

# A blueprint for food safety in China

Food safety  
in China

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## Abstract

**Purpose** – The purpose of this paper is to offer a blueprint, or outline considerations for the continuing evolution of the Chinese food safety system.

**Design/methodology/approach** – The paper begins with the review of the current food safety system in China and the demonstration of the successes in national food safety programmes. It goes on to identify the specific problems through food safety in China, and further to analyse the potential for implementing the key learnings from other national food safety programmes in the Chinese context.

**Findings** – The paper suggests a five-point Blueprint for food safety in China and other countries, allowing for the development of a robust food safety system, by combining the elements with best practice from system created by food safety practitioners internationally.

**Research limitations/implications** – It should be noted that even since the authors began developing this model China has already adopted a number of the recommendations covered by this Blueprint and is actively considering others.

**Originality/value** – This paper fulfills an identified information/resources need and offers a blueprint, or outline of considerations for the continuing evolution of the Chinese food safety system.

**Keywords** China, Health, Agribusiness, Agricultural policy, Food policy

**Paper type** General review

## Introduction

As societies evolve from food shortages to food sufficiency so expectations of food suppliers evolve to food affordability, safety and eventually sustainability. In the case of the leading food producers in the USA, European Union and more recently in China, these expectations have resulted in the development of highly regulated risk-based systems designed to support production of safe and affordable food. Despite these efforts serious food safety incidents continue to occur as unfortunate reminders of the need for continued diligence in the effort to provide safer food. In 2008 melamine incident that caused hundreds of illnesses and a number of fatalities, exposed serious weaknesses in the nation's food safety system and pushed food safety reform to the top of the Chinese leadership's policy agenda. Since then, significant progress has been



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made, through the introduction of the Food Safety Law in 2009, introduction of risk-based food safety standards and creation of the National Center for Food Safety Risk Assessment in 2011, and consolidation of downstream food safety supervision and enforcement functions in 2013. A number of food safety challenges remain, including consistent enforcement of safety standards by local-level authorities and supervising China's tens of thousands of small-scale manufacturers.

Food safety is not a uniquely Chinese issue, it is a global challenge. Supra-national organizations, such as the World Health Organization (WHO), the FAO and the Codex Alimentarius, as well as regional bodies such as the EU, have developed food safety standards and guidance for policymakers. In the USA alone the CDC used an estimate of 76 million food-borne illnesses and 5,000 fatalities. A major challenge is developing a robust food safety system in the context of limited resources and rising threats. The key is to create a system based on risk – through science-based risk analysis, risk monitoring, risk management and risk communication, an area where China has made significant headway since melamine. In September 2014, China's State Council announced that since risk-based surveillance and standard setting system was initiated in 2010, Chinese authorities have collected 5.4 million food safety test results covering almost 600 types of food under 30 categories to help assess food safety risk and develop standards. As the Chinese government continues to build a risk-based food safety system, what else can be done to assist this effort and help overcome persistent challenges? This paper looks at both public and private-sector initiatives globally, highlighting relevant success factors and identifying elements that may be applicable to the continuing development of a strong food safety system in China.

The paper begins with the review of the current food safety system in China and the demonstration of the successes in national food safety programmes. It goes on to identify the specific problems through food sully China, and further to analyse the potential for implementing the key learnings from other national food safety programmes in the Chinese context. Finally a Blueprint, or outline of considerations for the continuing evolution of the Chinese food safety system, is offered.

### **Literature review of the current food safety system in China**

#### *The importance of food in Chinese culture*

Food is a focal point of Chinese culture, and is an important element of daily life. Many Chinese construct their day around meals and the foods they consume. Dining together is considered essential for building and sustaining relationships, exemplifying harmony and order. This rich, food-oriented culture goes back many centuries. Under Confucius (551-479 BCE) and lasting until modern times, Chinese society was divided into four ranks – the elite (warrior elite and later scholar-officials), farmers, artisans and merchants. The relatively high status of farmers signifies the importance of agriculture and food production.

Life in modern China remains inseparable from food. The Chinese proverb “food is the first necessity of the people” reflects this importance. From a small gathering of friends to major events such as birthday parties, weddings or funerals, food plays a primary role. In Chinese culture, food extends beyond the physiological demand for sustenance: it contains complex cultural significance and serves as a key cultural symbol.

Although food has always played a very important role in Chinese culture and society, providing a reliable supply of safe, affordable food has been a continuing

challenge. For many years the primary concern in the middle kingdom was food security: ensuring that there was enough food. Over the past decade, with the steady growth in grain output, rapid economic development and the industrialization of food production, the focus has changed from quantity oriented (food security) to quality oriented (food safety). This shift in emphasis was formally articulated in the 2002 Central Rural Work Reference, which specified that the task of agriculture and food industry development should be upgraded from food security to food quality safety (Zhou and Jin, 2013). While the negative impacts of China's food safety problems are difficult to quantify, a 2011 study (Mao *et al.*, 2011) estimated that more than 94 million Chinese experience bacterial food-borne illness, leading to about 8,500 deaths annually (by way of comparison, the Centres for Disease Control estimate that in the USA, there are 76 million cases of food-borne illness, (including bacterial, viral and microbial sources of infection) with 5,000 deaths annually (Centers for Disease Control and Prevention, 2014)). In 2013, McKinsey research found Chinese residents are more concerned about food safety than healthcare, unemployment and crime (Towson and Jonathan, 2014).

#### *Current food safety system in China*

Rapid economic growth, significant increases in agricultural productivity, greater industrialization of food processing and changing patterns of consumption over the last 35 years have transformed the production, distribution and consumption of food in China. With food scarcity no longer a pressing issue in China, and given that people now have access to a wider range of food products, food safety has become the paramount concern. Where historically food in China was mostly produced and consumed in the same locality with little pre-market processing, modern China's intensification of agricultural production, rapid expansion of certain product sectors, longer supply chains and rising consumption of more processed food have exposed weaknesses in the food safety mechanisms and created new demands on China's food safety authorities. Intense market pressures and inadequate enforcement make food safety a challenging governance issue.

Over the last several years, the Chinese government has rolled out a series of policy initiatives to address food safety problems, both as a new policy domain and under the mandate of existing policy streams including agriculture, environmental protection and health. Some of these policies involve new standards relating to production environments and processes, as well as permissible levels of potentially harmful substances in food. Others involve the introduction of mechanisms for improving traceability and accountability through vertical linkage along the food supply chain or the scaling up of production and processing operations. Recent reforms have consolidated responsibility for food safety under a new China Food and Drug Administration (CFDA).

China's food safety regulations developed piecemeal, under the aegis of eight different government organizations, resulting in overlapping competencies, duplication of responsibilities and fragmented authority between the various bodies. In 2013 nearly all downstream food safety functions were consolidated, in an effort to streamline and improve communications. The consolidation intentionally separated food safety standard setting (now under the National Health and Family Planning Commission) from enforcement (China Food and Drug Administration; General Administration of Quality Supervision, Inspection, and Quarantine; Ministry of Agriculture; Public Security Bureau). The current structure is outlined in Figure 1.

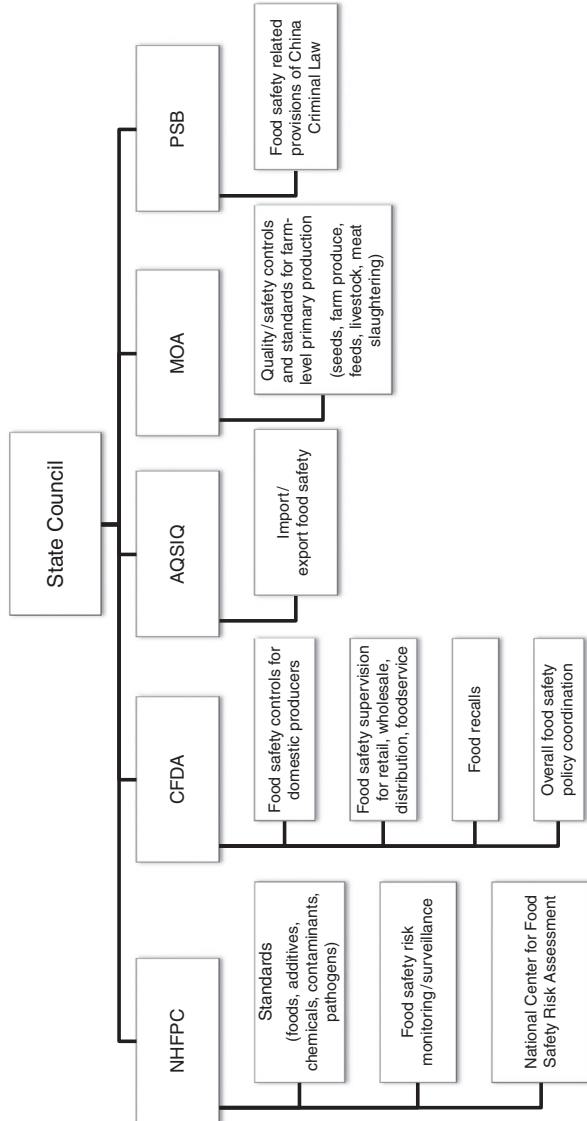


Figure 1.  
Food safety  
structure in China

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*Literature review*

However China has made significant progress in its food safety regulatory regime, there continue to be problems with food safety which cause the public concern. Certain challenges to governance of food safety stand out in much analysis. Some remained problems and challenges have been identified in the current China's food safety system.

*Industry structure.* China's regulatory approaches are complicated by the sheer size of the food sector: more than 450,000 food production and processing companies are active in China, 350,000 of which are small enterprises with fewer than ten employees. China's highly fragmented food supply chain composed of millions of small farmers, traders and retailers, many of which operate unsupervised, poses a great challenge to the implementation of a comprehensive and effective domestic food safety system (Ortega *et al.*, 2010). Many analysts see the fundamental problem is the nature of China's agricultural structures – “fragmented (san), small-scale (xiao) and weak (ruo)” (FORHEAD Working Group on Food Safety, 2014).

Implementing a twenty-first century food safety system in China poses a challenge. It is difficult to standardize and monitor production practices in a sector composed of 200 million farm households who typically have one to two acres of land divided into four to six non-contiguous plots. Farmers have only usage rights to their land, so they lack ownership incentives to make costly investments (Calvin *et al.*, 2006).

Strategies of vertical integration and horizontal coordination of food production and supply chains that are being introduced as part of efforts to modernize China's agricultural structures has not yet found very positive impacts in terms of food safety (Gale and Hu, 2012).

*Central-local relations and limited governance toolbox.* Many authors present food safety problem as a simple question of policy implementation, arguing that subnational governments lack capacity and implement national policy poorly. But the problem of weak implementation, which also affects many other policy areas, steams to a great extent from the interaction between central control over the policy agenda with the very uneven distribution of resources between the central and local state in China (FORHEAD Working Group on Food Safety, 2014).

China has a comparatively limited governance toolbox for dealing with food safety compared to more developed economic; research points to the lack of a strong legal system, insurance companies, industry associations and “consumer watchdogs” to support and supplement government efforts to ensure the safe production and processing of food (Thompson and Hu, 2007). To involve the stakeholder, each point of the food supply chain, can help to create the pull effect for governance toolbox.

*Policy directions.* The food safety standards system is imperfect. Compared with the international Codex standards, the limits established by Chinese standards frequently provide higher maximum mounts for contaminants. Although the overall risk is based on the amount consumed, these higher levels will cause difficulties with international trade. Moreover, within the food safety standards, some regulations are not consistent or even contradictory.

The Food Safety Law and subsequent policy is of very broad scope. Several major areas of work in the law include: development of surveillance systems and assessment of food safety risks; large-scale consolidation of food safety stands; change to regulation of production and trade of foodstuffs, including encouragement for scale production and development of recall systems; food testing. The Law, as well as the

more recent government reshuffle, increase the coordination of food safety management in order to overcome regulatory fragmentation.

No detailed or comprehensive analysis has been conducted of the multiple policies and initiatives being implemented across government agencies and multiple emerging subnational initiatives. Documenting and evaluating these will be an important priority for research. Nonetheless, the scope and ambition of current reform efforts is clear (FORHEAD Working Group on Food Safety, 2014).

The integrated system, a systemic and structured national food safety policy and plan is an essential part of an effective food safety system.

*China's food safety problems in global perspective.* Long plagued by food safety scandals at home, China now faces greater international pressure to effectively and transparently address concerns over the quality of food exports. Foreign safety standards pose an important challenge to China's exports of horticultural, meat, poultry and aquatic products.

The potential impacts of food safety hazards in China are amplified by the globalization of food trade. Given China's status as the world's second largest single-country food exporter, a food safety incident in China not only impacts consumers and businesses at the product's origin, but can affect a large number of consumers in export markets worldwide. The international dimension to the food chain has raised the profile of food safety in China, attracting the attention of regulators around the world.

*Access to information.* Although it is a rapidly growing field, food safety is a new topic of research in China and there is a lack of reliable data to enable an assessment of the scale and distribution of many problems. The field is very fragmented and characterized by a combination of aggregated data and small case studies, neither of which provides an accurate picture of the actual risks to which particular population or localities are exposed. Research from different disciplines and systems uses different samples and methods, and cannot easily be matched or analysed in an integrated way.

The media plays an important role as a source of information about food safety for both the public and the government. New media, in particular microblogs (weibo and wechat), have also become a space for citizens to air their opinions and grievances about food safety problems, serving to some extent as a barometer of public opinion.

With a lack of reliable information from government, in its place there is lots of false information which fills the internet and media. For the long term, education and training is the ultimate solution for gathering reliable information and data. In the absence of comprehensive, public accessible data, the media report on food safety issues that are brought to their attention, sometimes by researchers, but more often by advocacy NGOs or the direct victims of food safety problems. To the extent that the media is also source information for government, this may also affect policy and enforcement.

### **Case studies of success in national food safety programmes**

Food safety is an important public health problem for the entire world, particularly during periods of intense industrialization and urbanization. In response, public and private-sector bodies have developed a range of approaches to developing food safety polices and improving food safety systems. This paper does not provide a comprehensive literature review, but rather has noted a selection of initiatives that address recognized key components of a food safety system (an integrated system, science-based regulations, stakeholder involvement, education and training and monitoring and enforcement) and that have elements that could be helpful in the Chinese context.

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*Supra-national organizations*

Both the World Health Organization (1948) and the Food and Agriculture Organization of the UN (FAO) (1945) are charged with improving people's lives, in overlapping areas. WHO is focused on public health in all forms, including food security and food safety, while FAO was established to raise nutritional levels and agricultural productivity. WHO works to improve nutrition, food safety and food security, with a view to the effect on public health, while FAO is the lead agency for technical expertise in food security. The two agencies work together extensively.

Both WHO and FAO have a number of food safety initiatives that range from technical support to standards development to education. Of particular interest here is the emphasis on: clear standards: the Codex Alimentarius Commission was established by WHO and FAO in 1963 to develop harmonized international food standards, guidelines and codes of practice to protect consumer health and ensure fair practices in the food trade. The Commission also promotes coordination of all food safety standards undertaken by international governmental and non-governmental organizations; capacity building: developing the ability of people and organizations throughout the food chain to understand and deliver good food safety processes, by creating, coordinating, collaborating and communicating information on all aspects of food safety; systems: recognizing that "[...] most national policies and programs have weaknesses and there are inadequate linkages between strategies to ensure food safety including guidelines for strong food safety systems", WHO regional offices for Africa drafted guidelines around developing food safety systems, with a particular emphasis on how to conduct situation analyses (World Health Organization, 2012); evidence-based risk management: recognizing the complexity of the food chain, FAO developed a guidance structure "[...]to improve food safety decision making considering a range of multiple factors" (Food and Agriculture Organization of the United Nations, 2013); data: a lack of coordination and lack of a clear mechanism for collecting and sharing food safety data is a challenge in many countries. FAO notes a need for a central national point which collects then shares data and research work on food safety (Food and Agriculture Organization of the United Nations, 2009). Another joint initiative between WHO and FAO is the Global Initiative for Food-Related Scientific Advice[1], for the provision of scientific advice to the Codex Alimentarius Commission. Examples noted by the FAO include the SAFE FOODS Framework[2] and the Multi-factor Risk Prioritization Framework[3], both of which are designed to provide evidence of the public health impact of government policies and management decisions[4].

*Other public sector initiatives*

*European Union.* As part of creating an open internal market, in what has grown to encompass 27 countries, and in response to a drop in public confidence following a string of food safety scandals in the 1990s (e.g. the 1998 dioxin contamination of meat and milk in Germany and the Netherlands, as well as the 1999 contamination of animal feed with dioxins and polychlorinated biphenyls in Belgium) the EU developed a White Paper on Food Safety (2000)[5]. The White Paper emphasized the inter-linked nature of food production, noting that a strong food safety system requires: assessment and monitoring of the risks to consumer health associated with raw materials, farming practices and food processing activities; effective regulatory action to manage this risk; the establishment and operation of control systems to monitor and enforce the operation of these regulations.

It also recognized that no food safety system can be static: constant feedback and monitoring are needed to identify and manage new and changing risks, whether from developments in food processing or changes in relative power between the members of the food chain. For example, in areas where consumer food markets are small, they have little power, but in areas where there are large grocery retailers they have the power to enforce very strict inspections and quality standards. The list below illustrates the key elements of EU Food Safety System:

EU White Paper: key elements of a Food Safety System

- (1) Clear principles: scientific advice; data collection and analysis; regulation; enforcement; and consumer information.
- (2) Clear roles for all stakeholders: feed manufacturers, farmers, food manufacturers/operators, who have primary responsibility for food safety; government bodies, who monitor and enforce; the EU Commission, which ensures that there are competent authorities to manage the monitoring and enforcement systems; and consumers, who are responsible for proper storage, handling and cooking.
- (3) Traceability: the ability to trace feed and food and all ingredients, and to be able to withdraw any element in the event of problems.
- (4) Dynamic: food safety policies must be continuously reviewed and adapted as necessary to address shortcomings, changing risks and new developments, and these reviews need to be transparent to, and allow meaningful contributions from, all of the stakeholders.
- (5) Risk analysis: assessment (scientific advice and information analysis); management (regulation and control) and communication.

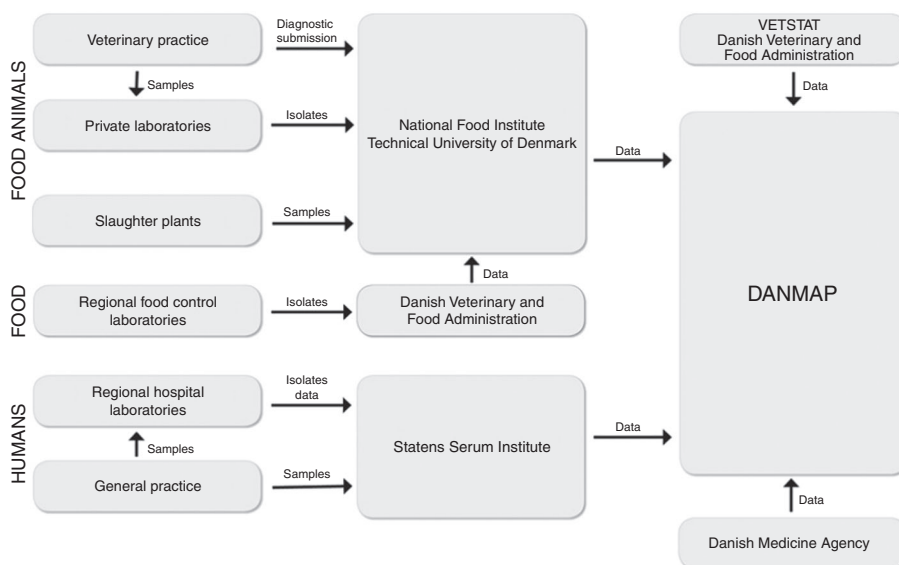
In particular, the White Paper noted the importance of a coordinated and integrated approach to food safety, and the essential role of commitment and collaboration amongst all of the involved parties. The establishment of the European Food Safety Authority was one the important outcomes from the White Paper.

*Antimicrobial resistance monitoring (Denmark): DANMAP.* An example of the monitoring function within food safety policy, DANMAP is the Danish programme for surveillance of antimicrobial consumption and resistance in bacteria from animals, food and humans. It has implemented the One Health approach, including the entire chain from farm to fork, since 1995.

DANMAP collects and presents data on consumption of antimicrobial agents and the occurrence of resistance in indicator bacteria, zoonotic bacteria and pathogenic bacteria from animals, food and humans. Annually, it maps out antimicrobial use in and the occurrence of antimicrobial resistance. A schematic description of sampling of isolates and data flow is presented in Figure 2.

This regulatory process is the key success factor for DANMAP that also has some relevance for China. In particular: science-based approach: the Danish programme is data-based, involving the collection and monitoring of data from each level of the supply chain, i.e. from both animals and humans (the “from farm to fork” concept). The scientific basis of the methodology was challenged and tested by both industrial interests and formally by the EU. Those challenges ensured that the science was sound, which in turn gives the programme greater credibility; farmer involvement: the involvement of farmers throughout the development of the programme is a significant success factor. Cooperation between researchers, government and agriculture is





**Figure 2.**  
Sampling of isolates  
and data flow

essential for effective implementation; Human healthcare and veterinary involvement: one of the strengths of DANMAP is the cooperation between veterinary and human healthcare providers, which brings expertise from broad range of viewpoints and professionals (Hammerum *et al.*, 2007); communication: raising the consumer awareness of risks in the food chain plays an important part in getting consumer support for regulatory systems, and in building awareness of good food safety practices in the community. Understanding the risks of antibiotic resistance not only generated support for reducing prophylactic use of antibiotics in animals, but informed consumers about the overuse of antibiotics in people. Media coverage can also create a sense of urgency, which can be positive, but misleading or incomplete information can backfire and undermine sound food safety efforts (Kovács, 2011).

#### *Private-sector initiatives: global and national*

*International private-sector scheme: Global Food Safety Initiative (GFSI).* The GFSI is an example of both stakeholder involvement – across the food chain and across the globe – and the importance of transparency. As the food supply chain expanded globally in the 1990s, it became clear to large organizations that it was not sufficient to know their direct suppliers. To successfully manage food safety, they needed to understand and manage the risks at every point in the supply chain. In the past, the majority of large food companies had their own safety systems and processes in place. As the supply chains became longer and more complex there was an increase in food safety incidents, which led to an influential group of retailers, manufacturers and certification bodies joining forces. Their goal was to harmonize standards, increase transparency across the supply chain and share best practices.

A shift in philosophy towards the sharing of systems, knowledge and processes has led to the greater understanding of food safety. In 2000, a group of large organizations formed the GFSI, with approximately 100 delegates attending the first global

conference in Geneva. Today, organizations such as Walmart, Metro, Cargill, Danone, LRQA, DNV, Diversey Sealed Air, Trace One and Coca-Cola are among the global, regional and local companies that are GFSI members. Over 1,000 delegates attended this year's 2014 GFSI Global Food Safety Conference in the USA.

Through technical working groups, the GFSI has been instrumental in harmonizing hundreds of regional, industry and even company-specific standards and schemes to a manageable set of 12 GFSI-approved standards and schemes. These standards address food, packaging, packaging materials, storage and distribution for primary producers, manufacturers and distributors. GFSI members are now educating, encouraging and mandating the certification of their suppliers to the same criteria, which in turn is driving continual improvement, mitigating risks, improving efficiencies across the supply chain and helping suppliers reduce costs. Evidence of the benefits of these improvements, including the reduction of consumer complaints, recalls and wasted products, is now being shared by the retailers like Metro and Walmart and manufacturers like Danone and Cargill at the GFSI conferences.

The GFSI and its members recognize that a successful food safety culture cannot be forced through the supply chain by the large multinationals alone. They have therefore also worked on a bottom-up approach, targeted at small suppliers and less-developed countries. The GFSI's Global Market Programme gives those suppliers a two-year window to gain an understanding of and implement one of the GFSI-approved standards and schemes. During that time, the large global organizations, working together with a certification or training services provider, engage with the smaller suppliers to help them successfully implement a GFSI-approved scheme and, importantly, the food safety culture that supports it.

A recent study demonstrated that food companies having achieved certification had well documented food safety management systems, improved product safety and well trained employees[6].

A common set of standards, systems and processes allows the food supply chain to benchmark and compare the manner in which organizations manage their risks (Reuvid, 2014).

The GFSI deals with a very complex set of regions, stakeholders, markets and expectations. Key learnings from their experience include: consumer expectations was a key initial driver; simplification and harmonization of standards: too many and overly complex standards reduce the ability to effectively monitor disparate and/or geographically remote members of the food chain; active involvement by stakeholders at multiple points in the food chain: in the initial stages, large companies joined together to create the framework, but once that framework was established they actively worked with smaller suppliers to bring them along; training and monitoring are essential.

*National private-sector scheme: Red Tractor Assurance (RTA) (UK).* An example of a national private-sector-based initiative targeted on traceability is the Red Tractor scheme in the UK. The RTA scheme sets out production standards developed by experts on safety, hygiene, animal welfare and the environment, for farmers and food producers. Foods and beverages that display the Red Tractor logo have met RTA production standards and are fully traceable back to independently inspected farms in the UK (RTA).

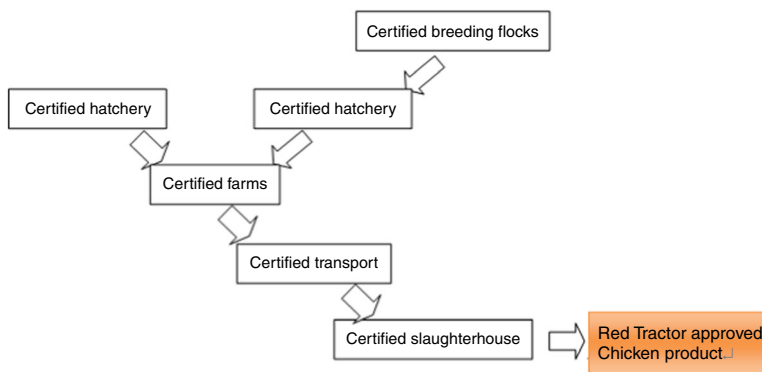
Following a series of high-profile food safety incidents in the early 1990s (notably, salmonella, E-coli and BSE), the UK faced serious food safety confidence issues, both in the UK and in its export markets. In order to improve public confidence a variety of

farm assurance schemes were introduced, but by 2000 the variety of new food safety schemes had led to confusion in the marketplace. Shoppers called for a single symbol that provides reassurance that food has been produced to good standards. Assured Food Standards was created as a single body, composed of experts from farming and food industries across the entire UK food chain. It developed the “British Farm Standard”, with an iconic red tractor as the quality mark logo. This provides consumers with a single, recognizable stamp of approval.

The Red Tractor logo can only be used to label ingredients from farmers, growers and food processors that have been inspected and certified to the standards specified by RTA. Use of the Red Tractor logo is strictly under licence, and applies to the use of the logo on any food or food product. In signing the licence agreement, packers undertake to put the Red Tractor logo only on eligible products and to guarantee that the logo is used appropriately. To that end, they must: keep records of incoming raw materials and production batches to allow full traceability back to the farms of origin; allow RTA to visit their premises at any time to examine these records and check their systems; offer full traceability from farm to pack.

The RTA scheme ensures that certification occurs throughout the entire supply chain. The process for chicken is shown in Figure 3.

Foods labelled with the RTA logo have a strong reputation for being safe, safety with consumers expressing a high level of trust in the RTA scheme. RTA-certified products now account for 90 per cent of foods sold in the UK market. RTA is a totally self-regulatory initiative, in which farmers choose to participate. It operates on an independent, non-profit basis, and is owned by the entire food industry with a board comprised of representatives from major industry groups and independent experts. Keys to the success of RTA in the UK include: industry cooperation: cooperation between farmers, trade associations, scientists, veterinarians and experts across the food industry is essential. The RTA has not been imposed on companies, but rather driven and embraced by the entire industry all along the supply chain in response to the demand of UK consumers for a food safety system they could trust; traceability: within the RTA, every critical step of the food supply chain is independently inspected to ensure food is produced to quality standards by assured farmers, growers and producers in the UK, from farm to pack. This requires changes in how the large food suppliers, who are dependent on small farms and producers for their products, manage



**Figure 3.**  
RTA process for  
chicken

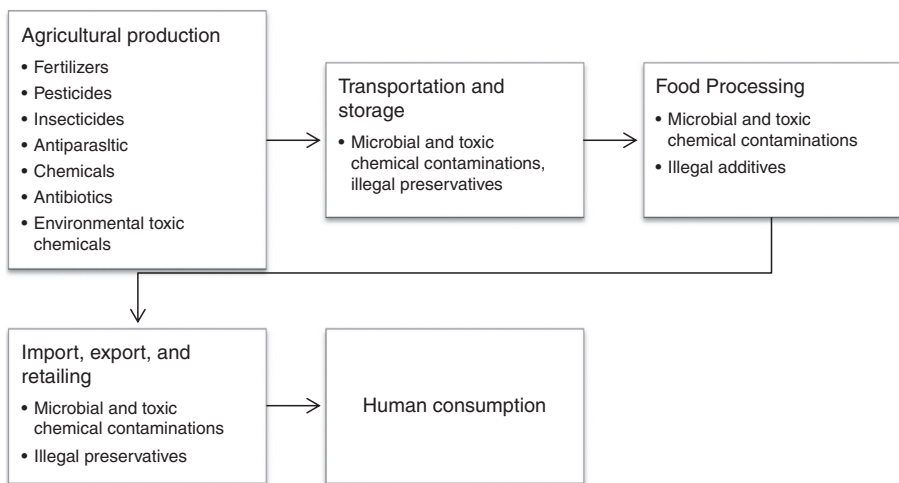
their upstream supply chain. Although many have developed good internal quality systems, food safety requires vigilance all the way through the food chain; single national standard: multiple inspection systems and multiple standards are harder to monitor, and harder for the consumer to trust.

**The Chinese context for food safety**

*Problem identification through food supply chain*

Identifying the vulnerable points in the food chain is a key element in developing an appropriate and effective food safety system.

The integrated nature of the food chain means that a weaknesses in one area of the chain can affect food safety throughout the entire food chain. The food production process provides many opportunities for contamination at various stages (Figure 4). During primary production, improper use of agrochemicals, fertilizers and pesticides in the field, and antibiotics and antiparasitic agents in animal agriculture, might lead to the presence of unsafe compounds in food products. Meanwhile, suboptimal storage and transportation might lead to contamination by harmful microorganisms and associated toxins. Use of unlawful additives in food processing can further contaminate food products[7]. Since water is essential to food production, preparation, and processing, a major source of food-borne disease in China stems from the shortage of clean water and poor sanitation. Meanwhile, chemical pollution is a major threat to both agricultural land and freshwater supplies (Zhang *et al.*, 2010). The rapid development of industrial facilities in rural areas, often immediately adjacent to agricultural land, is an escalating food safety problem because fields are being contaminated by industrial wastes such as heavy metals. In the context of agricultural production itself, overuse and misuse of certain agrochemicals pose another set of major concerns for public health and food safety in China (Gong *et al.*, 2011). Fertilizer overuse, for instance, is widely acknowledged in China and is associated with algal blooms in lakes and reservoirs that contaminate drinking water with toxic microcystins, leading to diarrhoea, liver cancers and other outcomes. Finally the addition of illegal additives is a prominent food safety problem with a particularly difficult recent history in China’s



**Figure 4.** Possible sources of contamination in the food supply chain

food sector. Incidents of illegal chemical additives in foodstuffs have occurred recurrently, leading to public health hazards, social distrust of the food industry and loss of public confidence in the regulatory system.

The potential impacts of food safety hazards in China are amplified by the globalization of food trade. Given China's status as the world's second largest single-country food exporter, a food safety incident in China not only impacts consumers and businesses at the product's origin, but can affect a large number of consumers in export markets worldwide. The international dimension to the food chain has raised the profile of food safety in China, attracting the attention of regulators around the world.

The primary sources of food safety incidents in China can be classified into four main categories: environmental (industrial pollution of the air, soil or water); production (including residues of pesticides, veterinary medicines and other chemicals, contaminated feed); processing (led by illegal use of food additives and illegal raw materials); post-production (including spoiling and other hazards through poor handling and storage, false labelling).

The contributing factors of food safety incidents also include poor management and the structure of the food chain. Subjective and intentional criminal acts taken by the behavioural agents of food supply chain for personal gain; flaws in the food safety supervision system, under-capitalized food production and processing enterprises, poor awareness and low levels of expertise in ensuring safe food all play their part.

While China has made significant progress in its food safety regulatory regime, the overall food safety system – combining both public sector and private-sector aspects – is hindered by China's food industry structure and enforcement at the local level, specifically in these aspects: supply chain complexity: China's decentralized and fragmented food industry structure presents a major challenge to ensuring food safety "from farm to fork". Almost 80 per cent of China's 500,000 food establishments are "cottage enterprises" with fewer than ten employees. As a result, it is often difficult to locate (even with a basic traceability programme) responsible parties when food safety incidents occur. The complexity of the food supply chain and the lack of a tracking system, together with a flat industry structure, can make it extremely difficult to pinpoint the source of contamination or to respond to food safety incidents in an efficient manner. Further, threats of bankrupting judgements from lawsuits that help motivate an industry to monitor or regulate their own supply chain (as with the food industry in Europe or the USA) are absent; poor farm returns: a combination of low technical capabilities, rising costs of feed, fuel, labour and other inputs and a market structure that favours food manufacturers over farmers means that small and medium-sized producers (who account for the vast majority of Chinese agricultural output) have chronically low returns. Persistent poor farm returns increase the temptation to engage in illegal practices such as overuse of agricultural chemicals and veterinary medicines to increase profitability; monitoring and enforcement: some critics argue that a lack of laws and regulations in China are the main reason for food safety problems. However, China has more than 3,000 food laws, regulations and standards, nonetheless it appears that the gap between written and enforced laws has been widening. Regardless of the number of rules, their effectiveness depends on robust monitoring and enforcement at the local level.

#### *A Blueprint for food safety for China: five elements for success*

The global food chain is one of the drivers of food safety policies, yet the core of agriculture remains in many ways intensely local. While the application of international experiences in solving food safety problems need to be tailored to

China's specific circumstances, guidelines for policy development can be drawn from the collective experience.

An effective food safety system protects public health by ensuring that food meets the necessary safety standards. It begins with a clear, unified mission that focuses and integrates the varied needs and responsibilities of all stakeholders, provides the stakeholders with a basis for achieving the goals of the system, and is widely accepted.

Combining these elements with best practice from systems created by food safety practitioners internationally suggests a five-point Blueprint for food safety in China and other countries, allowing for the development of a robust food safety system. It should be noted that even since the authors began developing this model China has already adopted a number of the recommendations covered by this Blueprint and is actively considering others (Table I).

The first step is to establish a systemic, structured approach: a national food safety policy and plan is an essential part of an effective food safety system[8]. Whether it is a framework for coordinating the efforts of different agencies and actors involved in the food chain, or a single agency is a clear line of sight through production, regulation and enforcement is essential. Equally, however, it is clear that the production side must be separate from the enforcement side. In the EU, for example, the Food and Veterinary Office is part of the Directorate General for Health and Food Safety, while food production policy and development initiatives come under the purview of the Directorate General for Agriculture and Rural Development.

A strong food safety policy will be clear about the objective and priorities, have clear roles for all of the stakeholders, define clear strategies for implementation and include effective performance assessment mechanisms.

The second step is to implement science-based good management practices to ensure that food safety regulations, inspection and monitoring activities are prudent, effective and efficient, which is including data collection and analysis, and risk controls. It is necessary along the entire supply chain. In some cases, safe production will need to be supported by HACCP-based systems that identify potential risks and create a system of controls, with built-in monitoring to confirm the system is working as intended.

A structured risk assessment system, based on a common agreement of food safety principles, improves both the quality of the assessment and the transfer of knowledge at the local level. However, adoption of effective quantitative risk assessment is difficult to ensure without an integrated food safety system, especially if different agencies have differing missions.

The third step is to involve the stakeholder. An effective food safety system is an interdependent system that includes each point of the food supply chain, as well as researchers, and supporting players. The system is dynamic and aligned to the unified mission of improving food safety, to protect public health. Supportive, involved and informed participants are critical to the integration and dissemination of research, education and information. Thus in addition to the direct participants from both the human and animal food chains, universities and college, special interest organizations, consumers and the news media should be involved. This creates the pull effect for standards and quality marks.

The fourth step is to develop education and training. Food safety officials throughout the supply chain often have a poor understanding of food safety practices and standards that cover their products. Training and follow-up is an essential pre-condition to foster consistent compliance with food safety standards and regulations. Also, monitoring and enforcement (below) require strong management skills.

Elements	Chinese context	Importance	Lessons from other national programmes
1 Establish a systemic structured approach	China's regulatory approaches are complicated by the sheer size of the food sector	An essential part of an effective food safety system	EU food safety system: - Clear about the objective and priorities - Clear role for all the stakeholders - Define clear strategies for implementation - Includes effective performance assessment mechanisms
2 Implement science based-good management practices	The science-based risk assessment is not complete	To ensure food safety regulations, inspection and monitoring activities are prudent, effective and efficient	DANMAP: Includes data collection and analysis, risk controls It is along the entire supply chain
3 Involve the stakeholder	Government bodies are the main stakeholder, and lack of involvement with other parts such as consumer, retailer, NGOs	Creates the pull effect for standards and quality marks	GFSI and Red Tractor UK: - Active involvement by stakeholders at multiple points in the food chain - Industry cooperation: cooperation between farmers, trade associations, scientists, veterinarians and experts across the food industry is essential
4 Develop education and training	Hard to access accurate information	An essential pre-condition to foster consistent compliance with food safety standards and regulations	All the success national programmes focus on education and training heavily
5 Enhance the monitoring and enforcement	Monitor and enforcement is mostly from public, should from both public and private-sector initiatives	Without continuous monitoring and meaningful enforcement the inevitable elements of human error and human greed will lead to food safety problems	Industry-based certification systems: Red Track UK Every critical step of the food supply chain is independently inspected to ensure food is produced to quality standards by assured farmers, growers and producers in the UK, from farm to pack

**Table I.**  
Blueprint- five-point plan for food safety

The last step is to enhance the monitoring and enforcement. This is arguably the most important point: no matter how good the systems, regulations and training are, without continuous monitoring and meaningful enforcement the inevitable elements of human error and human greed will lead to food safety problems. Strong food safety assurance systems, including routine verification that a system is working as intended, are

considered essential as it is an accepted notion worldwide that if producers are permitted to improve returns by marketing sub-standard products, they will be tempted to do so.

Monitoring and enforcement encompasses both public and private-sector initiatives. In particular, traceability – the ability to verify the history, location, or application of an item by means of documented recorded identification – is increasingly recognized as an essential component of a food safety system. Each participant in the supply chain should be able to account for their contribution at least one step upstream and downstream in the supply chain, and the bigger the producer the more steps up and down the chain should be required. For global brands, the expectation is that they can trace their products back to the raw inputs. Traceability requires strong management skills (including production management processes, and allocation of responsibility within the organization), and system processes (such as testing and a recall and tracing system).

Industry-based certification systems have shown to be useful in accomplishing these objectives in many countries. A robust certification system can serve as a complement to a strong regulatory body that can enforce legal standards while building consumer confidence. Successful certification programmes such as the RTA are supported by extensive training – both of the certification bodies and their farm assessors. Furthermore, certification performance monitoring helps ensure producer certifications are sound. Recognizing that these programmes take time to develop, one recommendation for Chinese industry in line with successful experiences elsewhere, is to begin on a modest scale, identify retailers and distributors who see value in a certification system like RTA, work only with committed producers and build on success and consumer acceptance achieved in these initial stages.

#### *Towards a new paradigm*

The history of food safety around the world and over time is episodic: through some combination of changes in science and technology, human venality and bad luck, high-profile food scandals unfold. The scandals drive consumers to demand safer food and governments to try and make better systems. New rules are put in place and the general level of food safety in that area improves. The difference now is that food scares are more public, the food chain is longer and more complex, and it is clear that cooperation across the food chain is essential.

Over the last number of years the Chinese government has taken many steps to develop a stronger food safety system, most notably the introduction of the Food Safety Law in 2009; the creation of the National Centre for Food Safety Risk Assessment in 2011; and consolidation of downstream food safety supervision and enforcement functions in 2013. Industry has also made numerous efforts to improve their food safety systems and, notably, two of the 15 board members of GFSI are from Chinese companies.

However, China has a number of challenges as it works to implement these initiatives. Developing education, enforcement and supervision mechanisms is arguably the most important step for China at this point- and the most challenging. The structure of the food industry is a major impediment. While large-scale modernized operations are growing rapidly, China's millions of small-scale farmers and manufacturers, many of whom are not currently capable of consistently meeting China's food safety standards, will continue to account for most food and agricultural output for the foreseeable future. Educating and supervising these small enterprises,



and improving food safety awareness at the beginning of the food chain, will continue to be a daunting challenge. A combination of risk-based education (e.g. expanding veterinary services and training to small farmers) on the one hand, and supervision (e.g. effective auditing of high-risk food manufacturers at the local level) on the other hand will help to counter poor compliance with food safety regulations and standards. The ability to detect food safety system weaknesses and evaluate corrective measures also needs development. How China balances consumer demands for food safety with local interests that typically favour producers is a key question that will likely drive the pace and direction of reform.

Food safety “[...] is not a single silver bullet; it is a cooperation within the whole supply chain, the government and the regulatory authorities”[9]. The Blueprint outlined here is offered in a Chinese context, but is applicable to every marketplace.

### Notes

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