

Urban Food Systems: Conceptual Foundations, Distinctive Characteristics, and Planning Governance

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Abstract: The safety and stability of urban food systems are essential to public health and urban resilience and have become a major concern in urban and rural planning, particularly in the post-pandemic era. From a planning perspective, this paper clarifies the concept of the urban food system, identifies its localized characteristics, and deconstructs the elements subject to planning governance. It then discusses regulatory approaches and planning strategies in response to the principal challenges currently facing Chinese cities. The analysis shows that every component of an urban food system is closely linked to planning. Key elements include agricultural land, transport and logistics networks, “last-mile” facilities, and the people who produce, distribute, and consume food. Food supply is maintained through a nested multiscale network spanning global, national, local, and community or household levels. The paper recommends coordinating territorial spatial planning, community planning, and sectoral plans according to each city's characteristics and functional role. Priorities include improving the allocation of agricultural land, clarifying functional divisions within food supply chains, strengthening transport and logistics networks, and optimizing the distribution of food-retail outlets.

Keywords: urban food system; food-system planning; food supply chain; healthy food; food desert; healthy city

Food and cities have maintained a symbiotic relationship for centuries [1]. Food shapes cities by influencing their location, construction, economic development, and political stability [2]; conversely, a city's capacity to secure a stable food supply often determines its status and viability [3]. As global urbanization deepens, cities have become the principal centers of human activity [4]. This has concentrated food-system activities in urban areas [5–6] and intensified ecological and soil degradation, food-safety risks, overweight and obesity, the coexistence of hunger with under- and overnutrition, and nutrition-related disease [7–8]. Extreme weather, public-health emergencies, and regional conflict have further increased supply pressure and uncertainty, creating unprecedented challenges for urban food security [4, 9]. Ensuring safe and stable urban food systems has therefore become a global priority [9–12].

Although the theoretical and practical importance of urban food systems is widely recognized, research has long been concentrated in agricultural economics, nutrition, and environmental studies [13–15]. Work from the perspective of human settlements—and especially urban and rural planning—remains insufficient. POTHUKUCHI and KAUFMAN were among the first to identify this gap [16–17] and, together with the American Planning Association (APA), promoted research, practice, and education in food-system planning. As a major subsystem of the complex city, the food system interacts with land use, housing, transport, the environment, and the economy, shaping both the physical environment and the public interest [17–19]. Yet its basic planning characteristics have not been fully revealed, limiting comprehensive understanding and the formulation of effective strategies.

This paper therefore asks: What does an urban food system mean from a planning perspective? What localized characteristics and governance elements does it contain? Through what forms of intervention, regulation, and guidance can planning help ensure safety and stability? To address these questions, the paper reviews food-system scholarship in disciplines related to human settlements, identifies governance elements and localized characteristics, and proposes planning responses to the main contradictions facing China's urban food systems.

1 Conceptual Foundations of the Urban Food System

1.1 Origins of the Food-System Concept

The conceptual origins of the food system are commonly traced to the “agribusiness” concept proposed by DAVIS and colleagues at Harvard University in 1957 and to the European idea of the “food chain” [2, 19–21]. As research deepened, definitions broadened. ERICKSEN [22] described the food system as activities involving production, processing and packaging, distribution and retail, and consumption. TAGTOW and ROBERTS [23] divided it into production, processing, distribution, consumption, and waste-management subsystems, emphasizing their interactions and effects on the environment, health, economy, and society.

In China, related terms include “food system,” “food-system framework,” and “agri-food system” [24]. ZHANG Qiuli [25], for example, defined the food system as an interdependent network of agriculture, livestock and fisheries, food manufacturing, consumers, catering, food circulation, and other elements. FAN Shenggen et al. [24, 26] defined the agri-food system as the totality of activities, elements, and interactions across agricultural and food value chains. Overall, the concept has expanded from a sequence of activities linking production and consumption to a systemic framework that also considers economic, social, and ecological impacts [13]. Nevertheless, it has historically remained outside the mainstream of urban and rural planning.

1.2 Urban Food Systems from a Human-Settlements Perspective

Food systems entered the field of human settlements and planning only around the turn of the twenty-first century. In 1999, POTHUKUCHI and KAUFMAN [16] argued that, although food systems received less attention than transport, housing, employment, or even environmental systems, they made major contributions to community health, resident well-being, and urban economic development. More importantly, food systems were connected to housing, transport, land, the economy, and the urban environment and therefore warranted explicit planning attention. In 2000, they further discussed why planners should address food systems and how they might do so, defining the urban food system as the chain of activities linking food production, processing, distribution, consumption, and waste management, together with all related regulatory institutions and activities [17].

Their work drew attention to “food deserts”—communities with poor access to healthy and affordable food, often characterized by concentrated poverty and social isolation [27]. *Urban Studies* and the *Journal of Planning Education and Research* subsequently published special issues on food deserts and community food systems [28–29]. POTHUKUCHI [30], CAMPBELL [31], HAMMER [32], and others emphasized community food-system education and community food assessments, urging planners to help create food systems that are more economical, environmentally benign, and socially just.

The APA then issued a pioneering policy guide on community and regional food planning [33] and developed further policies to integrate food into planning and promote healthy, sustainable urban food systems. MORGAN and SONNINO observed that the historical neglect of urban food-system planning was giving way to formal inclusion in planning agendas in many countries [34–35]. International initiatives—including the Milan Urban Food Policy Pact, the New Urban Agenda, and the FAO's City Region Food Systems approach—call for the scientific planning and governance of urban food systems to improve the balance between food supply and demand [36–37]. In 2021, the New York City Mayor's Office of Food Policy released *Food Forward NYC: A 10-Year Food Policy Plan*, the city's first comprehensive food-policy plan and a vision for a more equitable, sustainable, and healthy food system [18]. Food systems have thus become an important component of urban and community planning and an emerging planning topic requiring active intervention [2, 38].

Chinese research in human settlements began around 2010 and remains at an early stage. LIU Juanjuan et al. [39] and YI Xiaoxiang [40] introduced food systems as a new planning topic, explaining the complexity of food issues, the need for planning involvement, and the functions planning can perform. In recent years, Chinese planning scholarship has expanded rapidly [9, 18–20, 36, 41], indicating that urban food systems are becoming a significant disciplinary issue [42].

In general, the urban food system describes the life cycle of food, often summarized as “farm to table” or “field to plate”—a sequence extending from production to consumption [17, 22]. It can be defined as a complex system composed of urban food production, processing, transport, distribution, and consumption, together with the relevant actors, places, and institutions. Every stage is closely related to planning. Food-system activities interact with urban economies, employment, consumption, transport, resources, the environment, and multiple spatial systems, while also affecting public interests such as health and social stability [17]. They therefore possess a pronounced public-service character. China's rapid urbanization and changing diets impose higher requirements on the planning and management of production-to-consumption activities and present major governance challenges [19]. Advancing food-system planning is consequently important to creating healthier and more sustainable human settlements.

2 Distinctive Characteristics of Urban Food Systems

Urban food systems are complex and multidimensional, involving intricate interactions among “multidimensional elements interdependent across space and time” [43]. Identifying their components, key elements, localized characteristics, and principal contradictions is essential for setting planning objectives and designing targeted governance strategies.

2.1 Multiple Stages: Production, Circulation, and Consumption

Activities involving production, processing, wholesale, retail, and consumption are commonly grouped into three stages—production, circulation, and consumption—corresponding to producers, distributors, and consumers (Figure 1) [19, 22, 44–45]. Processing, storage, wholesale, and retail are included in circulation. Production and circulation together form the food supply chain that secures urban supply [22].



Figure 1. Components of the urban food system.

The **production stage**, the starting point of the system, includes all activities that produce food ingredients [44]: cultivating and harvesting crops, raising and slaughtering livestock, and producing aquatic products in ponds, rivers, lakes, and marine areas [22]. Production patterns vary among cities. Southern coastal cities possess paddy fields, fishponds, and marine fisheries and often practice multiple cropping, giving them more diverse and productive food systems than many northern inland cities. Cities with smaller populations and abundant agricultural land, such as Qiqihar and Panjin, may export food, while megacities such as Beijing, Shanghai, Guangzhou, and Shenzhen have large supply–demand gaps, low self-sufficiency, and strong dependence on external sources.

As China enters the later stage of urbanization and detailed territorial spatial plans are being prepared, densely populated megacities, metropolitan areas, and urban agglomerations need new forms of multifunctional peri-urban agricultural land use and regulation. Such planning can compensate for the insufficient attention paid to food-production space while reconciling territorial protection with the maximization of urban food-production benefits.

The **circulation or supply stage** moves food from farms, ranches, and fisheries to consumers. It generally involves four steps. First, raw products are transported to collection, storage, and processing centers at their places of origin for preliminary storage, slaughtering, cutting, and processing. Second, products are sent to primary wholesale markets for aggregation and redistribution; some are transported to other regions, while nearby restaurants and residents may purchase directly. Third, food moves to secondary wholesale markets, distribution centers operated by supermarket chains and e-commerce firms, central kitchens, or secondary processing plants for further processing and packaging. Fourth, processed and packaged products reach retail facilities accessible to residents.

New technologies such as cold chains and new business models such as business-to-consumer platforms and direct farm–supermarket or farm–business links have simplified circulation while imposing higher spatial and regulatory requirements [19]. Different city types perform different supply-chain functions, and larger and higher-level cities generally possess more complex networks [9]. Beijing's Xinfadi Market, Shenzhen's Haijixing Agricultural Products Logistics Park, and Guangzhou's Jiangnan Fruit and Vegetable Wholesale Market make those cities distribution hubs serving local, regional, and national markets. Planning should therefore clarify the supply-chain roles of different cities and arrange roads, logistics and storage facilities, wholesale markets, and new spatial carriers according to local conditions.

The **consumption stage** includes all activities from deciding what food to choose to preparation, eating, digestion, and waste disposal [22]. Because this study focuses on planning, it emphasizes acquisition rather than preparation and post-consumption recycling. Residents obtain food by purchasing ingredients from nearby retailers, consuming food in nearby or destination restaurants, or ordering through online platforms. Consumption is therefore fundamentally a “last-mile” issue. Although end facilities are highly market-oriented, spatially flexible, and numerous [46], they have often been neglected in conventional Chinese planning. Yet they determine whether residents can conveniently obtain sufficient food and profoundly affect nutrition and health across age, income, gender, and cultural groups. Protecting public interest in relation to “people” is a core planning responsibility.

2.2 Multiple Elements: Agricultural Land, Logistics Networks, Supply Facilities, and People

The activities above correspond to four principal planning-governance elements: agricultural land; circulation and supply networks; food-supply facilities; and people. Spatially, they are expressed as production, circulation, consumption, and associated social and living spaces and should be secured through territorial spatial planning (Figure 2).

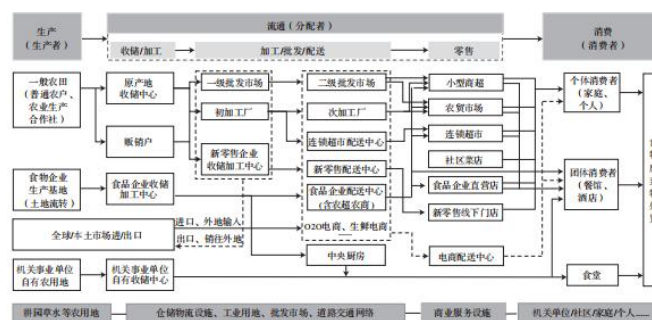


Figure 2. Actors and principal activities in the urban food system [20].

Agricultural land—including cultivated land, grassland, aquaculture waters, orchards, and some forest land—is the primary carrier of food production. Rapid urbanization and population growth have converted large areas to

construction land, while the non-agricultural and non-grain use of cultivated land has further compressed production space [19]. These problems are especially severe in the densely populated cities of southeastern China. Nationally, urbanization and rural labor outmigration have deepened regional specialization in grain production, reversing the former pattern of “grain moving from south to north” into “grain moving from north to south.” Low self-sufficiency in major consuming cities increases pressure on production regions [20].

China has responded through land-use regulation, the balance of cultivated-land occupation and replenishment, and permanent-basic-farmland protection. The emerging “five levels and three categories” territorial spatial planning system and specialized cultivated-land protection plans in provinces such as Guangdong and Hunan have strengthened control and land consolidation. A continuing planning challenge is how to regulate and guide urban agricultural space so as to improve sustainable regional production and supply.

Food circulation relies on wholesale markets, storage and logistics facilities, transport hubs, multilevel road networks, and logistics corridors. Although wholesale markets remain the dominant means of agricultural-product circulation [19], growing and changing demand has generated e-commerce distribution centers, central kitchens, cold-chain facilities, and other spatial forms. Highways, railways, ports, and airports also organize large volumes of interregional logistics. Their spatial layout determines distribution patterns, food miles, loss and carbon emissions, acquisition methods, freshness, and safety. Planning must secure land and facilities for circulation and build convenient, resilient transport and logistics networks while aligning with major national strategies.

At the consumer end, residents reach supermarkets, farmers' markets, wet markets, grocery stores, specialized fruit, vegetable, meat, grain and oil shops, new-retail outlets, and restaurants through different travel modes. Their spatial distribution affects convenience, spatial equity, and social equity. Some communities enjoy diverse stores and restaurants offering affordable fresh and healthy food, while older or low-income neighborhoods may have limited access, creating food deserts or “food swamps”—places highly exposed to calorie-dense fast food and junk food [47]. Rising incomes have also shifted Chinese diets toward more meat, fat, and sugar [48], contributing to overweight and obesity. Under the healthy-city agenda, planning should improve the accessibility and equity of healthy food, a core concern of post-pandemic resilient-city planning.

2.3 Multiple Scales: Global, National, Local, and Community

Urban food systems extend beyond municipal boundaries to all regions connected through food activities [23, 49]. They can be summarized at four scales: global; national or domestic; regional or local; and community, household, and individual (Figure 3).

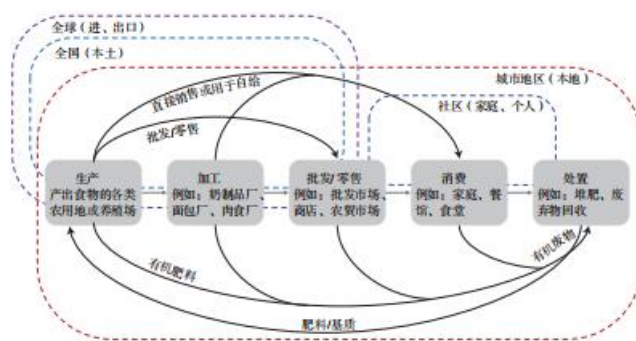


Figure 3. Spatial scales of the urban food system.

The local scale is the operational base. It connects outward to national and global supply networks while serving consumption embedded within urban communities, forming a nested multiscale structure organized around food flows. As urbanization, globalization, and dietary diversification deepen, cities produce only part of their food locally and increasingly rely on production enclaves or imports. Melons are grown in northern Myanmar for the Chinese market, while Shanghai and Guangzhou operate “vegetable-basket” bases in Guizhou, Gansu, and elsewhere. As ERICKSEN observed, only a small share of production and processing usually occurs in the city where food is consumed [22], resulting in long-distance supply chains.

At global and national scales, production, processing, and distribution follow two principal models: food is transported to local wholesale markets for further distribution, or products from a wider region are aggregated at major wholesale markets—such as Rungis International Market in France, Xinfadi in Beijing, and Shouguang in Shandong—where local purchasers buy or receive deliveries. At the local scale, all supply-chain, consumption, and post-consumption activities occur; at the community scale, retail, consumption, and post-consumption dominate. Ultimately, all scales serve community-level consumers, underscoring the public-interest character of the system and the need for planning intervention. Because wholesale and retail distribution occurs at every

scale, securing and arranging wholesale markets, supermarkets, farmers' markets, and community outlets is a central planning task.

3 Planning and Governance Strategies

Food is a basic livelihood need. The safety and stability of the urban food system directly affect residents' fundamental interests, and territorial spatial planning oriented toward "people's cities" should embed food systems within its institutional framework [19]. China faces three broad challenges. In production, rapid urbanization, declining agricultural land, population growth, and dietary change create a mismatch between people and land. In distribution, functional divisions within supply chains remain unclear and circulation-system planning requires improvement [9]. In consumption, unstable or inappropriate diets contribute to obesity, overweight, and nutrition-related disease [7], while access to food—especially healthy food—is unequal [50]. Coordinated territorial spatial, community, and sectoral planning is needed to address these challenges.

3.1 Production: Improve Agricultural-Land Allocation and Stabilize Agricultural and Subsidiary-Food Production

To address the contradiction of "many people and little land," "large cities and small-scale agriculture," and dependence on external grain sources, territorial spatial planning must guarantee the scale of agricultural-land supply.

First, constraints assigned by national and provincial agricultural-production strategies should be translated into municipal and county plans. Suitability evaluations and the "three zones and three lines" should be used to delineate agricultural production space (Figure 4). Permanent basic farmland should be rigidly controlled and used for grain and important agricultural products [19–20]. Within general agricultural space, internal conversion and non-grain use can be regulated more flexibly under annual occupation–replenishment and entry–exit balance rules [51].

As diets diversify from predominantly plant-based food toward combined plant and animal products, demand for meat, aquatic products, fruit, and vegetables rises [48]. Grain and cooking oil can be stored for longer periods, whereas fresh products depend more heavily on cold chains and costly storage. Under the "greater food" concept, general farmland may therefore support higher-value vegetables, feed crops such as soybeans, and diverse production forms where the cultivated layer is not damaged and rapid restoration to farming remains possible [52].

Second, land consolidation and transfer should be accelerated. Southern cities contain extensive hilly and mountainous terrain and highly fragmented farmland. Recombining production factors and consolidating small plots into larger units can improve productivity. The Huangyan mandarin-orange base in Zhejiang, for example, integrated contiguous hillsides, introduced small-track transport, mechanized production, and intelligent sorting, reducing labor costs and increasing income. Urbanization-released homesteads and vegetable plots, newly reclaimed land, and idle farmland should be periodically added to general agricultural land; large, high-quality parcels can be designated as reserve areas for permanent-basic-farmland supplementation.

Western food-urbanism ideas may also be adapted by inserting community agriculture, facility agriculture, and urban farming into scattered plots. Smart agriculture should support the national strategy of storing grain in land and technology, while planning should explore plant factories, marine ranches, "blue granaries," woody grain and oil crops, and insect protein. Land-scarce eastern coastal cities may additionally explore interregional trading of agricultural and construction-land quotas under provincial coordination, including transactions with provinces rich in agricultural land or "vegetable-basket" production.

Third, agricultural-land supply should emphasize both quantity and quality. Differentiated planning should clarify relationships among high-standard farmland, grain-production functional zones, and protected spaces for vegetables, fruit, aquaculture, and other products [52]. Detailed plans can define land-use units, crop plans, planting indicators, and quality controls, while township-level plans identify specific parcels and project indicators [53]. High-standard farmland construction, comprehensive land consolidation, ecological restoration, differentiated use-control rules, and rotational fallowing should be advanced. Because pesticides and chemical fertilizers generate environmental externalities, organic production should be encouraged where feasible. Crop rotation and intercropping can improve soil and yields [54], while abandoned and fragmented plots can be used to test aquaponics, rice–fish systems, agroforestry, and other locally appropriate models [36].

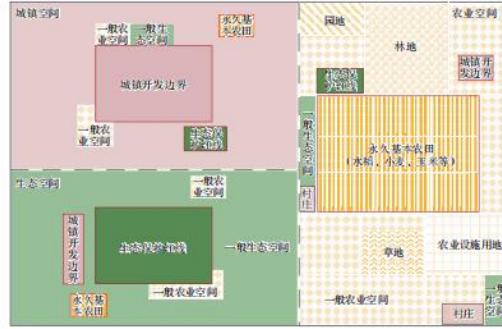


Figure 4. Land-control and spatial-layout model for the food-production stage.

3.2 Circulation: Clarify Supply-Chain Roles and Strengthen Transport and Logistics Networks

Drawing on XU Shiguang et al. [19], Chinese cities can be classified from a circulation perspective as hubs, suppliers, or terminals, each requiring differentiated territorial-spatial support.

Hub cities are generally higher-level centers that aggregate and distribute food regionally or nationally. They must serve local demand and supply surrounding hinterlands. Beijing uses Xinfadi and Jinxiu Dadi markets, while Guangzhou relies on major South China fruit and vegetable markets. Such cities should plan circulation systems regionally, allocate land beyond local population needs, and strengthen supporting facilities around transport hubs and corridors, including logistics parks, regional freight terminals, and cold-chain transfer warehouses (Figure 5).

Supplier cities are often general cities whose principal role is production, although they also circulate food. Cities such as Suihua, Zhanjiang, and Shouguang supply the other types through wholesale markets and new distribution platforms. Their plans must protect production space while supporting supply-chain infrastructure.

Terminal cities include both high-level and ordinary cities in which circulation and aggregation are not dominant functions. They rely on supplier cities or global markets, as Shenzhen and Dongguan do. Planning should focus on local demand, external gateways, and logistics networks that ensure efficient input and distribution.

Within cities, wholesale markets, central kitchens, cold-chain storage, import–export hubs, and logistics parks should be arranged as key nodes and connected through robust networks. China's *Guidelines for Municipal Territorial Spatial Master Planning (Trial)* already require improved logistics systems and support for new business models [19]. Wholesale markets may be divided into origin markets serving local producers within a defined radius and destination markets that handle high-volume inflows and outflows and serve both local and external distribution [19, 56]. Sectoral plans for roads, freight, logistics hubs, and supply chains should be coordinated to create cold-chain networks centered on major transport hubs, supported by logistics parks, distribution nodes, and multimodal transport. Priority land supply should be provided for key logistics and cold-storage facilities.

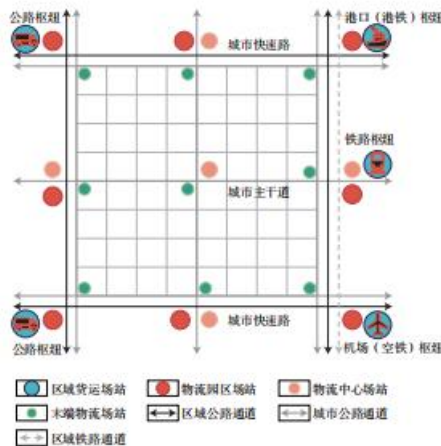


Figure 5. Layout of transport and logistics facilities in an urban region.

3.3 Consumption: Optimize Retail Networks and Improve Accessibility and Equity

At the consumption stage, spatial distribution of food-retail outlets should be optimized to improve convenient and equitable access. Modern residents obtain food from supermarkets, farmers' markets, specialized stores, restaurants, and online platforms, all of which should be secured through a combination of market mechanisms

and planning controls. Facility deficits are especially pronounced in old neighborhoods with concentrations of older and low-income residents [19].

Community life-circle planning and the 15-minute-city concept provide an effective basis for last-mile food supply. Facility types, scale, and quantity should be specified according to supply and demand within a 15-minute community catchment (Figure 6). Population profiles, existing distribution, consumption behavior, and spatial analysis can then guide the placement of different retail formats and improve accessibility and equity. In older communities, public-interest and age-friendly renewal should be supplemented by community kitchens or service teams to protect spatial and social equity.

With overweight, obesity, and nutrition-related diseases increasing, community planning should combine healthy-diet education with targeted control and business programming. Healthy-food stores and facilities selling fruit, vegetables, and fresh meat should be encouraged, while outlets dominated by high-sugar, high-fat, and high-calorie products should be restrained to address food deserts and food swamps. Families should also be encouraged to produce some food locally or establish stable direct relationships with farmers through community agriculture and community-supported agriculture (CSA). Community farming creates opportunities for interaction, strengthens social ties, activates neighborhoods [57], promotes healthy cooperation between urban residents and farmers, and supports urban–rural integration and rural revitalization. Small gardens on commercial rooftops and in peri-urban villages in Beijing, Shanghai, Guangzhou, and other large cities are emerging local practices worthy of planning support.

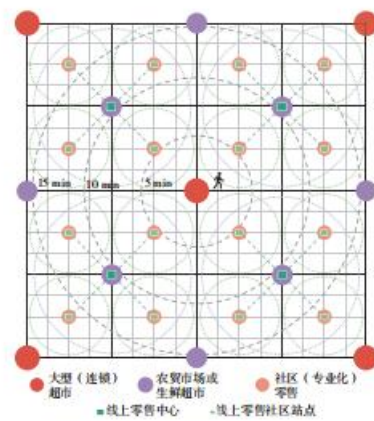


Figure 6. Planning model for end-of-chain food-supply facilities.

4 Conclusion

This study identifies the distinctive characteristics and planning-governance elements of urban food systems and proposes strategies for ensuring their safety and stability. The urban food system is a complex interaction among production, circulation, and consumption. It connects agricultural land, transport and logistics networks, last-mile facilities, and people and maintains supply through nested global, national, local, and community or household networks. Because every stage is closely tied to urban planning, the discipline should intervene actively, maximize resource efficiency, and safeguard system stability. Territorial spatial planning, community planning, and sectoral plans should be coordinated to improve agricultural-land allocation, clarify supply-chain functions, strengthen logistics, and optimize retail networks.

Urbanization, population growth, external uncertainty, and new technologies and business models make incorporation of food systems into planning both feasible and necessary. Chinese cities differ greatly in level, function, and characteristics, and therefore require different positioning, priorities, objectives, and governance mechanisms. A classification and evaluation system should be established, followed by targeted city-specific analysis. Future research should also explore food-system-centered urban governance, participatory planning, and food policy and promote a shift from efficiency alone toward equity and resilience.

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