKNI, 2021) for nearly 20 years, it is found that the risk assessment in China can be divided into microbial risk assessment, chemical hazard risk assessment, and food processing and circulation process risk assessment. At the same time, from the media attention in the past five years, the technical working group found that people's attention to food risk assessment is gradually increasing, which can prove that risk assessment is a widely used means in China's food safety monitoring.

In the past 20 years, there have been nearly 4 000 outbreaks of foodborne diseases caused by microorganisms in China, involving 12 000 patients. These foodborne diseases are mainly caused by *Vibrio parahaemolyticus* (34 percent), *Salmonella* (24 percent), *Staphylococcus aureus* (15 percent), *Bacillus cereus* (ten percent) and *Escherichia coli* (five percent). There are many outbreaks involving a large number of people, which has also raised the concern of microbial risk analysis. Due to the specificity of bacterial preference, there are many evaluations on milk and dairy products, meat and meat products, aquatic products, baked goods, eggs and egg products in China.

There are nearly 6 000 outbreaks of foodborne diseases caused by chemical substances in China, 70 percent of which are caused by toxic animals and plants and toxins. The number of patients involved has reached 70 000, and more than 60 percent of them are caused by toxic animals and plants and toxins. There are 200 safety incidents caused by food processing and circulation process (excluding microbial hazards and chemical hazards). With the assessment work, it has begun to reduce year by year.

With the progress and development of food science, more and more kinds of food have come into the public's vision. A series of new products, such as new technology, new methods, and new raw materials and so on, need to go through the analysis of food risk assessment to ensure the extremely low frequency of food safety events. Although China has actively responded to the risk assessment work, it always lags behind the progress and development of food science, and the whole risk assessment work is in a passive state. However, China's laws and regulations, standards and policies have actively curbed the high-risk food safety problems, and food safety standards and risk monitoring and assessment work have achieved remarkable results. In order to actively implement risk analysis, China has implemented "hard and soft" simultaneously. At the same time, in cooperation with relevant risk analysis laws and regulations, it has effectively reduced the hidden dangers of food safety and effectively maintained the health and food safety of the people.

3.4.3.3 Shortcomings of verification work and next step plan

In the verification process, due to the statistical strength, the data of some villages, townships, towns and remote areas are not comprehensive, and the statistical means are backward. In the next step, the technical working group should vigorously develop the advantages of the data era, integrate multiple data, and comprehensively cover the data investigation work of villages, townships, towns and remote areas in China, so as to ensure the accuracy and comprehensiveness of the statistical data. Actively cooperate with and give feedback to relevant departments, so as to make use of and benefit the popularization and investigation of the people.

3.4.3.4 Inspection responsibilities and training requirements of food inspectors who have received official food control training

The professional quality of food practitioners is related to food safety. The effective training and supervision of food practitioners can improve the professional quality of food practitioners and improve the level of food safety. In recent years, food safety has become one of the most concerned topics of Chinese people's daily life. The state has issued new laws and regulations, and the functions of regulatory agencies have been adjusted many times. So far, the new regulatory model and the corresponding laws and regulations are still in constant adjustment and improvement. In the catering service, the key factors restricting food safety, in addition to ensuring the safety of raw materials, the effective supervision of employees is also an extremely important factor. Data show that 70 percent of the food borne diseases are caused by human factors.

During the period of the eleventh five-year plan, the number of agricultural and side-line food processing industry, food manufacturing industry and beverage manufacturing industry above medium scale increased by 82 percent, 69 percent and 86 percent respectively. The increase in the number of food enterprises and food practitioners not only drives the development of China's food industry, but also brings severe challenges to the production and product safety of the food industry. Article 32 of Chapter IV of the Food Safety Law promulgated in 2009 clearly stipulates that food production and operation enterprises shall strengthen the training of food safety knowledge for employees. In 2010, in order to implement the Food Safety Law and strengthen the leadership of food safety work, the food safety committee of the State Council was established. In 2011, the office of the food safety committee of the State Council issued the outline of food safety publicity and Education (2011–2015), which requires all parties concerned to further strengthen the integrity and law-abiding business sense and quality and safety management level of food producers and operators by popularizing food safety laws and regulations and scientific knowledge.

It also requires relevant departments, industrial organizations and production and business units to strictly implement the system of "training first, then taking up posts". Each person in charge of the production and business operation units and the main employees shall receive centralized training on food safety laws and regulations, scientific knowledge and industrial ethics for no less than 40 hours every year, Food safety supervision personnel shall receive no less than 40 hours of centralized professional training every year. Establish a long-term mechanism for food safety publicity and education, and form a working pattern in which the government, enterprises, industry organizations, experts, consumers and media participate in the work.

At present, there are three types of food safety training in the society according to the classification of training organizers.

1. The training of government and industry organizations mainly includes food safety training for enterprises and supervisors from food and drug administration at all levels, quality and technical supervision and entry-exit inspection and quarantine departments, food industry associations, catering industry associations and other management organizations and organizations. They regularly release some relevant educational information to relevant units or their members, and often set up relevant short-term training courses.
2. The training of professional training institutions, mainly provided by the training departments of colleges and universities, scientific research institutes and commercial training institutions on food safety knowledge.
3. Internal training of enterprises, that is, the training of safety knowledge and operation skills carried out by enterprises for their employees or suppliers.

Secondly, a qualified food inspector should complete the following work in a timely and conscientious manner with good quality and quantity.

- Abide by the rules and regulations of the laboratory, complete the inspection task timely and accurately according to the relevant quality standards and inspection operation procedures, obey the work arrangement of the leaders, and ensure the safety in production.
- Be responsible for the analysis and inspection of raw materials, intermediate products and finished products.
- In the process of inspection, if any quality problems or abnormal phenomena are found, they should be reported in time, and cooperate to find out the causes and handle them properly.
- Prepare all kinds of reagents and test solutions, maintain and calibrate instruments and instruments regularly.
- Timely, accurately and truly fill in the original inspection record and the inspection report issued.
- The quality problems or inspection accidents should be reported in time, and no concealment or fraud is allowed.

Finally, to want to obtain the Food Inspector certificate, the following conditions have to be met:

- possession of food professional or related professional college degree;
- more than two years of laboratory inspection work in food enterprises;
- hardworking, conscientious and responsible, with strong learning, analysis, communication and coordination ability;
- familiarity with the food industry related quality and hygiene requirements; and
- relevant examination passed.

Main training contents were divided into theoretical study and practical operation training (to carry out the actual detection operation according to the national inspection method standard). Theoretical study trainings include topics such as food related laws and regulations (the Food Safety Law of China, food production license management measures, food business license management measures, etc.), food related standards (standards for flavouring products, national standards for general food safety, acceptance standards for raw materials of seasoning products, acceptance standards for food packaging materials, hygienic standards for seasoning products, production specifications for seasoning products, standards for testing methods involved in flavouring products, etc.), and ex-factory inspection items specified in condiment standards (net content, acid value, peroxide value, salt, water, protein, amino acid nitrogen, total ash, acid insoluble ash, total bacterial count, coliform group, etc.)

Practical operation training included the items mentioned below.

- Physical and chemical project detection: introduction of basic technology, detection method, detection principle and operation points of physical and chemical routine items. Reagent preparation, standard solution preparation and calibration, sampling and sample preparation method selection.

- Microbiological item testing: introduction to the basic technology of microbial inspection and detection, the collection and processing technology of food microbiological test samples, the detection methods, detection principles and operation points of routine food microbiological items. Culture medium preparation, sterilization, aseptic operation, medium inoculation, microscope use, Gram staining observation, biochemical reaction experiment, etc.
- Actual testing operation of real samples: according to the standard requirements, the teacher first demonstrated and guided, and the trainees used real samples to carry out the actual detection operation. According to the needs, they were grouped into groups for on-site operation training, and the instructor corrected errors and commented on the analysis.

3.4.3.5 Presence of and access to accredited food testing laboratories with well-defined standard operating procedures

According to the statistical data of 2012 (National Bureau of Statistics of China, 2021), there are 1 088 certified food safety testing laboratories in China with clear operating procedures.

3.4.3.6 Presence of monitoring and verification mechanisms by the government on self-checking system of the producers, processors, food industries and food business operators throughout the food chain

Under the system of segmented supervision, food safety is jointly supervised and responsible by health administration, agricultural administration, quality supervision, industry and commerce administration and food and drug supervision and management departments according to their respective responsibilities. The two main responsibilities addressed were 1) to establish and improve the supervision system of food safety, and 2) to strengthen the social responsibility of enterprises.

First, the technical working group should strictly promote the market access system. In short, it is necessary to strictly require access standards and appropriately raise food access threshold. This access system is not only for individual food, but also for food production enterprises. It requires enterprises to have perfect production conditions and the ability to implement food safety system. The strict promotion of market access system needs long-term adherence, and it can't be abandoned halfway. It will stop at the form. Second, improve the food recall system. At present, there are many loopholes in food recall in China, which makes it difficult for enterprises to regain consumer confidence after food problems. To improve the food recall system, the first thing is to define the conditions under which the food needs to be recalled, the second is to establish a recall organization, which is especially responsible for the food recall work to improve the efficiency, and then to punish the illegal enterprises for their poor management of food production, and finally, to strengthen the relevant technical level.

The premise of strengthening the sense of social responsibility of enterprises is to improve their self-discipline behaviour, require them to strengthen management in all aspects of food production, refuse to use harmful food for processing and production, and strengthen the basic moral construction, so as to control the quality of food from the source and reduce the hidden danger of food safety. Secondly, enterprises cannot blindly pursue economic benefits, but should shoulder their social responsibilities and make due contributions to the society.

3.4.3.7 Batches of reported rejections of food exports due to food safety by importing countries

The national inspection and quarantine data of entry-exit goods are collected by 35 inspection and quarantine bureaus directly under the State Administration of quality supervision, inspection and quarantine.

Table 1. The national inspection and quarantine data of entry-exit goods from 2014 to 2018

	2018	2017	2016	2015	2014
Inspection and quarantine batches of entry-exit goods	8 942 228.00	9 065 132.00	9 064 018.00	9 422 612.00	14 640 231.00
Unqualified batches of entry-exit goods in inspection and quarantine	162 593.00	594 876.00	594 831.00	535 301.00	113 012.00
Inspection and quarantine value of entry-exit goods (Million dollars)	111 656 302.25	84 140 107.00	84 122 847.00	96 321 837.00	91 148 843.24
Value of unqualified goods in inspection and quarantine of entry-exit goods (Million dollars)	10 966 515.39	11 038 637.00	11 038 455.00	12 073 094.00	13 359 359.00

3.5 Food safety indicator twenty-six

3.5.1 Overview

The technical working group of indicator 26 was chaired by Nanjing Agricultural University. Two kinds of data were collected, the reported contamination of *Salmonella* or *Listeria* in raw and cooked meat, as well as the reported outbreaks caused by *Salmonella* and *Listeria* in meat products. China has established the food borne disease surveillance network to collect information on outbreak of food borne diseases. And the food risk surveillance system was there to monitor the risk and hazard associated with food. According to the collected data, contamination by *Salmonella* and *Listeria* was reported both in raw meat and cooked meat, from 2009 to 2018, the overall situation was getting better, especially for raw meat, which might have something to do with the stricter regulation and monitoring. However, the proportion of reported cases on contamination by *Salmonella* in cooked meat was increasing in the same period of time.

Based on the analysis, the technical working group were thinking about the reason of this scenario. According to the Iceberg Theory, except the reported cases which have been collected and counted by the surveillance network, there might be a larger number of unreported cases. Most food borne disease outbreaks were reported by hospital and the Chinese Center for Disease Control and Prevention, in some cases, when the symptom was not server, the consumer would not go to hospital, and their data could not be collected. This was one big limitation of the analysis, which brought challenge to the communication on the result of the analysis. The technical working group also noticed the imbalance between provinces and areas, which might be associated with the difference in dietary patterns, level of economic development, and the control measures. More statistical analysis was necessary since the correlation between the changes of outbreak/contamination numbers and the implementation of different control measures was unclear at this moment. The reported contamination and outbreak of *Salmonella* in cooked meat also reminded that improving the awareness of consumer was important, since the proper handling of food product by consumers was essential.

In order to investigate the pathogenic contamination status of meat products in China, the technical working group was set up, consisting of four PhD students, who are main responsible for method selection, data acquisition, results analysis, and results discussion, respectively. Regular work meetings are held every month, and then work schedules were discussed, and the next work was arranged. Through this work, the technical working group can further understand the contamination levels of *Salmonella* and *Listeria monocytogenes* in meat and related-products. This work is a primary basis for assessing the risks of pathogens and developing control strategies.

3.5.2 Methodology and data collection

The technical working group selected the published contamination data from 2009 to 2018, and took *Salmonella* and *Listeria monocytogenes*, two representative pathogens with the highest contamination rate in meat products, as the research objects. After comparing multiple data sources (including reports of government quality supervision departments, regional reports of research scholars and articles from China National Knowledge Infrastructure), work group finally selected China National Knowledge Infrastructure, which has extensive data coverage and no missing years, as the final database.

In the search mode of China National Knowledge Infrastructure (CKNI, 2021), the published Chinese articles were searched with "meat + *Salmonella* or *Listeria monocytogenes*" as keywords. The investigation articles on pathogenic bacteria contamination of meat products reported by provinces were summarized and analysed. During the investigation, the group took the percentage of pollution rates as the final form of comparison; for data collection of each individual year, the data of major meat-producing provinces, such as Shandong, Henan, Inner Mongolia, Jiangsu and Liaoning, are the main sources, supplemented by the data of other provinces. Samples collected in selected pollution reports are all over 100. The sample types were divided into raw meat and meat products, and the contamination rates of *Salmonella* and *Listeria monocytogenes* in two types of meat from 2009 to 2018 were classified and summarized to obtain the data of individual years.

3.5.3 Results

The result showed that the contamination rates of *Salmonella* and *Listeria monocytogenes* were higher in the meat. The overall contamination rate of *Salmonella* in fresh meat was higher than that of *Listeria monocytogenes*, but the contamination rate of *Listeria monocytogenes* in cooked meat products was higher than that of *Salmonella*. The contamination data over the decade as a whole have levelled off. After 2015, the contamination rate of *Salmonella* in fresh meat showed a trend of decline, and that of *Listeria monocytogenes* in cooked meat products also declined after 2015. It can be obviously seen from the data that these two representative pathogenic bacteria should be regarded as the key monitoring objects of meat microbiological safety, and long-term monitoring technology and control scheme should be developed.

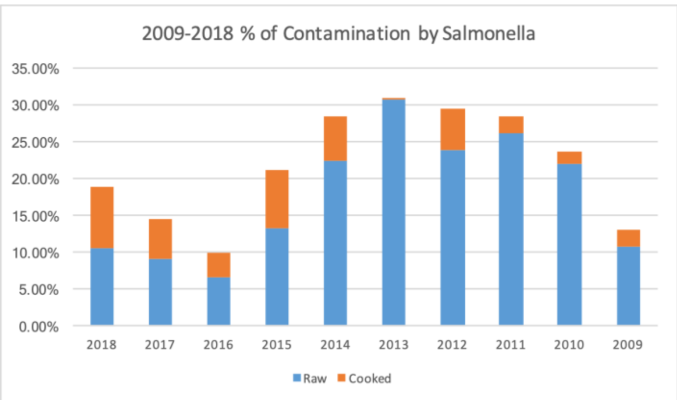

Figure 3. Percentage of *Salmonella* Contamination in Raw and Cooked Meat

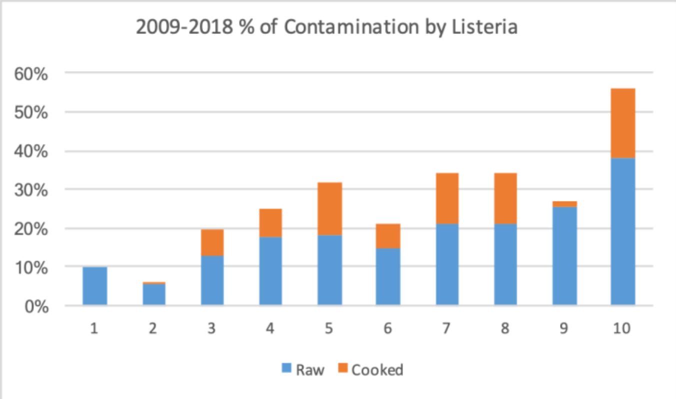

Figure 4. Percentage of *Listeria* Contamination in Raw and Cooked Meat

3.5.4 Preliminary Conclusion

Salmonella and *Listeria monocytogenes* are still the main threat in meat and meat products, especially in summer. The contamination rates of these two kinds of bacteria are significantly correlated with seasonal distribution, with high incidence in warm season and low incidence in cold season.

The contamination of pathogenic bacteria species, is directly related to the type of meat, with great difference between fresh meat and meat products. Therefore, the industry should intensify prevention in slaughterhouses and further processing, government regulators should strengthen law enforcement in the end, further reducing pollution rate; Sales stores and supermarkets should be strong environmental health supervision, prevention of meat products contaminated by pathogenic bacteria.

3.5.5 Limitation of this work

In this work, although the technical working group predicted the occurrence of *Salmonella* and *Listeria monocytogenes*, in meat product, some limitations are still existed, first, the collection time of selected samples is not uniformly distributed in the four seasons; the second is the missing provinces, especially the central and western provinces.

3.6 Food safety indicator thirty-six

3.6.1 Overview

The technical working group for indicator 36 was leaded by Zhejiang University. In their work, the water supply and its composition, utilization of water, quality of water supply, especially potable water was measured. Due to some constrains, only data from 2015 to 2017 was available and adequate for measuring and comparing. In their analysis, China's water supply shrank from 2015 to 2017. And water source was mainly from surface water, followed by groundwater. Agriculture was the main source of water consumption. During these years, though industrial and agricultural water consumption had decreased and domestic water consumption had increased, per capita water consumption had decreased. The quality of surface water in China was slightly optimized, but the quality of Class I water was greatly declined. The groundwater quality was deteriorating, however, due to the implementation of water resource management, water with the poorest quality was decreasing. The quality of centralized water supply in prefecture level cities or above was generally better, and surface water quality was significantly better than groundwater.

And since the water was regulated by Ministry of Natural Resources, in order to get more information and to better understand the data, it is considered to get more support from the Ministry of Natural Resources. Water is the source of life and is inseparable with the food industry, the availability of water source and water quality can reflect the level of national food safety development. In order to improve Chinese food safety standards system and strengthen food safety supervision, the technical working group conducted a systematic analysis of the current situation of China's water resources, and compared the drinking water quality standards of different countries in the world. Through this work, the technical working group can find out the similarities and differences between Chinese food safety standards and international standards, and propose further work recommendations for possible gaps and deficiencies. Therefore, this work is not only conducive to improving the utilization rate of water resources, but also critical for improving the formulation and implementation level of Chinese food safety standards and actively affecting the development of international food standards.

3.6.2 Methodology and data collection

The technical working group go through several steps of data collection, data analysis, results summary, deficiencies found and suggestions proposed. This process is based on science and evidence, and makes a comprehensive summary of the indicator of drinking water safety. The technical working group have compiled various data on Chinese water resources and drinking water standards, including relevant laws and regulations, organizational reports, national standards, policy requirements, relevant documents in the past 20 years.

In this paper, the technical working group combed the current situation of water resources in China, analysed the change of water quality, and evaluated the lack of water resources utilization and rectification measures. In addition, in terms of microbiological indicators, toxic substances indicators, sensory indicators, the technical working group compared the drinking water quality standards of China with those of developed countries such as the United States of America and Japan. Assessment and suggestions are listed to provide strong support for China's food safety.

3.6.3 Results

3.6.3.1 The basic situation of water resources in China

China is a country with severe drought and water shortage, which total freshwater resources are 2 800 billion cubic meters, accounting for six percent of global water resources, ranking fourth in the world after Brazil, the Russian Federation and Canada. However, China's per capita water resources are only 2 300 cubic meters, only a quarter of the world average, and it is one of the countries with the poorest per capita water resources around the globe. However, China is the country with the largest water consumption in the world. In 2002 alone, the national freshwater consumption reached 549.7 billion cubic meters, accounting for about 13 percent of the world's annual consumption, which is about 1.2 times that of the United States of America freshwater supply of 470 billion cubic meters in 1995. In China, water resources distribution is extremely uneven, with more in the south and less in the north, and more in the east and less in west. The same is true with the distribution of *per capita* water resources. In 2013, 11 provinces in China were below the water poverty line of 1 000m^3, including some first-tier cities such as Beijing, Tianjin and Shanghai.

As shown in Table 2, China's water supply shrank from 2015 to 2017. And water source was mainly from surface water, followed by groundwater. Agriculture was the main source of water consumption. During these years, though industrial and agricultural water consumption had decreased and domestic water consumption had increased, *per capita* water consumption had decreased.

Table 2. China's water supply and consumption from 2015 to 2017

Classification	2015	2016	2017
Total water supply (100 million m^3)	6 103.2	6 040.2	6 043.4
Surface water proportion	4 968	4 910.7	4 943.5
Groundwater proportion	1 068.1	1 057	1 015.3
Other than	67.1	72.5	84.6
Total water consumption(100 million m^3)	6 103.2	6 040.2	6 043.4
Domestic water	793.5	821.6	838.1
Industrial water	1 334.8	1 308.0	1 277.0
Agricultural water	3 852.2	3 768	3 766.4
eco-environmental water	122.7	142.6	161.9
Per capita water consumption (m^3)	445	438	436

3.6.3.2 The basic situation of water quality in China

Table 3 shows that the quality of surface water in China was slightly optimized, but the quality of Class I water was greatly declined. As indicated in Table 4, the groundwater quality was deteriorating, however, due to the implementation of water resource management, water with the poorest quality was decreasing. In addition, Table 5 presented that the quality of centralized water supply in prefecture level cities or above was generally better, and surface water quality was significantly better than groundwater.

In general, Chinese government is paying more and more attention to the treatment of sewage discharge. However, the influencing factors of water quality changes include climate change, sewage discharge and other human activities, and the proportion of each factor is still unclear. Therefore, it is necessary to do more in-depth research on the extent to which each factor affects water quality in the future.

Table 3. Changes of surface water quality in China from 2015 to 2017

Year	Class Ⅰ	Class Ⅱ	Class Ⅲ	Class Ⅳ	Class Ⅴ	Class Ⅴ (poor)
2015	2.8%	31.4%	30.3%	21.1%	5.6%	8.8%
2016	2.4%	37.5%	27.9%	16.8%	6.9%	8.6%
2017	67.9%			23.8%		8.3%

Table 4. Changes of groundwater quality in China from 2015 to 2017

Year	Excellent	Better	Good	Poor	Extremely poor
2015	9.1%	25.0%	5.1%	43.2%	18.8%
2016	2.9%	21.2%	0	56.2%	19.8%
2017	0.9%	23.5%	0	60.9%	14.6%

Table 5. Water quality of centralized drinking water in prefectural level cities or above in China

Year	Surface water compliance rate	Groundwater compliance rate
2015	92.6%	86.6%
2016	93.6%	85.0%
2017	93.7%	85.1%

3.6.3.3 Comparison of drinking water quality standards between China and other countries

At present, there are three instructive drinking water quality standards in the world: The National Drinking Water Quality Standard of the United States Environmental Protection Agency (USEPA), the Drinking Water Quality Directive of the European Union and the Drinking Water Quality Guidelines of the World Health Organization (WHO). Drinking water quality standards of other countries or organizations are basically established on the basis of these three standards.

The drinking water quality standard currently adopted in China is the "Sanitary Standard for Drinking Water" (GB5749-2006, Ministry of Health of China, 2006), which is revised on the basis of the version developed in 1985. The new standards have increased from the original 35 items to 106 items, among them, four more microbiological indicators, three more drinking water disinfectants, 11 more inorganic compounds in toxicological indicators, 48 more organic compounds in toxicological indicators, and five more sensory traits and general physical and chemical indicators are added.

At present, China’s drinking water indicators are still immature and the technical working group still have a lot of room for development. Drinking water is closely related to food safety. According to the estimates of experts from the Environmental and Development Research Center of the Chinese Academy of Social Sciences, the total output of contaminated grain due to sewage irrigation reached 18.82 million tonnes. Pathogens can migrate into human bodies through the food chain of grain, vegetables and aquatic products, and cause various acute or chronic poisoning.

However, the United States of America started early on drinking water environmental management based on laws, regulations, and standards, and is relatively mature in the establishment of water environmental management institutions and policy formulation. So it is necessary to compare China’s drinking water quality standards with those of developed countries such as the United States of America and Japan, and point out the development status, advantages and areas that need to be improved in China and it will be an important reference for further improving China’s drinking water quality standards.

Therefore, the technical working group compared some toxicological indicators, sensory and general chemical indicators, and microbiological indicators. It can be seen from Table 6 that the limit value of the United States of America is slightly lower than that of the other two countries, and the limit value of China is slightly higher, which has a certain relationship with the country's economic development level. The lower limit of organic toxicological index values in the United States of America is worth learning.

For sensory traits and general chemical indicators, most of the indicators in various countries are similar. The pH value of drinking water in various countries is around neutral, and it is more alkaline. Most indicators reflect the content of pollutants in water, and turbidity is not only related to the content of suspended solids, but also to the particle size and shape of impurities in water. Therefore, turbidity is more important for water quality detection.
The microbiological standards in the United States of America are tested on a monthly basis, and Japan and China have stricter requirements: total coliforms cannot be detected. Not only that, in the

"Sanitary Standards for Drinking Water" (GB5749-2006) (Ministry of Health of China, 2006), China's heat-resistant coliforms and *Escherichia* large intestine are also not detectable, which are stricter than the standards of other countries, showing that China attaches importance to the impact of microorganisms.

Table 6. Comparison of drinking water quality standards in the United States of America, Japan and China

Classification		Name	United States of America Water Quality Standard	Japan Water Quality Standard	China Water Quality Standard
Toxicological indicators	Organic matter	1,2-Dichloroethane	<0.005mg/L	<0.002mg/L	<0.03mg/L
		Trichloroethylene	<0.005mg/L	<0.03mg/L	<0.07mg/L
		Tetrachloroethylene	<0.005mg/L	<0.01mg/L	<0.04mg/L
		Carbon tetrachloride	<0.005mg/L	<0.02mg/L	<0.002mg/L
		Phenol	<0.001mg/L	<0.005mg/L	<0.009mg/L
	Inorganic matter	Cyanide	<0.02mg/L	<0.001mg/L	<0.05mg/L
	Metal	Antimony	<0.006mg/L	<0.002mg/L	<0.005mg/L
		Beryllium	<0.001mg/L	<0.003mg/L	<0.002mg/L
		Lead	<0.015mg/L	<0.05mg/L	<0.01mg/L
	Non-metal	Arsenic	<0.05mg/L	<0.01mg/L	<0.01mg/L
		Selenium	<0.05mg/L	<0.01mg/L	<0.01mg/L
Sensory traits and general chemical indicators		pH	6.5～8.5	5.8～8.6	6.5～8.5
		Chroma	<15	<15	<15
		Turbidity	<0.5-1NTU	<2NTU	<1NTU
Microbiological indicators		Total Coliform	No more than 5% of samples per month should be positive	Not detectable	Not detectable

3.6.4 Suggestions for future work

3.6.4.1 Several recommendations for utilization and protection of water resource in China

The following recommendations were identified for the utilization and protection of water resource in China.

- Clarify the status of water environmental protection: it is necessary to attach great importance to water resources utilization and water environmental protection, and clarify its work status. First, it is necessary to use water resources economically, and second, treat sewage effectively and further purify water resources.
- Formulate a unified policy: for relevant departments, it is necessary to coordinate the interests of various departments, clarify the responsibilities and powers between various departments, provide a certain basis for follow-up accountability issues, and avoid the phenomenon of mutual excuse of power and responsibility.
- Strengthen the improvement of the evaluation system: to implement the goals of water resource utilization and water environmental protection, a sound evaluation system is essential. Relevant agencies should scientifically detect the water environment, continuously improve the efficiency of rational use of water resources, and vigorously protect water resources. At the same time, it is necessary to strengthen the formulation of scientific evaluation standards to reflect the characteristics of diversity and objectivity.

- Focus on protecting regional water resources: The government must strictly supervise and manage the discharge of industrial waste water, and impose strict requirements on the treatment of waste water. If it does not comply with the corresponding standards, it should prohibit the discharge. Enterprises should maintain close coordination with the relevant government work, actively promote the concept of energy conservation and emission reduction, and strengthen the application of sewage treatment technology.

3.6.4.2 Several recommendations for China's drinking water quality standards

The following recommendations were identified for the quality standards of China’s drinking water.

- Pay attention to the scientific nature of water quality indicators. When formulating drinking water quality standards, on the one hand, the technical working group must make the water quality better and lower the threshold, on the other hand, the technical working group must consider the positive effects of the elements in water on human bodies.
- Develop indicators based on local conditions. As the water source conditions in various regions of China are different, the indicators must be fine-tuned for different regions.
- Appropriately increase capital investment in water resources management. The environmental protection technology budget in the "Twelfth Five-Year Plan" amounts to 22 billion CNY. As an important part of environmental protection, water pollution control is bound to increase capital investment in water resources management. Of course, while formulating reasonable indicators, the technical working group must also comprehensively consider economic benefits, and strive to achieve the most reasonable drinking water indicators with the least capital investment.
- Take certain legal measures. The technical working group can learn from the law of drinking water safety promulgated by the United States of America. After making detailed and reasonable regulations, the technical working group can formulate supporting laws to ensure implementation. Only by ensuring the real implementation of drinking water quality indicators can the technical working group ensure the safety and health of people's lives and better promote economic and social progress and development.

3.6.5 Preliminary Conclusion

With the development of economy, Chinese government attaches great importance to the safety of drinking water and constantly amends laws and regulations to improve water quality. Remarkable results were achieved in water management. But water shortage is becoming more and more serious in China and the utilization efficiency is not high, food safety incidents due to water pollution still occur from time to time. Therefore, the ability of independent risk management needs to be strengthened, and the establishment of a scientific food safety comprehensive evaluation index system is conducive to the understanding of the development trend of national food safety.

3.6.6 Limitation of this work

In this work, the technical working group conducted a systematic comparative analysis of drinking water quality standards between China and some developed countries, but the food safety indicator systems of many developing countries are also worthy for our study. These developing countries should also be included in our study (The above data comes from the network, the FAO, the 2015–2017 National Water Development Statistics Communique and the 2015–2017 China Environmental Communique (National Bureau of Statistics of China, 2021)).

4 Interaction with the China Food Safety Index

When the China food safety indicator pilot project was conducted by the Chinese Institute of Food Science and Technology, there was a similar program, China Food Safety Index, which was undertaken by the China Agricultural University, leaded by Professor Yunbo LUO. The Index aimed at providing a comprehensive tool for risk communication to the public. The Index has three layers, the guidelines layer, level 1 indicators and secondary indicators. Analytic Hierarchy Process (AHP) has been used in finding right indicators and criteria layers. Food safety supervision and control activities, food safety manufacturing, processing and handling, food safety at the end consumers, and the satisfaction level of the society would be evaluated.

In the April workshop, and the training program in October, the two project teams exchanged their ideas and working progress. It has been recognized that these two projects shared a lot in common. And at the same time, they were facing similar confusion and problems. With regard to the unreported cases which might affect the evaluation result, it was recommended by the Index team that pilot study be carried out in a province or even a city to estimate the unreported ratio. And it was also suggested that secondary indicator or sub-indicator could be developed under some food safety indicators so that the technical working groups might collect more quantitative data for better evaluation result.

The two project teams agreed to collaborate by sharing data collected and communicating their working progress on a regular base.

5 Conclusions and recommendations

According to the results of the pilot six indicators, China has been improving its food safety control system from 2009 to 2019. And food in China did become safer. With more effort and input to the food safety control system, the organizational structure, working mechanism in regulation development, risk assessment, risk communication, as well as activities including control of food-borne disease, and improving potable water quality were better organized and designed.

All the five horizontal working groups did good jobs despite the difficulties and limitations. Which proved their capability in continuously carrying on the follow-up work in the project. Based on the discussion in the preparation phase, since all the 40 indicators were relevant and useful in examine China food safety control system. It is a general willingness to go on and finish the work of the remaining indicators step-by-step in the future years. Hearing the work of China Agricultural University on the Food Safety Index, the pilot project team also strongly felt that the result of this pilot project could be used in developing China Food Safety Index, which would be a more intuitive and understandable communication tool for the public. It was agreed that more collaboration between this two work should be explored.

Inspired by the Food Safety Index, to refine the project, developing sub-indicators or tertiary indicators, especially for the indicators without direct quantitative data was found necessary. In some cases, only a “yes” or “no” answer was inadequate. In addition, the reporting basis should be decided at the beginning of work on each indicator, in order to provide clear guidance to the working group. Consumer is also essential in the food safety control system. Therefore, it is considered whether to invite the consumer into the future work, there should be more discussion on the ways to involve consumers in this work.

During the discussion, China recommended to establish surveillance network for food contamination and food borne outbreaks. The data collected by the surveillance network could be the basis of further analysis. And it is also suggested to invite the experts from academia to the project, since they could provide neutral opinion from an external perspective. And because of this, CFSA has chosen the Chinese Institute of Food Science and Technology to be the partner in carrying out the pilot project, since it had abundant resource and could reach out to both food industry and academia.
After the final report of the pilot project in 2019, another round of discussion will begin to choose another five to six indicators to work on in 2020. The procedure of pilot project in 2019 will be followed, more experts from ministries, agencies, organizations, institutes, especially from food industry will be invited to join the project.

6 References

CFSA. 2021. China National Center for Food Safety Risk Assessment. In: *CFSA* [online]. [Cited 10 September 2021]. https://en.cfsa.net.cn/

CKNI. 2021. China National Knowledge Infrastructure. In: *CKNI* [online]. [Cited 10 September 2021]. https://oversea.cnki.net/index/

FAO. 2018. Meeting proceedings: Regional consultation on food safety indicators for Asia and the Pacific [online]. [Cited 10 September 2021]. http://www.fao.org/3/I9459EN/i9459en.pdf

FAO & WHO. 2013. Principles and Guidelines for National Food Control Systems (CXG 82-2013) [online]. [Cited 10 September 2021]. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXG%2B82-2013%252FCXG_082e.pdf

FAO & WHO. 2017. Principles and Guidelines for Monitoring the Performance of National Food Control Systems (CXG 91-2017). [online]. [Cited 10 September 2021]. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXG%2B91-2017%252FCXG_091e.pdf

Ministry of Health of China. 2006. Sanitary Standard for Drinking Water (GB5749-2006) [online]. [Cited 10 September 2021]. https://www.aqsiq.net/pdf/China_GB_5749-2006_Standards_for_Drinking_Water_Quality.pdf

National Bureau of Statistics of China. 2021. Press release: Statistical Communiqué of the People's Republic of China on the 2020 National Economic and Social Development. In: *National Bureau of Statistics of China* [online]. [Cited 10 September 2021]. http://www.stats.gov.cn/english/PressRelease/202102/t20210228_1814177.htmln

NPC. 2009. Food Safety Law of the People's Republic of China. In: *NPC* [online]. [Cited 10 September 2021]. http://www.npc.gov.cn/zgrdw/englishnpc/Law/2011-02/15/content_1620635.htm

UNDESA. 2020. World Population prospects 2019. In: *United Nations Department of Economic and Social Affairs* [online]. [Cited 10 September 2021]. https://population.un.org/wpp/

WHO. 2005. IHR (2005) Monitoring and Evaluation Framework. [online]. [Cited 10 September 2021]. https://apps.who.int/iris/bitstream/handle/10665/204368/9789241510172_eng.pdf;jsessionid=37237D24C97612CFB4F7FE518C7667A0?sequence=1

World Bank. 2021. GDP per capita – China. In: *The world Bank* [online]. [Cited 10 September 2021]. https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=CN

Annex 1. Chinese version of the regional food safety indicator areas

No	English version	Chinese version
	Food safety competent authority (-ies) and partners	**食品安全主管当局及其合作伙伴**
1	Presence of a leading food safety agency (entity) to drive the coordination work to ensure food safety.	存在领先的食品安全机构(实体)，以推动协调工作，确保食品安全。
2	Food safety relevant agencies have clearly defined roles and responsibilities for food control management.	食品安全相关部门对食品监管的角色和职责有明确的规定。
3	Competent authority is supported by necessary infrastructure and adequate resources (e.g. human and financial resources and lab equipment and materials).	主管部门有必要的基础设施和充足的资源(例如人力和财力资源以及实验室设备和材料)支持。
	Policy and legal and regulatory framework	**政策、法律及规章制度**
4	Presence of enabling national policy and legal and regulatory framework are consistent with international standards, guidelines and best practices (including legally embedded criteria for executing food recall and traceability) and they show government commitment to protect public health and ensure fair practices in food trade.	具有与国际标准、准则和最佳实践(包括执行食品召回和可追溯性的法律嵌入标准)相一致的国家政策和法律及规章制度，表明政府致力于保护公众健康并确保食品贸易中的公平做法
	Principles of the national food control systems	**国家食品监管系统的原则**
5	National food control system covers the entire food chain (farm to plate) in an integrated system	国家食品监管系统是一个涵盖整个食物链(从农场到餐桌)的完整系统
6	National food control system is implemented in a transparent manner with mechanisms for information, education, communication and coordination with relevant stakeholders	以透明的方式实施国家食品监管体系，并建立与利益相关者的信息、教育、沟通和协调机制
7	Use of risk analysis paradigm by the competent authority to inform and support risk-based, science-based and evidence-based decision-making and establish food safety control measures with a mechanism for expert consultation to advice government on food safety risk assessment	主管部门利用风险分析的模式，为基于风险、科学和证据的决策提供信息和支持，建立食品安全控制措施，并建立专家咨询机制，就食品安全风险评估向政府提供建议
	Codex and functions with other international bodies and platforms	**Codex 及其他国际机构和平台的职能**
8	Existence of National Codex Committee with allocated budget	存在有财政支持的国家食品法典委员会
9	Level of engagement in the work of Codex	参与法典工作的程度
10	Ability to meet and demonstrate compliance with international food safety and quality requirements and obligations (e.g. Codex standards, WTO SPS Agreement and requirements of trade partners)	符合并可证明符合国际食品安全和质量要求及义务的能力(如 Codex 标准、世界贸易组织 SPS 协议和贸易伙伴的要求)

11	Credible functioning of national contact points for Codex, World Organisation for Animal Health, International Plan Protection Convention and other relevant international organizations and platforms (e.g. International Food Safety Authorities Network (INFOSAN)) with required resources	为 Codex、世界动物卫生组织、国际计划保护公约以及其他相关国际组织和平台(如国际食品安全当局网络)提供所需资源，使国家联络点可靠运作
	Food inspection	**食品检查**
12	Criteria for risk categorization and prioritization established for food inspection	拥有为食品检查确定风险分类并建立优先次序的标准
13	Presence of functioning risk-based food inspection mechanism with well-defined standard operating procedures	建立以风险为基础的食品检查机制，并制定明确的标准操作程
14	Number of food inspectors (per population) trained on official food control	接受食品监管官方培训的食品检查员(按人口计算)的人数
15	Number of inspections being conducted for infrastructure, installations and hygiene throughout farm to plate food chain (primary production, processing, distribution, hotels and restaurants and community kitchens)	正在进行的对贯串整个食物链(初级生产、加工、分销、酒店及食肆及社区厨房)的基础设施、设备及卫生情况的检查数量
	Food safety certification	**食品安全认证**
16	Presence of functioning food safety certification systems with well-defined standard operating procedures	具有明确标准操作程序的有效食品安全认证体系
	Testing and analysis	**测试和分析**
17	Presence of and access to capable diagnostic and analytical laboratories with well-defined standard operating procedures	具有可承担工作的诊断及分析实验室，并有明确的标准操作程序
18	Presence of and access to accredited food testing laboratories with well-defined standard operating procedures	设有经认可的食品检测实验室，并有明确的标准操作程序
	Notifications	**通知**
19	Presence of notification mechanism on food safety incidents and outbreaks	设立食品安全事故及爆发的通报机制
20	Presence of notification mechanism on food recalls	设立食品回收通告机制
	Support to self-checking systems	**支持自检系统**
21	Presence of monitoring and verification mechanisms by the government on self-checking system of the producers, processors, food industries and food business operators throughout the food chain	政府对整个食物链的生产者、加工商、食品企业和食品经营者的自查制度是否存在监督和核查机制
22	A recognition system for the producers, processors, food industries and food business operators implementing good food safety practices	设有对推行良好食品安全措施的生产商、加工商、食品企业及食品经营者的认可制度

23	Presence of effective guidelines for developing good standard operating procedures and instructions concerning good agricultural practices (GAP), good manufacturing practices (GMP), good hygiene practices (GHP) and Hazard Analysis and Critical Control Point (HACCP)	存在有效的指南，以制定良好的标准操作程序，包括良好的农业规范(GAP)、良好的操作规范(GMP)、良好的卫生习惯(GHP)及危害分析及关键控制点(HACCP)
	Food monitoring, health surveillance and epidemiology	**食品监管、健康及流行病学监测**
24	Mechanisms are established and functioning for detecting to foodborne disease and food contaminations	建立了检测食源性疾病和食品污染的机制并发挥作用
25	Existence of One-Health disease surveillance systems (animal plant, human and environmental health)	存在“One-Health 惟一健康”疾病监测系统(动植物、人类和环境卫生)
26	Number of outbreaks of foodborne illness reported a. Salmonellosis in humans b. Listeriosis in humans	食源性疾病暴发的报告数量 a 人类沙门氏菌病 b.人类李斯特菌病
27	Percentage of reported occurrences in which presence/contamination of hazards are identified (biological, chemical, physical) in all types of food and feed from farm to plate [or, Percentage of commodities (food or animal feed) that comply with regulations (e.g. maximum residue levels), pertaining to pesticides, pesticide residues, veterinary drug residues, food additives, mycotoxins, heavy metals, radiological substances and key chemical, microbiological and physical (non-food) contaminants] c. *Salmonella* spp. in food (specify a commodity for an indicator) d. *E. coli* in food (specify a commodity for an indicator) e. *Listeria monocytogenes* in food (specify a commodity for an indicator)	报告的案例中的百分比，如存在/污染危害识别(生物、化学、物理)在从农场到餐桌的所有类型的食品和饲料中的百分比(或者,大宗商品(食品或动物饲料)的比例符合规定(如 maximum residue 水平)，属于农药、农药残留、兽药残留、食品添加剂、霉菌毒素、重金属、放射性物质和主要化学、微生物和物理(非食品)污染物) c.食品中的沙门氏菌(指定某一产品为指标) d.食品中的大肠杆菌(指定某一产品为指标) e.食品中单核增生李斯特菌(指定某一产品为指标)
	Data collection, collation and interpretation	**数据收集、整理和解释**
28	Institution(s) exists that is responsible for the collection, collation and interpretation of data on food safety issues (including microbiological, chemical, natural and environmental) at the national level	存在机构负责收集、整理和解释国家一级关于食品安全问题(包括微生物、化学、自然和环境)的数据
	Food safety emergency preparedness	**食物安全应急准备**
29	National food safety emergency response capacity supported by a national plan/guidelines/rapid alert system, which state responsibilities, relevant parties and necessary systems and actions including traceability and food recalls Information, education, communication and trainings	国家食品安全应急响应能力由国家计划/指南/快速预警系统支持，该系统规定责任、相关方和必要的系统和行动，包括可追溯性和食品召回信息、教育、沟通和培训

30	Risk-based education and trainings to food business operators related to hygiene and food safety are mandated and provided	对食品企业经营者进行与卫生和食品安全相关的风险教育和培训
31	All stakeholders farm to plate, including consumers, are reached in food safety information activities and are aware of the potential problems and risks related to hygiene and food safety shared responsibility - industry, producers, processors, food business operators	包括消费者在内的所有从农场到餐桌的利益相关者都参与食品安全信息活动，并意识到与卫生和食品安全相关的潜在问题和风险以及行业、生产商、加工者、食品经营者应共担食品安全的责任
32	Percentage of producers, traders and food business operators implementing documented self-checking food safety management system, such as good standard operating procedures on GAP, GMP, GHP, HACCP or any others in accordance with the local context	生产商、贸易商及食品经营者推行有据可查的食品安全自查制度，例如标准操作规程（GAP、GMP、GHP、HACCP 或其他操作程序）所占的百分比
33	Percentage of food establishments from farm to plate displaying information, education and communication materials or signs on hygiene and food safety within their premises	从农场到餐桌的食品企业在其场所内展示有关卫生和食品安全的信息、教育和宣传材料或提示语等所占的百分比
34	Percentage of producers, processors, traders and food business operators that have implemented a functioning traceability system	已实施有效追溯制度的生产商、加工商、贸易商及食品经营者的百分比
35	Percentage of food establishments complying to labelling requirements including allergen risk indications	符合标签规定(包括过敏原标示)的食品企业的百分比
	Access to potable water	**饮用水获取**
36	Percentage of the population with access to potable water	可获得饮用水的人口百分比
	Public trust in food safety	**公众对食品安全的信任程度**
37	Presence of mechanism to understand public perception on the national food control system	存在了解公众对国家食品监管体系看法的机制
38	Levels of public trust in food safety	公众对食品安全的信任程度
	Food and feed trade	**食品与饲料贸易**
39	Percentage of reported rejections of food exports due to food safety by importing countries	报告中因进口国食品安全问题而拒绝出口食品所占的百分比
40	Mutual recognition of equivalence systems (e.g. mutual recognition agreements, memorandum of understandings for market access) based on international guidelines	基于国际准则的对等制度的相互承认(例如相互承认协议、市场准入谅解备忘录)

FAO Regional Office for Asia and the Pacific
FAO-RAP@fao.org
fao.org/asiapacific

Food and Agriculture Organization of the United Nations
Bangkok, Thailand

CB6634EN/1/09.21