

# Review of food system research

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## ABSTRACT

In recent years, under the trend of domestic carbon peak, carbon neutral as the environmental goal and global sustainable development, food system, as an important issue closely related to human life has gradually entered the research vision of scholars. This paper uses the literature review method to summarize the research context of food system at home and abroad, and analyzed and predict the future research hotspots and trends of food system, in order to provide theoretical reference for the optimal development of healthy food system in China in the future. This paper holds that: (1) the concept of food system has evolved to a mature stage, and the research is more diverse, and more attention to the relationship between food system and community vitality, cultural retention, economic development, social justice, environmental quality, ecological integration and human health.(2) At present, the research theories and methods of food system mainly focus on structuralism, positivism and humanism.(3) The resilience of food system in the post-epidemic era, the transformation of food system in China and the development of local food system will become the research hotspot of food system in recent years.

## KEYWORDS

Food system; Research progress; Research hotspot.

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## 1. INTRODUCTION

The Global Food Policy Report 2022 released by the International Food Policy Institute (IFPRI) and the 2030 Agenda for Sustainable Development issued by the United Nations both emphasize the close link between the food system and global sustainable development. The food system is a huge system highly related to ecological environment, social environment and economic living environment. It is more inseparable and closely related to urbanization, agriculture, rural areas and rural areas in China and rural revitalization. Its complexity and importance are self-evident[1]. More importantly, a functioning food system can address global climate, economic, environmental, health and social challenges, which are important for people around the world who will live with COVID-19 with it for a long time. More importantly, the successful transformation of the food system can actively address global climate, economic, environmental, health and social challenges[2], This "resilience" is important for people around the world who have long lived with COVID-19.

Early literature on the food system generally focused on addressing the needs between the food system and the growing population. These issues cover food production and distribution[3], and consumer behavior-oriented market research[4]. In recent years, the more comprehensive food system research has attracted the attention of scholars and international organizations[5-6]. Based to the existing literature, from the composition of the food system to the driving factors behind the food system, these studies cover all the elements of the food system, including activities related to the

production, processing, distribution, preparation and consumption of food, as well as the output of these activities, including socioeconomic and environmental results[7-8].

The research on food system originated from abroad. At present, with the joint efforts and participation of many scholars, the research on food system has formed rich research results around relevant theories and practices, which has laid a solid theoretical foundation for the reconstruction of a sustainable food system to ensure food safety. In contrast, the Chinese academic circle still lacks enough attention to this field, and attention to the international research hotspots, including the development of food system development, food system resilience, and interdisciplinary research of food system. Therefore, it is of great significance to sort out the research context of food system, grasp the progress of foreign research, and look into the future development prospect of food system. It also provides a new perspective for China to further improve food system planning in China and carbon neutrality as soon as possible.

## **2. THE LITERATURE REVIEW OF FOOD SYSTEM**

### **2.1. The concept of the food system and evolution**

The concept of food system can be traced back to the European "food chain" theory (Greer, 1985) and the "agricultural" proposed by professors Trelogan and David of Harvard University (1957), both of which analyze the links of food circulation but do not explicitly propose the concept of "food system". Until 1985, the University of Wisconsin professor B.W. Marion Led the university of the Midwest agricultural economists formed NC117 committee, entrusted by the US government of the American agriculture, food manufacturing and circulation relationship of the systematic research, after formally put forward the concept of "food system", and defined it as "the sum of the relationships between agriculture and economic main body".Traill[9]argue that the elements in the relationship between the food system are further analyzed, and the organizations or individuals involved in food production, processing, circulation, providing raw materials and equipment are included in the food system. The rapid rise of food system research in Europe and the United States has attracted the interest of Asian scholars, Chinese scholar Su Shiyan[10]put forward the new thinking of food science system in the 21st century. In Japan, the food system seminar was organized by Professor Shotaro Takahashi[11]strictly defined the concept of food system, think it is "agriculture, aquaculture, agriculture, manufacturing, wholesale, retail, catering and consumption combined constitute a system of interaction and mutual influence", he especially emphasized solving the problem of food not only need the efforts of the relevant agricultural sector, more need the whole food system related industries. Tagtow[12]believed that the food system is composed of five parts: production subsystem, processing subsystem, distribution subsystem, consumption subsystem and waste treatment system, which are associated with multiple complex subjects, whose subsystems interact and have an impact on economy, environment, health and society. This deconstruction expands the conceptual connotation of the food system. Ingram[13], Hlpe[14], Moscatelli[15] and international organizations have laid a theoretical foundation for their food system research. In recent years, the FAO has defined the food system as consisting of a series of participants and activities related to the production, aggregation, processing, distribution, consumption and disposal of food[16].

According to the conceptual evolution of the food system in the past 60 years, it can be found that: 1)The understanding of the connotation of the food system is gradually deepening. From "Agribusiness", "Food chain" to "Food system", from the simple food itself to the food system, and then to the subordinate subsystems of the food system, indicating that the academic and international organizations are increasing the normative and systematic cognition of the food system. This gradually deepening "system thinking" not only describes the food system as a linear chain of activity from production to consumption, but also as a circulatory system full of linear and nonlinear feedback. Obviously, the food system has become an "open and complex giant system" combined by the

subsystems of the production of food raw materials, food processing and circulation, food consumption and related waste disposal.2) The relationship between the food system and human beings is getting more and more attention. The food system is influenced by resources, capital, technology, culture, system and other factors. Through the exchange and feedback between subsystems, between subsystems and and external environment of material, , the subsystems are interconnected and interact to form an organic whole together. Thus, community vitality, cultural retention, economic development, social justice, environmental quality, ecological integration, and human health are all closely linked to the food system. Food system is an important link to solve urban problems through planning and creating sustainable cities and communities.3) From the perspective of the driving factors, urbanization is the most persistent reason driving the evolution of food system, and technological innovation is the most critical reason driving the evolution of food system[17]. Urbanization is accompanied by increased household income, population growth, changing lifestyle, and increased personal health concerns in recent years, which are constantly changing the market's requirements for the type, quantity and quality of food. At the same time, the continuous innovation of agricultural science and technology has spawned new technologies, new products and new equipment, leading to the sustained growth of agricultural output and productivity in most parts of the world [18]. Processing, circulation, and information technology are increasingly reshaping food systems, making the relationships in the system more complex and tight.

## **2.2. Research theories and methods of food system**

Through the sorting and induction of the literature, at present, the theoretical basis and research methods of the research on food system are mainly based on positivism, structuralism and humanism. Among them: 1) Structuralism takes the integrity of structure, transformation function and self-regulation function, and focuses on the deep analysis of the composition of the food system and its driving factors. The food system has its own composition law, and there are organic connections among the elements of the system. Its nature in the whole is different from that when it is an independent individual or in other structures. When the food system is structured, it has its own regulatory mechanism, that is, the structure is self-consistent. Most of these studies focus on structural modeling, resilience assessment and spatial research of food systems, and try to summarize the essential properties and laws behind the evolution of food systems.2) Positivism takes phenomenology as the starting point and focuses on the study of the spatial relationship change and dynamic mechanism of the food system. The food system is in a dynamic process of constant change. Such research explores the sustainable development of the food system through mining data and applying technical means, in order to optimize the pattern of the food system and related policies of the food system.3) Humanism attaches great importance to the concern for human personality, centered on human itself, and focuses on the study of the direct connection between the food system and the human being and the consequences of the interaction between the two. Most of these studies focus on exploring the relationship between the space and place of the food system, the groups and individuals in the food system, and the food system and human life, economy and religious beliefs. In addition, the advantage of humanistic research is that it can deeply explore the relationship between the food system and the culture, for example, the transformation of food consumption culture, the embedding of food culture, and the sense of belonging and place constructed by human beings through the food system.

## **3. PROSPECT OF FOOD SYSTEM RESEARCH**

### **3.1. A Study on Food System Resilience in the post-epidemic era**

The impact of COVID-19 on billions of people around the world is not limited to the direct health threat posed by the virus, but also indirectly threatening to human food safety by causing damage to local and national food systems. The impact of the outbreak not only reflects the limitations and

vulnerabilities of the national and international health systems, but also reveals an important relationship between the resilience of the food system and human food safety. Chen Zhigang et al[37] pointed out that the food system crisis since the COVID-19 outbreak was caused by several interrelated factors. First, the flow of food in the supply chain has been significantly disrupted due to epidemic lockdown measures in various countries and the health status of workers at all parts of the food system. Second, the global recession caused by the pandemic has caused large numbers of jobs, with lower incomes further deepening hunger and undermining the vitality of the food system. Third, some complex factors lead to highly unbalanced food price fluctuations at the local and global levels, aggravating the local food system crisis. Eventually, these problems trigger a chain reaction, which in turn can affect food safety, trigger nutritional crises, and change the way people get adequate and nutritious food. By 2022, the number of global food hunger has increased for five consecutive years, with about 2 billion people without normal access to safe, nutritious and adequate food, and 144 million children with stunting. The World Food Programme (WFP) predicts that 130 million people will face severe hunger as a result of the crisis[38]. Without strong measures, 840 million people around the world will face food shortage and hunger by 2030, and the UN cannot achieve the Sustainable Development Goals (SDGs)[39].

The COVID-19 epidemic has sounded the alarm of the food system in the future. The world has entered an era of compound risk with multiple crises. It is crucial to enhance the "resilience" of the food system[40]. Therefore, it is necessary to reshape the global food system, promote the food system transformation, and enhance its resilience and inclusiveness while increasing productivity, in order to ensure the nutritional health of humans and the sustainability of the earth's natural environment[41]. The Intergovernmental Panel on Climate Change defines resilience as the ability of a society or ecosystem to maintain the same basic structure and function, to self-organize and to adapt to stress and change in the face of disturbance[42]. At present, the academic community also proposed the resilience of food system.[41], [43-44]This includes 1) food availability: including food production, distribution and exchange; 2) food accessibility: including economic ability, cultural background and distribution equity; 3) food availability: including nutritional value, social value and safety value; 4) food stability: including food storage capacity, supply capacity, soil fertility.

### **3.2. The Transformation and Planning of China's food system**

Currently, food systems in high, middle and low-income countries are undergoing rapid transformation, which not only accelerates the spread of growing human health problems such as malnutrition and excess nutrition, but also poses great challenges to the natural environment and social sustainable development [17]. In September 2020, Chinese President Xi Jinping announced at the 75th Session of the United Nations General Assembly that China will strive to peak its carbon dioxide emissions by 2030 and strive to achieve the goal of carbon neutrality by 2060. However, the role of the whole food system cannot be ignored[45]. Globally, the food system accounted for 21 percent-37 percent of the total greenhouse gas emissions from 2007 to 2016[46]. Greenhouse gas emissions from China's agricultural activities were 710 million tons of carbon dioxide equivalent in 2018, an increase of 18% over 1990, accounting for about 11% -12% of the world's total agricultural emissions[47]. At the same time, China is in the process of rapid urbanization. The essence of urbanization is to establish a connection between urban and rural areas and promote the flow of population, resources, goods, information, technology, capital and cultural concepts[48]. The flow and exchange of these factors profoundly change the human ecological environment and the way of life, thus significantly affecting people's food intake and health. For example, migration from food-produce land leads to poor self-sufficiency in agriculture, forcing urban dwellers to become more dependent on commodity food supplies; as food demand and prices increase, people become more dependent on cheap food that does not provide adequate enough nutrients[24]. Overall, the expansion of the urban geographic scope has greatly changed the pattern and complexity of the food system[49]. With the development of economy, the level of agricultural mechanization has been significantly

improved, the agricultural industrial chain has been extended, and the energy consumption and carbon emissions of agriculture-related food processing industry, storage, transportation, transportation, wholesale and retail and catering have increased significantly. The emission reduction of food system has also been mentioned on the important agenda.

Therefore, not only need to system research agricultural food system carbon emissions, carbon sink potential and emission path, for the transformation of agricultural food system power carbon neutral 2060 target provide scientific basis, also need to the problems in the urbanization of food system transformation, especially the urban food safety and urban food supply put forward the corresponding solutions[50].

### **3.3. The local food system**

Libery[51]It believe that the local food system is a response to the global food system, which aims to connect food with local areas, making local production and consumption a sustainable production and marketing system, contributing to local economic, social and environmental development.Brunori[52] believed that local food contains five dimensions: 1) Functionally, it represents the health and taste of the local people.2) Ecologically, it focuses on the distance of food mileage, biodiversity and the change of the landscape.3) Aesthetically, it is characterized by diversity and difference.4) Ethically, it embodies the sense of identity and the relationship of sharing weal and woe.⑤ Politically, local food policy can affect all aspects of the traditional food system and have an influence on changing the production and consumption patterns of local residents. Over the past few decades, there has been a growing outcry to fundamentally change the food market to better serve the locals[53]. At the same time, a series of new cooperation models have gradually emerged in the local food system and in the local food supply chain[54], Including new farmers' markets, urban horticultural areas, community support agricultural groups and producer cooperatives[55], these changes involve food production locally, nationally, globally, covering the economic, environmental, social and cultural dimensions of food consumption[56].

In food system based on the basis of "in" and "natural", combined with the special meaning and cultural connotation, connecting the "producer-consumer" network, different actors have different interests and goals, in the success of the food system operation depends on the actors (producers and consumers) by the network has the ability to "alliance", and agree with the value connotation of the network[57]. It can be seen that in addition to producers and consumers, the local food system network also plays a very important role in the support of local social culture, organizations and local groups. However, in the face of the global food system tide and the impact of COVID-19, the local food system needs to be solved in the future.

## **4. DISCUSSION AND CONCLUSION**

In general, the food system research has the following characteristics: 1) The dissipative structure of the food system determines the need to focus on the dynamic changes in the study. The essence of the food system is a dissipative structure far from the equilibrium state. The food system and the external environment are constantly carrying out the "influence-feedback" process, evolving according to the general trend of "non-equilibrium state- -equilibrium state- -new non-equilibrium state"[1]. The internal structure of the food system is complex, and the links are highly connected and continuously changing[58], compared with the traditional "static" analysis of the internal structure of the system, the food system research needs the study of "dynamic" changes. By analyzing the structural changes and drivers of the food system, we can reveal the changing trends and problems of the food system in the future, providing a forward-looking reference for the industry and policy makers.2) The multi-level and multi-scale characteristics of the food system determine the need to pay attention to the analysis of the relationship between subjects in the system. Among them, the

multiple levels include the natural ecosystem and the social and economic system. The natural ecosystem level includes natural resources, climate, water supply, biodiversity and other environmental factors, while the social and economic levels include food production, processing, packaging, distribution, retail and consumption. Multiple scales include different spatial scales from place to regional to global as well as time scales from short to long periods[1], [13]. A system is a collection of parts or things that form a whole[24], since the food system is composed of multiple independent subjects, its structure is unstable, in order to avoid the impact of this instability and to achieve the overall goal of the food system, it is of great significance to pay attention to the coordination and cooperation between subjects to predict the structural changes of the food system.3) The versatility of the food system requires a well-established research framework at the time of research. Food systems are developed to meet people's constantly changing need for food[20]. First of all, from the economic activities of food production and supply to the cultural activities that provide a rich food experience, the functions of food systems have become increasingly diversified. Secondly, the connotation of "food safety" is increasingly changing from the traditional quantity and quality to nutrition, health and ecological sustainability. Human beings also require the future food system to adapt to the concept of ecological civilization. With the development of economy, the external environment of the food system is increasingly complex, and the traditional agricultural economy research, food industry research, food demand research pay more attention to the research of a certain stage in the system, lack of the overall understanding and countermeasure research based on the overall goal. Mature food system theories can run these studies throughout, providing a systematic framework for research on the overall environment around food supply and demand.4) The complexity of the food system requires a multidisciplinary perspective. The concept of a food system is widely used in agriculture, food science, nutrition, and medicine to describe the complex activities that provide food and nutrition for the maintenance of health.Ingram[13]defining food system activity as "dynamic and interacting processes embedded in society, politics, economy, history, and environment" means that a small change may also have unpredictable effects at different stages of the food system. As these unpredictable phenomena accumulate or overlap, the study of food systems needs to learn from different subject concepts and theoretical tools to cope with this complexity. Therefore, scholars need to carry out interdisciplinary and multi-field joint research, and promote different disciplines to find the entry point of food system research. At the same time, we should explore new research perspectives, expand the research field of food system, and strive to use more normative research methods of empirical analysis and quantitative analysis, to conduct deeper research on food system.

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