

# Ways Analyses on Food Safety and Cooperative Supervision Pattern in the Perspective of Synergetic

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**Abstract** – Impeccable food safety and cooperative supervise mode is the necessary condition of food safety, healthy life and social stability. However, the frequent food safety incidents reflect the numerous problems on the food safety supervision mode at present over and over again. Therefore, we should build the multi-agent cooperative supervision pattern to improve the quality of food safety supervision based on the synergetic theory, complete the law system, optimize the rights and liabilities, cultivate the societal forces and establish the information platform of food safety supervision to promote the improvement of the validity of food safety supervision.

**Keywords** – Food safety supervision; Synergetic; Cooperative supervision; Synergistic effect

## 1. The problems of China's public food safety supervision

Hunger breeds discontent, food safety is the first to. Food safety problems are closely bound up with the masses' vital interests, and will influence the masses' healthy safety directly. Meanwhile, food safety problems also will influence the social stability and economic development. Therefore, enhancing the food safety supervision and ensuring the food safety is not only in favor of the guarantee of the national healthy, but also in favor of the maintain of social stability and economy healthy.

However, the repeatedly occur of the food safety event reflect the hidden danger and the crisis of our public food safety such as “Tony red”, “Poison milk powder”, “Dyeing steamed bread”, “Clenbuterol hydrochloride” and so on. Of course, there are many in factors that result in the unsafe public food. The faultiness of the food safety supervision pattern is the most important reason. To solve the food safety problem, it is bound to complete the food safety supervision pattern in our country constantly.

### 1.1 For actual food safety supervision, the rights and liabilities are decentralized, and the coordination is inadequate.

China's new food safety supervision pattern was established by the release of Food security law of the People's Republic of China. In the central government, Under This Law, the State Council set up food safety committee and set the related responsibility of it, and the State Council Hygiene Administrative Department assumes the comprehensive coordinate duty of the food safety, and the supervision activities of food production, food circulate and catering serve was carried out respectively by the State Council Quality Supervision, Industrial and Commercial Administration and State Food and Drug Administration; In the local government,

administration of local government above county level according to the law and the rules set by the State Council to define the food safety supervision responsibility of Hygiene Administration, Agriculture Administration, Quality Supervision, Industrial and Commercial Administration and State Food and Drug Administration.

From above all, we can see that, China's food safety administration authority distributes in the department of Hygiene Administration, Agriculture Administration, Industrial and Commercial Administration and Food and Drug Administration, and forms multi-departments and multi-institutions management regulation of food safety system. However, the multi-supervision structure in the practice will weaken the efficiency of the food safety supervision to some extent. On the one hand, the multi-supervision pattern will make the departments at the same level cannot demarcate the rights and liabilities in the supervision process of the food safety. Then, mutual shuffle disputes over trifles among these departments are unavoidable, which will directly result in the low regulatory efficiency. Because of the ambiguous demarcation of the rights and liabilities, once the food safety event happened, the liabilities could not be traced, and the accountability of the department is bound to become a mere formality. On the other hand, the paragrapping of the multi-agent supervision administration pattern also could give rise to the harmony insufficient. Once the necessary coordination mechanism runs away, each department will seriously be intersected, and this will make the entirety coupling effects ineffective, so far as to make the conflict among the department continuous. All of these things will finally affect the efficiency of the food safety supervision.

### 1.2 The subject of the food safety is simplex and the participation of society power is insufficient.

China's actual food safety supervision pattern still seems the administration supervision as the absolute domination, which lacks the third force excepting the

government and market, that is to say, the society power's participate in the food safety supervision. The main representation is that: First, the participation of association is insufficient. Now, although China has built some association about the food safety such as the China Food Industry Association, China Healthy Food Association, China Green Food Association and so on, these food associations have not get ample fostered, which management and operation still need to be specified. The insufficient development of the food associations limits the participation of the food safety supervision. Second, the participation of the masses is insufficient. As the direct food consumer, the health and life safety of the public was significantly affected. In order to protect the benefits of ourselves, the public should widely participate in the supervision of the food safety. However, due to the faultiness of the public participation mechanism in food safety supervision, the public could not participate in the food safety supervision effectively. Then, the active role could not be given full play to supervise the food safety. Third, the participation of the news media is insufficient. In recent years, the news media have exposure many great food safety events, and forced our related government and supervision department to solve those successfully. According to that, we can see the enormous supervision effect expressed by the news media in the food safety field. But the related government supervision departments kept a suspicions and vigilant attitude instinctively about the participation of the news media in the food safety supervision because of the influence of the traditional concept. That made the participation of the news media in food safety supervision limited. It is undeniable that some media may violate the professional morality to pursue the commercial interests and report some hollow news which bring the misdirection for the public and affect the social stability. Government should enforce the guidance and standard on the action like that, and make the media could join in the food safety supervision amply and express the front power.

### **1.3 The information asymmetry of the food safety supervision**

Information asymmetry means one side generally has better information than other sides, so that information appears asymmetric on the whole. Information asymmetry is constant. Absolute information symmetry doesn't exist flatly. In the food production and processing, the food producers and the processors have more real information than consumers and the state supervision department. They have abundant information and occupy the absolute advantage on information, what bring them a prodigious operation room in the food production and processing, also a prodigious barrier on the food safety supervision.

For consumers, the channels they get the food information is so limited. They get most of the food information from advertisement or food package, all of which is the surface information. It is very hard to get the information about the food safety information involving the consumer's health which will usually be hidden by the producers and processors. So, the information

asymmetry appears. How could the consumer to supervise the food safety? Furthermore, the information asymmetry between the enterprise and consumer in the food safety supervision also would lead to the food safety information cost paid by consumer too expensive. The high cost on the supervision will certainly weaken the consumer's engagement in the food safety supervision.

For the state supervision department, they usually establish the compulsory food safety standard to make sure the supervised food quality. If the producers and the processors produce the food in strict accordance with the standard, the food quality also can be guarantee. But actually, the supervision department could not control the true act of production of the producers and the processors exactly, and could not make sure they produce the food according to the standard. The supervision department is in the information inferior position. Driven by the benefit, the producers and the processors been in the information preponderant position could make use of the advantage to avoid the supervisory control by hook or by crook. Finally, the lack of the information makes the supervision department passive in the supervision processing on food safety, which weakens the efficiency of the supervision.

## **2. Synergetic theory for analyzes on food safety supervision**

### **2.1 The outline of the synergetic theory**

#### **2.1.1 The connotation of the synergetic theory**

"Synergy" comes from ancient Greek at the earliest, which means "Coordination and cooperation". In the 1970s, Professor Hermann Haken, who is the physics from Germany, had an research on the synergy from the natural science point of view, and explicated the synergy conception. Based on that, he created the synergetic theory.

Synergetic theory is mainly study the complicated open system how to make the subsystem differ in thousands of ways to generate the synergistic effect according to the self organization process among the subsystem by the external drive, and finally spontaneously forms a new stable structure on the time, space, and function. By means of the research in different domain, and with the help of mathematical model analyses, synergetic theory describes a common regular pattern that all kinds of system and phenomenon in nature and society change form the disorder to order. It expounds a synergistic effect and bulk effect generated by the subsystem cooperation in the open system, and proclaims the system self-organization function bring by the synergistic effect. That is to say, self-organization is the core conception of the synergetic.

#### **2.1.2 The principle of the synergetic theory: self-organization principle and synergistic effect principle**

##### **2.1.2.1 Self-organization principle**

Self-organization means that a system achieves its spatial structure and/or functions without specific interference from agents outside the system. After abundant study, Haken discovered that, if most of the

subsystem in the system acted as they please and could not reach symbiosis, the system would not generate the new specialty. Then, the system would be in the position of disorder. However, when the system was or would near the critical point, the critical moderation created by one or a few of parameters will lead to critical fluctuation. And, their change may make other subsystems strike up the cooperative relationship rapidly, and act as collective way orderly. With synergistic effect of every subsystem, the system had a macroscopically qualitative change, and the antecedent disorder state was replaced by the structural order state. In the Synergetic, Haken described the system's behaviors when the system was near the critical point and presented order parameter and considered that the system's evolution was controlled by order parameters and the final structure and orderly degree of the system's evolution were depended on order parameters.

Self-organization principle of the Synergetic is aimed at explaining the process that the system's evolution from disorder to order. Substantially, it is the self-organized process in the internal system, and the synergetic is the manner and method of self-organization. Based on that, we can think that, Self-organization is an effective way to change the state of system's development from disorder to order, and also is basic way that the system improve itself constantly. Of course, if the system needs to realize the self-organized process, it must have the condition of self-organized process. First, the system should be a open system. In this condition, the system could exchange the material, power and information with the external environment, and the system could have the motive power to develop and improve itself. Second, the system must be non-linearly relevant. That is to say, the subsystem in the internal system must cooperate with each other. Only in this way, the subsystem could reduce the unnecessary internal friction and express the intrinsic function.

### 2.1.2.2 Synergistic effect principle

Synergetic effect is whole effect or collective effect created by the subsystem interaction and cooperation with each other in the complex open system. The whole effect or collective effect is far more than the effect produced by the subsystem on their own, separately. Synergetic effect principle points out that, the cooperation of the subsystem is the inherent driving forces for generating the system's ordered structure. For any complex system, their subsystems are non-linearly relevant. The system and external material, power, or information exchanges can reach the threshold value that self-organizing needs. The subsystem will break the original disorder state, and be in the state of coordination and cooperation with each other. Thereby, the synergistic effect can be generated. The synergistic effect makes the system have a macroscopically quality change in the critical point. Just because of the synergetic effect, the system appears from chaos to order. The structure becomes stable from the chaos.

## 2.2 The synergistic effect analysis of the food safety supervision

From all of the above, the major study subject of the synergistic is non-equilibrium system under phase transition, and the food safety supervision system is properly in line with the conditions.

First of all, the food safety supervision are a complex system. It has respect to many agents, such as the enterprise of plant and fish breeding and poultry raising, the enterprise of food produce and process, the government supervision department, the food industry organization, the news media and the public as the food customer and so on. It also has respect to many object elements, such as laws and regulations system, the supervision mechanism, the supervision information and so on. Therefore, as such supervision system on food safety is a complex system combined by many subsystems, and can be the object of study for synergistic. Moreover, synergistic principle tells us, the cooperation of each subsystem decides the express of synergistic effect. If these subsystems of the food safety supervision system can coordinate with each other, and keep them balance, and could be of one mind for the common target of food safety, the synergistic effect will be more efficiency than independence. The validity of the food safety supervision will be improved undoubtedly. Conversely, if the internal systems on food safety supervision hold each other back by the elbow and the conflict and clash are continuous, the internal friction will increase, and the subsystem will not express their proper functions. All of these will make the system in the disorder state. Then, supervise the food safety will not be in a position to mention.

Next, food safety supervision system has the characteristic of self-organization. It has two conditions of self-organized process: The first one is that the food safety system is an open and dynamic system. It is influenced by the external environment, and the system exchange the material, power and information with the external environment to develop and improve itself, which will make it adapt to the external environment. The second one is the related supervision department, the food service industry organization, the public and all kinds of supervision mechanism, supervision information and so on, will militate on the food safety supervision in the internal food safety supervision system. All of them is non-linearly relevant.

Above all, the author thought that, for the problems existed in China's food safety supervision, the synergistic could provide us an effective and new analyzes Way on Food Safety and Cooperative Supervision Pattern. We should build and continuously improve a multi-agent cooperative supervision pattern to make sure the food safety in the actual food safety supervision system. What is called food safety cooperative supervision is that, in the food safety domain, the subsystems of the food safety supervision subject which takes the government supervision department as nuclear and includes the public, the news media, the organization of food service industry and so on, take the related laws and regulations, administration, science and technology, information, public voice and so on as method to make the subsystem or various elements cooperate with each other, which can realize the integration and appreciation of the physical strength. Consequently, synergistic effect analysis of the

system will be expressed, and the supervision on the food safety will be more effective. Thus, the food safety and the public benefit will be guaranteed.

### **3. The path choice of China food safety supervision pattern**

#### **3.1 Improving the legal system of food safety regulation**

From the view of synergetic, as an open system, the internal each subsystem of the food safety cooperative supervision system, if there are external parameters of driving, will take collaborative action through purposeful self-organizing process, ultimately resulting in synergistic effects and playing the regulation function. Therefore, as the external control parameters of the food safety cooperative supervision system, the legal system will undoubtedly play a very important role. It provides the behavior of the various subsystems in the food safety cooperative supervision and the relations among the various subsystems. Perfect legal system is bound to be code for specification acts of the various subsystems, and restrict the irregular independence movement of the various subsystems in the original food safety cooperative supervision system, making the various subsystems operate cooperatively under the normative guide and around the common food safety supervision target, thereby forming a stable and orderly structure of food safety cooperative regulation. Therefore, the primary task of establishing food safety cooperative supervision mode is to keep on perfecting the legal system of food safety cooperative regulation.

Currently, the design of the legal system about China's food safety supervision mode is still based on taking care of the original pattern of the executive powers under the current system mechanism, embodying in the administrative regulation the institutional arrangement is absolutely dominant in the institutional arrangement, lack of other subjects involved in the food safety regulatory system. At the same time, there are some defects in the existing legislation; the operability of the practical supervision is not strong, which greatly undermines the quality of food safety supervision. Mirror this, perfect the legal system of food security collaborative regulatory, the first thing should to do is to perfect the basic law of the existing food security regulatory, the various subjects related to food safety are integrated into the legal framework of food security regulatory, clearing the status of all main in food security regulatory through legislating, clearing their regulatory rights and obligations. Secondly, around basic law, to perfect the synergistic regulatory rules, making the designed legal system be more operational, guiding better the synergistic supervision on the food safety, improving the effectiveness of supervision, finally, to develop the synergistic supervision working system of various department and various subjects, to implement the synergistic supervision work of food safety regulation practically.

#### **3.2 Optimizing the power and responsibility system of food safety cooperative regulation**

Synergistic effect of the food safety regulatory system depends on its internal synergies among the various subsystems. Subsystems can be mutual coordination and cooperation, in addition to the perfect legal system to regulate and guide, still to clear the supervision powers and responsibilities of various subsystems in the food safety supervision. This is because the powers and responsibilities system of food safety cooperative regulation is incentive mechanism and the mechanism of motive power which various subsystems interact and form self-organization.

The food safety cooperative supervision mode is a sort of supervision mode which is centered on the government, other subjects participate broadly. Therefore, to optimize the powers and responsibilities system of food safety cooperative regulation, on the one hand, need to clear the powers and responsibilities of the existing each food safety supervision departments, and clarify the responsibilities among food safety supervision departments, and as well the responsibilities relation between food safety supervision departments and other interrelated departments, overcome the malpractice of multi-head management. At the same time, construct efficient department independent coordination mechanism, and strengthen the coordination among different departments to promote collaborative operation among departments, both division of labor and cooperation, ultimately ensure the good results of food safety supervision; on the other hand, need to separate the power appropriately, add definite decision-making and coordination function to other subsystems in food safety supervision system, enabling them play the role of supervising food safety in their respective core advantage area. Proper separation of powers has, to a certain extent, inspired other subsystems to participate actively in the regulation of food safety, and cooperate mutually with governmental regulators, acting in concert to avoid power loss in food safety monitoring, and realize the food safety regulatory objectives.

#### **3.3 Fostering the social forces of food safety cooperative supervision**

As with other complex open systems, the food safety regulatory system is composed of multiple subsystems. The independent operation of the individual subsystems can affect the operation of the whole food safety supervision system in varying degrees. Food safety regulation, therefore, is to achieve a good social effect, relying solely on the government's power is hardly enough, it also needs to give full play to the regulatory power of the other subsystems. In particular, it needs to give full play to the function of the food industry organizations, the public and news media and other social forces, coordinating and cooperating mutually with the governmental supervision departments, forming cooperative supervision on the food safety, and to improve the quality of the food safety supervision. To this end, it should foster extensively the social forces of food safety regulation, and establish social promotion mechanism of food safety supervision. Cultivating the development of the food industry organizations is the first thing that it needs to do. Mature industry organizations

can constraint their enterprises, playing the role of promoting food security. But, China's food industry organizations have not fully nurtured recently, their role in food safety is not good enough to play. Therefore, the government should take positive measures to foster the development of the food industry organizations, guiding and promoting food industry organizations to play the role of constraints and supervision. Secondly, it should establish perfect system of public participation, guiding and encouraging the public to participate energetically in the food safety regulation. The food security issues effect directly the interests of the public, so the government should explore actively various approaches and methods which the public participate in supervising food safety, establishing the public's food safety regulatory status, keeping effective communication with the public in the food safety issues through relevant mechanisms, ultimately promoting synergistic action between the government and the public on food safety supervision. Thirdly, exerting the supervisory function on food safety of news media is necessary. The governments should encourage actively news media to carry out vigorously the work of the supervision by public opinion, and guide actively the media playing a positive role of supervision by public opinion, reducing unnecessary friction and conflicts between the two sides, thereby reducing the system's internal friction, marching toward collaborative action under the guidance of the common goal that ensure the food security, enhancing food safety regulatory power.

### 3.4 Establishing information platform for food safety regulation

Synergy theory says, the change of collaborative information affects the self-organizing system non-equilibrium phase transition, and emerging new order macro-structures. Thus, information plays an extremely important role in the evolutionary process of system. Currently, the information asymmetry that exists in the food safety supervision will greatly block the food safety cooperative supervision. To overcome this obstacle, the first and foremost thing is to establish a unified food safety information platform.

In order to meet the information requirements of the entire main in the cooperative supervision, the establishment of this unified food safety information platform should begin from several areas of work: firstly, establish the perfect food security information collection mechanism, to collect comprehensive and complete food safety-related information. Secondly, establish an effective information analysis system, analyzing the food security information scientifically that has collected, filtering out the key and valuable information, and making necessary consolidation, offering information support for food safety cooperative regulation at any time. Thirdly, establish efficient information dissemination mechanisms, the cooperative regulatory body, including government regulators, the public and the news media, need to collaborate, implement joint construction and sharing of information, and use respectively advantages in their respective field to expand issuance of food security information, making the food

safety place in the supervision of the whole society. All in all, the establishment of the food safety regulation information platform can promote multifaceted information exchange, provide convenience for coordination and cooperation among the various subsystems, thereby to promote the production of food safety supervision synergies, dramatically improve the quality of food safety supervision work.

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