Theoretical Approaches for Effective Sustainable Urban Food Policymaking

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The emergence of food strategies and policies in many cities worldwide (chapter "Urbanization Issues Affecting Food System Sustainability; Nicolas Bricas") has prompted researchers to investigate associated building, support and assessment processes. In the light of the limits of industrialized food systems, these strategies and policies are driven by the need for a transition towards more sustainable food systems. This chapter looks at the conceptual frameworks used by researchers to assess urban food system sustainability.

Diversity and Complexity

The main problem currently facing researchers and public, private and community actors is the need to account for the complexity of the issue, including the extent of stakeholder involvement, policy areas and the scope of governance and action (Brand 2015). Until recently, the food issue has been handled on a sectoral basis at international, European and national levels. The dimensions of this issue have been slotted into separate 'silos', so it has only been dealt with regard to its agricultural, commercial, normative health security and, more recently, public health aspects (Brand 2015). In 2007, Guillaume Dhérissard and Dominique Viel underlined the risk of vulnerability and perverse effects linked to segmentation of the food issue (productivity, health security, ecology, marketing, etc.), which could lead to disruptive situations. They pointed out the need to consider food as a complex social phenomenon with a complete change of approach in favour of sustainable urban food systems and governance.

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Moreover, the first report of the International Panel of Experts on Sustainable Food Systems (IPES-Food) called for a more holistic view of food systems (IPES-Food 2015). They proposed to look at food systems as a network of complex interactions between actors and system processes, and as a network of policies and regulatory frameworks. The complexity paradigm suggested by Edgar Morin highlights that a *whole* is not simply the sum of its parts—the complexity binds the parts to the *whole* and the parts to each other. This paradigm provides a structure for our thoughts on sustainable urban food systems. It is thus understood, for instance, that urban agriculture considerations cannot be limited to a nurturing approach, but should also include issues pertaining to education, social ties, aesthetics, biodiversity conservation, etc. (Duchemin et al. 2010; Duchemin 2013).

That said, the hardest part is to determine how to identify levers that could improve the sustainability of food systems based on a holistic view, and how to take the complexity, diversity and totality of sustainable urban food systems into account. This chapter successively outlines ways of dealing with this complexity.

Scientists are addressing this complexity by developing conceptual frameworks and representation models to encompass various aspects of sustainable urban food systems within a common vision. These analytical and insight-generating approaches are associated with forms of representation and single- or multi-disciplinary conceptual references (geography, political science, agronomy, economy, sociology, etc.). They offer different ways of identifying problems, finding solutions and enhancing the sustainability of urban food systems, while mobilizing practical tools for their assessment (phosphorus and nitrogen flows, food kilometres, food desert mapping, food footprint, carbon footprint, etc.).

There are several possible integrated ways of dealing with the issue of sustainable urban food systems, by focusing on: the food system, food sectors, social practices, policy areas or instruments, sustainability issues, spatial representations, etc.

These conceptual frameworks are not always explicitly geared towards promoting sustainable urban food policymaking. They are also used to gain insight into and describe urban food systems, in addition to building simulation models and developing approaches to assess the impacts of specific policies, projects or initiatives.

Through this diversity of approaches, a range of different solutions may be proposed for building more sustainable food systems. Combinations of approaches and tools may be able to effectively account for the complexity of the sustainable urban food issue—it is not necessary to build a widely applicable blanket framework integrating all approaches for this task. This notion of arrangements and combinations is common in many research fields that address the sustainability issue, including nutrition through studies on individual dietary diversity and its impacts, and economics via combined policy assessments (Esnouf et al. 2011). As diversity is now recognized as being a resilience factor, a range of combined approaches should be considered as a way to achieve more sustainable urban food systems.

In this chapter we thus present three types of approach that we feel are effective for drawing up sustainable urban food policies: systemic approaches that strive to incorporate sustainability issues in the food system analysis; approaches developed

for analysing and building sustainable cities while addressing food issues; and finally a sustainable development approach to urban issues and food.

Food System Approaches

Systemic and Modelling Approaches

Systemic approaches have been used to understand and describe how food systems function (Rastoin and Ghersi 2010). When implemented by agrifood economists, these approaches are based on a functional view of food, describing a chain of operations and sectors (production, processing, distribution, consumption disposal/recycling, regulation). The food system has thus been defined as:

> […] an interdependent network of actors (businesses, financial institutions, public and private bodies) located in a given geographical area (region, State and plurinational area), while directly or indirectly participating in the creation of flows of goods and services geared towards fulfilling the food needs of several consumer groups locally or outside of the considered area (Rastoin and Ghersi 2010: 19).

The focus here is essentially on how the supply is organized.

Rationales have changed in favour of cyclical views, with the development of the circular economy concept, along with growing awareness that the waste produced by our food system is a resource. Analysis and assessment tools have thus been developed to gain greater insight into how territorial food system cycles work. For instance, on the basis of industrial ecology research, territorial ecology has given rise to the territorial metabolism concept, which makes it possible to get a snapshot of territorial food supplies: "[…] the analysis of material (raw), energy and substance flows, as well as the measurement of environmental footprints are concepts and methods that all contribute to this [territorial metabolism] characterization" (Barles 2014: 2).

Territories are seen as living organisms based on a 'lifecycle' rationale focused on inflows, 'digestion' and outflows (chapter "Urbanization Issues Affecting Food System Sustainability; Nicolas Bricas", Box 1.1). As Barles points out in her study on the urban metabolism of Paris, the global approach to flows is also interesting because it highlights the upstream and downstream dimensions (fertilization and waste management) of the food issue, which have yet to be sufficiently accounted for in thinking and initiatives:

> It reveals the need for new public policies, especially concerning waste management—to reduce construction material imports—and urban planning—to reduce their consumption. In addition, more research and the development of action plans to link urban and agricultural policies to improve the use of urban fertilizers and to favour local food supply are required (Barles 2009: 911).

Systemic approaches focus on the relationships between system components, their interactions and interconnections. For example, the model developed by

Vanessa Armendáriz and colleagues reveals the interdependence between the different components of food supply and distribution systems. This model has a system perspective and applies the system dynamics method to gain insight into food supply systems. Although developed to assess situations in developing countries, the model is otherwise especially interesting because it offers a representation that sheds light on the overall functioning of a given food system in interaction with others (habitat, movement, economy, technology, etc.). It shows the linkages and reciprocal influences between these systems, as well as cause-effect and carryover relationships between the different components. This facilitates identification of indirect causes or effects that may not be foreseen at the outset. It also serves as a research tool to simulate the impacts of policies targeting certain levers on the entire food system.

A Systems Approach to Urban Food Supply and Distribution Systems[1]

Vanessa Armendáriz, Stefano Armenia, Alberto Stanislao Atzori

This section presents a framework to gain a greater understanding of food supply and distribution systems (FSDS). The latter are described using system thinking (ST) and system dynamics (SD) approaches to highlight how the identification of FSDS feedback structures can guide policymaking to meet urban food needs.

A system perspective implies the presence of interconnected elements to fulfil a function or an objective over a given time period (Meadows 2008). Those elements can be physical or informative. When observing food systems, interrelationships may be detected between different elements involved in food production, supply, processing, distribution and consumption activities. A systemic and dynamic analysis can help gain insight into food system feedback loops and accumulation processes in urban environments. Accumulation processes determine changes in critical resources and drivers of food production and distribution, and are essential for assessing their sustainability.

What Are System Dynamics (SD)?

SD techniques may be used to assess a system structure, characterized by feedbacks among its parts. The system behaviour over time is the result of the system feedback structure, which can be qualitatively conceptualized through causal loop diagrams (CLD). Causal maps (or CLD) may be drafted to map feedback within and across

[1]The authors would like to thank the Food and Agriculture Organization of the United Nations (FAO/AGS – Rome, Italy) for providing valuable information and prior knowledge on the FAO FSDS Framework of Analysis, and for precious help in building the revised SD framework.

interacting subsystems. Two kinds of loops are studied on the basis of their characteristics:

1. Reinforcing: self-reinforcing loops. This implies that the system grows exponentially if these loops are dominant or the sole ones in the system.
2. Balancing (B): self-correcting loops that counteract change. Balancing loops seek equilibrium.

The system dynamics (SD) arise from the interacting complex network of these two kinds of loops (Sterman 2012). The SD can be analyzed through simulation after building a stock and flow diagram (SFD), also referred to as an SD quantitative model. The model formalization consists of describing, through an SFD, involving the presence of differential equations, how the system variables are interconnected and how the accumulation processes are determined by flow changes that alter the state of the system levels (or stocks).

System Dynamics (SD) Applied to Study Urban Food Systems

SD modeling is an iterative process to get a better understanding of the system (Ghaffarzadegan et al. 2011). As shown in Fig. 4.1, the modeling process requires the identification and definition of the problem. The overall system conceptualization results in a qualitative or quantitative model formalization, which often

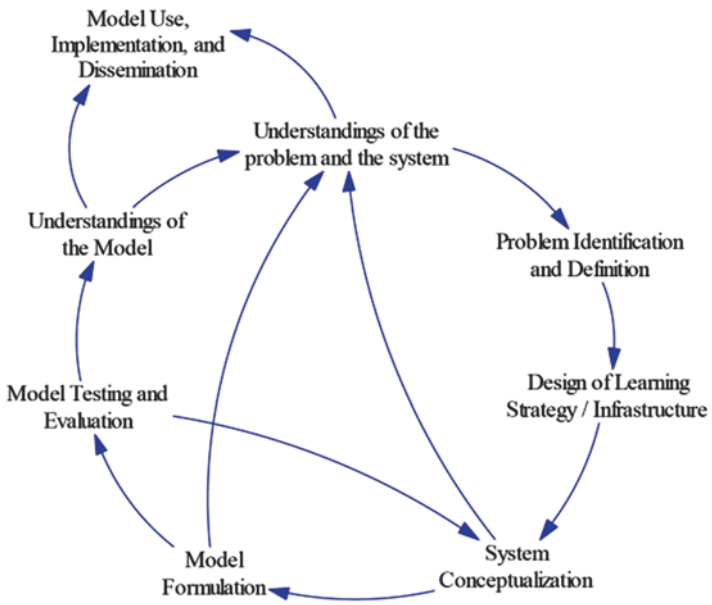

Fig. 4.1 Overview of the SD modeling process. (Zock 2004, adapted from Richardson and Pugh 1981)

improves our initial understanding of the system. The simulation model enables assessment of the model validity with empirical data, testing policy alternatives and gaining insight to increase the likelihood of performing a good policy analysis.

An example of the application of the SD method to study urban food systems is the FSDS framework setting model (Fig. 4.2) created on the basis of a detailed study leading to the publication of the Methodological and Operational Guide to Understand FSDSs (Aragrande and Argenti 2001) and complementary FAO documents (Argenti 1999a; b; Balbo et al. 2000; FAO 2000). The aim of this work was to get an overall understanding of urban food systems. This model was designed on the basis of the dynamics that generally prevail in developing and transitional countries. In the modelling phase, we decided to not include the characteristics of developed cities. This approach, in fact, required some simplification of the first detailed FSDS model (Armendáriz et al. 2015a) in order to capture—at an aggregated level, while maintaining its validity—the main system interactions, including non-food system issues.

In Fig. 4.2, blue arrows indicate a positive causal effect of an independent variable change on the dependent variable, i.e. when an independent variable increases or decreases, the dependent variable changes in the same direction. The red arrows indicate a negative causal effect among independent and dependent variables, i.e. when an independent variable increases the dependent variable decreases. The bold blue arrow represents the main question addressed in the FAO guide, i.e. "how can the urban food needs of a growing population be met?" The main feedback struc-

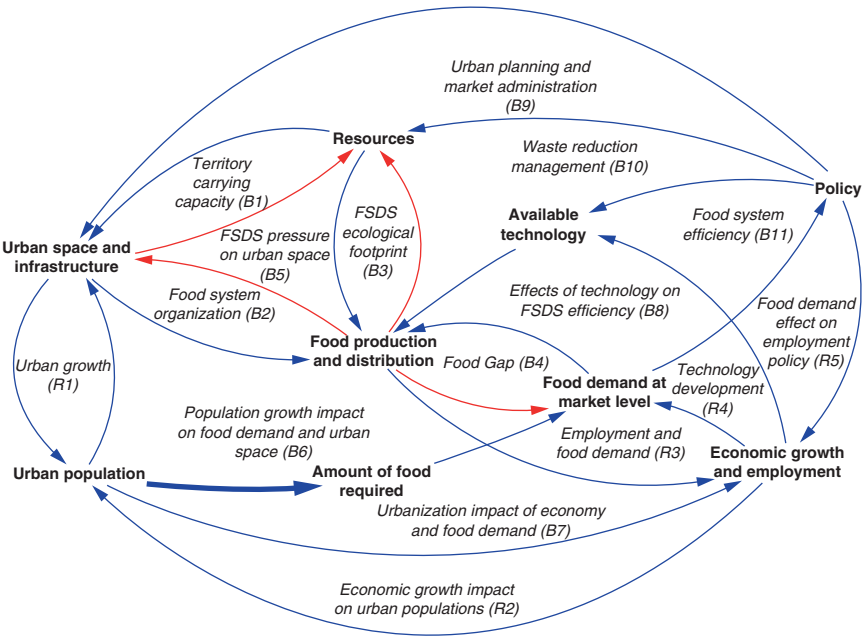

Fig. 4.2 FSDS framework setting model

tures are identified and named according to their function in the system: B1 Territory carrying capacity, B2 Food system organization, B3 Ecological footprint, B4 Food gap, B5 FSDS pressures on urban space, B6 Population growth impact on food demand and urban space, B7 Urbanization impact on economy and food demand, B8 Effects of technology on FSDS efficiency, B9 Urban planning and market administration, B10 Waste management reduction, B11 Food system efficiency, R1 Urban growth, R2 Economic growth impact on urban populations, R3 Employment and food demand, R4 Technology development, and R5 Food demand effect on employment policy.

The Urban growth (R1) system loop represents the feedback between the urban population and the urban space, which is a self-reinforcing relationship. Urban population growth increases the need for new infrastructure and urban space, meanwhile urban growth functions as a population attractor (World Bank 1999). The Economic growth impact on urban populations (R2) loop explains an additional self-reinforcing dynamic observed in developing and transition countries, i.e. economic growth in cities increases the rural population migration rate, in turn increasing the labour force for economic activities (UNDP 1999; Waibel and Schmidt 2000). Conversely, developed countries have different urban growth dynamics due to their different economic development patterns (Kastner et al. 2012).

The impact of urban growth may be noted in land-use changes, increased pollution and changes in non-renewable resource availability (Forrester 1970). This could be explained by the Territory carrying capacity (B1) of the system, which represents the maximum limit for continuing to produce or supply raw materials given the extent of resource depletion (Brenner 2014).

The relationship between urban space for markets and food logistics forms a balancing loop called the Food system organization (B2). Land devoted to urban activities (housing, services) reduces the space available for food markets and roads. Meanwhile, in the long-term, an increase in road coverage leads to an increase in urban agglomerations, thereafter increasing merchandise transport times and thus distribution costs (Aragrande and Argenti 2001). The FSDS Ecological footprint (B3) is explained by the environmental impacts of food production, processing, distribution and consumption activities involving renewable and non-renewable resource use, waste and pollution (Cordell et al. 2009; Ericksen 2008). The FSDS Pressures on urban space (B5) loop indicates that food system activities are only possible after urban space use and resource consumption issues have been addressed. The resource competition relationship between activities could lead to resource overconsumption, representing a risk for both the food system and the urban system.

Food system business revenues ensure economic growth, while the resulting employment opportunities provide income for the community, therefore increasing food demand at the market level. These relationships are represented by the Employment and food demand (R3) loop**.** The relationship between the food demand at the market level and food production and distribution activities is described by the Food gap (B4). Food production and distribution management deficiencies or even a resource crisis in the system could decrease the urban food supply and increase the food gap (Hanjra and Qureshi 2010; Pimentel and Pimentel 2007).

The Population growth impact on food demand and urban space (B6) represents the food demand linked with population growth, which boosts food production and distribution processes. However, population growth also requires an increase in urban space and infrastructure, which in turn leads to urban growth that attracts populations (Ehrlich and Holdren 1971; Waibel and Schmidt 2000). Another external balancing loop, i.e. the Urbanization impact on economic growth and food demand (B7), was discovered after assessing the population impact on economic growth. Employment increases income, thus increasing the food demand, while economic growth increases urban growth, which will boost the food production and distribution process, leading to competition with other industrial activities and housing for space and infrastructure (Allen and Sanglier 1978; Batty 2008; Pumain et al. 2015).

Indirect effects of the food market on economic growth and technological improvement are accounted for by the Technology development (**R4)** loop (Boserup et al. 1983). Enhancement of the food supply chain efficiency depends on the organization and technology levels applied to food production and processing, as explained by the Effects of technology on FSDS efficiency (B8) loop.

System Dynamics (SD) to Enhance Urban Food Policy

The results of a detailed analysis of FAO recommendations to policymakers in developing countries highlighted the target of improving food availability at the market level (Armendáriz et al. 2015a). Policy proposals were directly stimulated by variations in food demand. However, the FSDS framework (Fig. 4.2)—by identifying important interrelationships among urban elements and providing an aggregated view of the urban food system structure—revealed the following insight regarding the effectiveness of urban policies geared towards meeting actual food needs.

The urban food demand differs from the actual amount of food required in a city. The socioeconomic conditions determine the extent to which people are able to use their income to fulfil their food needs. Therefore a sound urban food policy should aim at reducing urban poverty levels. Economic growth and employment are needed to ensure access to food (Zezza and Tasciotti 2010; Von Braun 1995). The Food demand effect on employment policy (R5) loop explains how income is directly related to food consumption in terms of amount and quality. The socioeconomic status of the urban population is also closely related to health problems such as malnutrition and obesity. The impact of economic development on diet and health changes should be taken into account when planning interventions (McLaren 2007; Popkin 2001).

The Food system efficiency (B11) can be boosted by increasing the technology level used in food production and processing activities. Natural resource consumption is closely related to the efficiency of supply chains, consumer lifestyles and waste disposal processes. Environmental sustainability and urban metabolism indicators should be taken into account when designing food policies for rural and urban areas. Excessive use of natural resources due to the growth of human activities (i.e. in terms of both supply chains and consumption) could deplete system inputs and put the viability of the system at risk (Giampietro et al. 2013).

Waste reduction and management (B10) policies can improve the supply chain efficiency and reduce pollution. B10 and B11 structures represent balancing feedbacks that aim at increasing food supply by tackling urban inefficiencies and negative environmental impacts, while also reducing the urban food gap (Godfray et al. 2010; Parfitt et al. 2010).

Food policy and regulations (administrative protocols, regulations and laws) impact the quality of food to which communities have access. Different policy recommendations should be listed for the processing, distribution or consumption of different foods based on their core properties (high and low quality standards, prices, brands, food product lifecycles and availability of substitute products). For example, perishable and nonperishable foods have very different characteristics related to their lifecycle. Processing, distribution and consumption processes regarding these foods have constraints related to the available infrastructure, urban spatial organization, business logistics, consumer preferences, health risks, etc. (Beske et al. 2014). Apart from delays and side effects in some special food chains, there is a risk of causing urban food policy failures. For example, dairy products need a well developed refrigeration system, while an improvement in the storage capacity for dairy products would not be worthwhile if the distribution processes are limited by an absence of roads or by normal urban congestion and traffic, which would cause distribution delays.

Urban planning should be considered to optimize FSDS organization by setting up an effective food distribution infrastructure able to support both growing populations and the food gap (Pothukuchi and Kaufman 1999; Pothukuchi 2004; Born and Purcell 2006). The Urban planning and market administration (B9) loop considers key areas for policy intervention. These areas are related to urban spatial management and innovations, urban density and congestion, adequate roads and planned city allocation of formal and informal markets according to the urban population distribution and their socioeconomic characteristics. Loops B1, B2, R1, B5 highlight the indirect effects of such urban planning policies.

Preliminary outcomes from the studies on the application of the SD methodology to the understanding of FSDS (Armendáriz et al. 2015a, b, c) underlined that improving food system operations was not enough to cope with expected urban population growth, especially in developing countries. However, it turned out that urban population growth was not the main problem. The increase in urbanization processes is what actually causes the greatest pressure on food system support structures due to their impacts on land use patterns and their attraction for migrant populations and conurbations.

The Systems Approach for Food Policies in a Nutshell

A systemic view helps identify relevant issues beyond those related to food and which are often overlooked in urban food system analyses. The system dynamics (SD) method enables us to gain greater insight into interconnections between elements from which the structure of food systems can be analysed. Understanding

how food systems work can support decision makers in identifying the actual problems and in formulating better policies to solve them, rather than just tackling the symptoms. Simulation exercises can even enable testing of different policies in a virtual environment. The example illustrated in this work has shown that it is essential to assess the environment in which FSDS are embedded. Understanding how the city is related to various physical or material issues (resources, technology, economy) is essential to gain insight into the origins of system pressures, while identifying possible intervention points for sustainability policies. The limitations of the FSDS model presented in Fig. 4.2 include: the focus on the FSDS structure and urban dynamics in developing and transition countries, especially megacity trends; the fact that the model was built on the basis of the FAO guide, with the aim of understanding FSDS in developing countries, and; the model's high level of abstraction, with the FSDS framework still being a qualitative approach to urban food systems. More comprehensive and robust policies are possible by integrating different methodologies in urban food system analyses, including agent-based modelling (ABM), structural network analysis (SNA), and geographical information systems (GIS).

Adaptive System

Systemic and modeling approaches provide an overview of the state of food systems, especially regarding the food supply organization and functioning mechanisms. However, as highlighted in the previous conclusions, these approaches must be combined with other tools to be able to gain insight into the full complexity of sustainable urban food systems.

For instance, it is hard to incorporate shifting uncertainties and dynamics related to stakeholders' practices into modelling approaches, but territorial ecology studies—at the crossroads between systemic and modelling analyses and more socially-oriented analyses on stakeholders (Barles 2010)—may help overcome this problem. Moreover, Debuisson (2014) combined a quantitative material and energy flow approach with a more qualitative approach that included role playing and modes of stakeholder interaction in the organization of these flows in order to analyse food and energy systems and understand how sustainable territorial dynamics become anchored. Approaches that stem from the complexity paradigm focus on 'adaptive systems', as opposed to 'deterministic systems' (end states) whose behaviour can be predicted (Cloutier 2013). In an adaptive system, the same stimulus can produce two different behaviours since they are dependent on the relationships between elements and not on the individual rationales of these elements. Hence, this approach can account for the fact that the same stimulus could trigger different reactions depending on multiple factors such as time, desire, humour, personal history, hunger, etc. This complex adaptive systems approach also helps us gain a more dynamic understanding of how urban food systems work.

This illustrates the advantage of combining the systemic approaches presented here with approaches that help gain insight into the practices and action capacities of system actors (who are linked with the sociopolitical, human, historical and cultural setting) as a way to grasp the complexity and sustainability of urban food systems.

Territorial Food Systems

A territorial view of food systems has more recently developed, particularly via the globally renowned city region food systems (CRFS) concept[2] and the territorial food system (TFS) concept[3] developed in France, both of which encompass the territory and agrifood sector concepts (Rastoin 2015). They are in keeping with literature that has emerged since the outset of the new millennium regarding the development of so-called 'alternative', 'regional' and 'local' food systems to better address sustainability challenges (Kneafsey 2010; Feenstra 1997, 2002; Feagan 2007; Hendrickson and Heffernan 2002).

These new concepts place the food system in a political, cultural, historical, agricultural and landscape setting. They contend that urban regions (a city associated with a more or less extensive supralocal area) have a key role to play in governance and in enhancing food system sustainability. These concepts reflect the hypothesis that a territorial approach could help solve some of the problems outlined in chapter "Urbanization Issues Affecting Food System Sustainability; Nicolas Bricas". They provide solutions for the issue of detachment (geographical, cognitive, economic) between urban and rural citizens, consumers and producers.

CRFS offer better integration of urban and rural issues regarding food supply through strengthened relationships between these two spaces (Jennings et al. 2015). Without simply advocating food autonomy or 'localism' as a blanket solution, territorialization of the food system concept has been put forward as a way to regain control of a system that eludes us in its global scope. The aim is to build a comple-

[2] A city region food system is defined as: "the complex network of actors, processes and relationships to do with food production, processing, marketing and consumption that exist in a given geographical region that includes a more or less concentrated urban centre and its surrounding periurban and rural hinterland; a regional landscape across which flows of people, goods and ecosystem services are managed." (Jennings et al. 2015)

[3] A territorial food system is defined as: "a consistent set of agrifood chains located in a geographical area of regional dimension. This concept focuses on maximizing the local integration of sectors as opposed to long globalized agrifood chains" (Rastoin 2015). In line with the mandate of the United Regions Organization (ORU Fogar), in the framework of the International Year of Family Farming, the Association of Regions of France published the Declaration of Rennes for Territorial Food Systems (TFS). This declaration underpins the position of the association in favour of promoting initiatives to entrench agrifood systems and their defense in local national and international public policies.

mentary alternative to the agroindustrial model that prevails with regard to food systems (Rastoin 2015).

These approaches mainly aim to encourage urban governments to account for food in their policymaking, in addition to the impacts of their policies beyond the territories they administer. They conceptually contribute to gaining greater insight into scaling issues by suggesting that multiscale food challenges should be taken into account locally.

Sustainable City Approaches

The territorial approach to food systems dovetails with other sustainable city planners' approaches. The food issue has, since the beginning of the new millennium, been placed back on the urban agenda of developers (Pothukuchi and Kaufman 2000). These approaches tackle urban food systems by taking spatial occupancy and organization or individuals and their practices into consideration—a viewpoint that complements that of the systemic approach.

Sustainable City Planning

The sustainable development target was promptly taken up by cities to such an extent that an 'urban shift' has been noted with regard to urban territorialization (Emelianoff 2007). Sustainable city concepts, indicators and models have been developing since the 1980s, in addition to the emblematic United Nations Agenda 21 action plans for sustainable development.

Sustainable city thinkers recognize the need for a change to a more sustainable and resilient urban system. Problems facing cities are not the specific problems identified in chapter "Urbanization Issues Affecting Food System Sustainability; Nicolas Bricas" but may be approached via the broader sustainable development concept, which is focused on concerns such as climate change mitigation, air, soil and water quality enhancement and rational resource management (water, energy, soil and biodiversity). These global issues are associated with specifically urban challenges such as urban growth, sanitary issues, water and energy supply, socioeconomic and sociocultural issues, waste management and spatial planning. Urban architects, planners and developers thus design sustainable city models geared towards mainstreaming all urban sustainable development issues under one umbrella. These models are shaped by life science concepts, as well as economic, social and political science concepts and are based on cycles and resilience factors, e.g. the symbiotic city (Ranhagen and Groth 2012) and biophilic city (Beatley 2010) approaches. These sustainable city approaches overlap sustainable development issues with a variety of fields of urban action. For instance, the SymbioCity approach developed by Ulf Ranhagen and Klas Groth (2012) interlinks the following fields:

energy, architecture, water supply, waste management, industry and infrastructure, landscaping, urban transport and traffic, information and communications.

Food is not treated separately under these approaches and is at best one of many elements in the overall design of cities.

Urban Food Planning

Food is the focus of a targeted approach in the urban food planning field. Since the 2000s, a movement that brings together researchers and practitioners has been spreading in North America and northern Europe focused on integration of the food challenge in planning in association with the urbanization process. This field of research and action is structured on the basis of the noteworthy absence of food in the purview of planners. The terms used with regard to this absence highlight the sudden awareness of a missing piece in the thinking: "a puzzling omission" (APA 2007), "the dark side of urban dwelling?" (Viljoen and Wiskerke 2012), and "this intellectual lacuna" (Morgan 2015).

First, Pothukuchi and Kaufman (1999, 2000) showed that food is a key element in the functioning of the territories and as important as habitat and mobility which are the focus of urban planners' interventions. Secondly, the urban environment has been identified as an essential framework for showcasing faults and new food practices (Sonnino 2009; Morgan and Sonnino 2010; Morgan 2015). A 'new food equation'[4] is essential for the future development of areas undergoing an urbanization process (Morgan 2009; Morgan and Sonnino 2010).

This field is part of a new trend and mindset linked with the urbanization process and the territorial sustainability paradigm, where the role of actors involved in the food system as well as the planning of urban and metropolitan areas are reconsidered from a food perspective (Fig. 4.3).

Urban planning is a tool for building more sustainable and equitable food systems through a range of policy areas, while also reconsidering the status of food systems in production and spatial organization mechanisms (especially urban). Territorial configurations provide testing grounds for responses to major global issues in which the new food equation is nested.

This field offers an integrated vision of food systems whose governance includes civil society, private and public actors (Fig. 4.4).[5]

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[4] The new food equation is based on the sudden increase in food prices in 2007–2008, which gave rise to new food security issues of global scope with regard to quantitative aspects of food supply, climate change, conflicts around arable lands and the urbanization process (Morgan 2009; Morgan and Sonnino 2010).

[5] In Figure 4.4, we have retained the different items concerning the food issue as presented in the schematic diagram of Johannes S.C. Wiskerke (2009) because they seem clearer than in the FoodLinks research report of Ana Moragues et al. (2013). However, we have kept the actor categories presented in the latter report because they seem more precise than those presented in Wiskerke (2009). We have not retained Weskerke's categorization and characterization of relationships

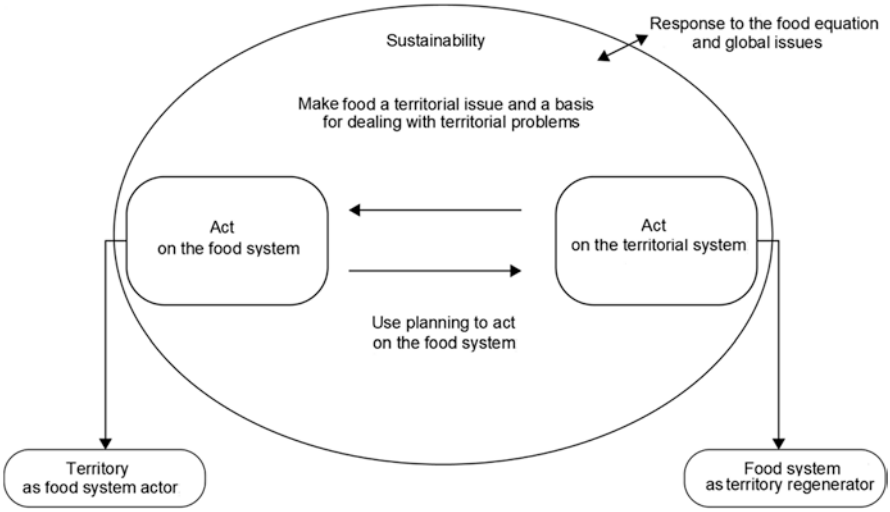

Fig. 4.3 Urban food planning – linking sustainability, the food system and the urban system. (Source: Brand 2015)

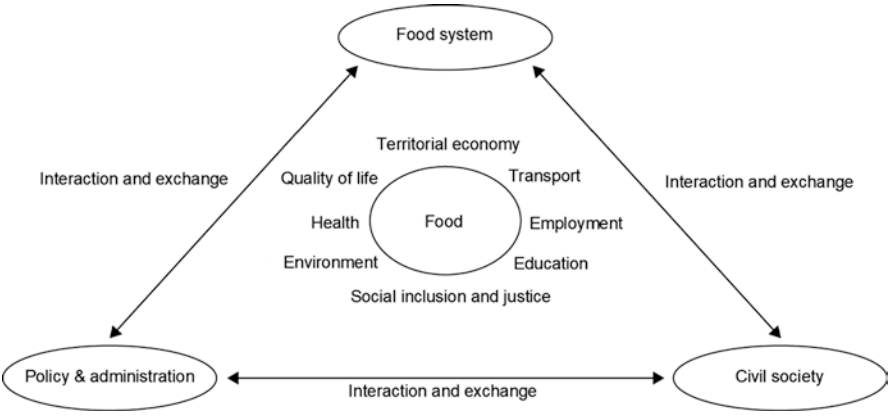

Fig. 4.4 Food governance described and considered in urban food planning. (Source: Brand 2015, from Wiskerke 2009: 376 and Moragues et al. 2013: 6)

between actors because they seem too restrictive of the actual and potential types of relationships between these actors with regard to the food issue (limited in the article to public food procurement, alternative food supply chains and urban food strategies). Moreover, in the 'urban food strategies' category, Weskerke's diagram indicates a relationship between government and civil society. We consider, however, that these strategies should also include economic actors in the 'market' actors sphere.

Urban planners, developers and architects must take the food issue—in all of its complexity—into account in sustainable city management and planning. Practical applications have been reported, such as the food sensitive urban planning and design framework (Donovan et al. 2011) in Victoria (Australia) and the Food Urbanism Initiative (Verzone 2012) in Lausanne (Switzerland), as well as the continuous productive urban landscape concept designed with regard to urban density (Viljoen et al. 2005). The aim is to link the food system, or associated elements such as agriculture, with urban planning.

The interaction between urban space and inhabitants' health in relation to food has been the focus of studies, giving rise to the foodscape concept, i.e. the food landscape—how the urban environment has an impact on food access or on the development of food-related diseases. At the crossroads of health planning and geography, researchers focus especially on the location and characterization of the type of food distribution outlets (Cummis and Macintyre 2002), e.g. studies carried out in the United States on the impact of the urban food environment and built environment on obesity (Raja et al. 2010). The authors showed that the proximity of a supermarket or grocery store to the consumer's home was correlated with women's body mass index (BMI). This concept has revealed new levers for local urban governments.

The organization of urban space has thus proven to be a significant determinant with regard to the food practices of city users (inhabitants, workers, tourists). The recent and ongoing rising awareness of urban planners, developers, architects and leaders concerning the food issue has prompted these actors to focus on the food system. This has fostered dialogue between their disciplines and other food system oriented disciplines (agronomy, management, economy, sociology, nutrition, etc.).

Approaches specifically concerned with the interaction between individual behaviours and the urban space complement these spatial organization oriented approaches. They consider other food system components, such as culture, food knowledge and individual consumer behaviours. The sociology of consumption, which is focused on individuals and their choices, along with other disciplines (e.g. environmental psychology) develop approaches that integrate factors that consciously drive individuals and factors that more unconsciously shape their habits. Behavioural theories that have until now fueled awareness-raising, information and education policies for individuals have been widely questioned (Lahlou 2005; Stø et al. 2008). Among these new approaches, the theory of practices provides an innovative framework, thus breaking away from behaviourism practices that are considered inefficient. Cohen and Ilieva (2015) have suggested using this innovative practice theory to provide cities with effective levers and facilitate the transition to a more sustainable urban food system.

Theory of Social Practices for a Sustainable Multidimensional Urban Food Approach

Nevin Cohen

Like all large-scale sociotechnical systems, the food system is so entrenched that it seems unchangeable. Yet it is composed of and shaped by everyday mundane and habitual social practices. Hence it can be modified by policies geared towards changing these practices (Shove et al. 2012; Watson 2012).

Ubiquitous everyday food practices have significant environmental and public health impacts, for instance cooking, refrigeration and dishwashing together account for 25% of household electricity consumption in the United States (Canning et al. 2010), while eating at a restaurant an extra day a week instead of at home can add a bit less than 2 kg a year to a person's weight. Such practices can thus generate a set of diet-related illnesses such as obesity (Todd et al. 2010). Conversely, these seemingly inconsequential food practices—which are often overlooked by food system planners because of their ordinariness—can turn out to be strategic levers to achieve broader social and environmental goals.

Role of Social Practices in Food Policy

Social practices are the everyday routines that people perform throughout their lives. They consist of *meanings* (beliefs, cultural norms and conventions), *materials* (tools, technologies, and financial resources), and *competencies* (know-how and skills) (Shove et al. 2012). Practices are *social* because they are shaped and reinforced by shared understandings of what is considered ordinary and appropriate ways of doing things. They are thus distinct from behaviours, which are actions based on the decisions of atomized individuals.

Practices are performed in the framework of interdependent sets of practices (Schatzki et al. 2001), so changes to one practice will therefore affect the entire set of practices.

Individuals are *carriers* of practices (Seyfang et al. 2010). They follow the rules and norms and, through their repeated performance of practices, they reproduce and normalize them and enrol others in the practices. According to Anthony Giddens (1984), their role as *carriers* is constrained by the structures and norms that arise concomitantly as they shape the practices. But individuals can also innovate and vary the way they perform practices, which are dynamic and can be reconfigured, leading to the emergence of new practices while others may disappear (Warde 2005). For example, conventional food canning practices have been supplanted by the freezing process. This is accompanied by a change in the meaning and skills associated with household food preparation practices and in the way of shopping.

Despite attention to environmental and social conditions and other upstream factors that contribute to obesity (Story et al. 2008; Freudenberg et al. 2015), policy-

makers have mainly focused on interventions geared towards changing individual behaviours rather than social practices (Warde 2014; Delormier et al. 2009). Behavioural interventions in the United States are generally designed to encourage healthier eating while reducing the incidence of obesity. They include mandatory disclosure of calorie information at fast-food restaurants to discourage excessive consumption. Moreover, financial incentives are proposed for new supermarkets to open in low-income communities in order to encourage fruit and vegetable consumption, or for individuals to buy healthier food at farmers markets (Cohen 2014).

The focus on individual behaviour is based on a framework that treats consumption as a function of the aggregated behavioural choices of individuals determined through individual preferences and rationally calculated assessments of risks and benefits (Halkier and Jensen 2011). Theories of behavioural change such as the planned behaviour theory and social marketing persist because of public health and policy conventions. They are in line with neoliberal ideology and relatively simple compared to more complex multi-sectoral approaches (Baum and Fisher 2014). Despite their popularity, behavioural approaches—which Shove (2010) criticizes as being an A-B-C (attitudes, behaviours, choices) theory of change—have not led to systemic changes in eating or to sustained reductions in the incidence of obesity (Cohn 2014).

In contrast, a social practice approach views that consumption models are embedded in the ways practices are structured. This approach does not overlook the effects of policies like regulations, consumer information or economic incentives to influence behaviour, but rather analyses and seeks to change unhealthy or unsustainable practices. Attention is paid to the meanings of a practice, the material dimensions and competencies associated with the practice. Focusing on the practices, how people perform them and what they use when carrying them out reveals the technologies and infrastuctures, cultural and social images and conventions, and knowledge that constitute these practices. The focus of this approach—rather than being about the ways individuals make food decisions—is on how their social practices (shopping, cooking, travel, dining with friends, taking a work break) structure their food practices.

Understanding the persistence and transformation of everyday food practices reveals opportunities for a transition towards healthier practices through policies that change the underlying meanings, materials and competencies. Consider for instance the practice of preparing food at home from scratch instead of eating less healthy fast food. Cooking should be a normal and socially desirable practice, not a burden that diminishes quality of life. Individuals need the requisite food storage and cooking equipment, in addition to time. Skills and know-how are also needed to prepare meals. If these three elements—meanings, materials and competencies—are not in place, the practice will not take hold and develop. Food practices must be viewed as part of a cluster of interdependent practices. A given practice may be changed (switching to cooking fresh products), along with associated practices (shopping on foot rather than by car) or how a practice is carried out may be modified (reducing the locations, e.g. classrooms or libraries, in which eating is considered acceptable). Hence, a social practice-based policy should also simultaneously

consider a set of related practices associated with preparing meals at home (shopping, washing dishes, waste management, etc.).

Towards Strategic Management of Social Practices

Cities are uniquely positioned to engage in 'strategic practice management' (Cohen and Ilieva 2015), the process of stimulating new practices, re-establishing old ones, or changing the nature of existing ones. They can institute policies and programmes that could foster new meanings of practices, change the material and infrastructure conditions under which practices are performed, while altering competencies or disseminating new ones. Cities have many food practice transformation levers (Cohen and Ilieva 2015; 2016).

Cities—as centres of media and dense social networks—are able to support the creation of new meanings. Cities also run public school systems that offer strategic entry points to influence the practices of youth. Urban planning departments shape the spatial layout of practices by acting on the locations of fresh food retailers or authorising urban rooftop farming. Urban public health departments also influence the materials of urban food practices by setting nutritional standards or regulations for trans-fats, soda or salt. Moreover, cities can enhance the visibility of unconventional but healthy urban food practices.

Practice elements themselves can be sources of dynamism and challenge systems of practice. For example, making misshapen fruit culturally acceptable by serving it in public canteens can change buying practices and reduce food waste. Reviving school cooking instruction can change cooking competencies, stimulate home cooking and eventually increase fresh food purchases. Urban policymakers need to be attentive to practices with the greatest health and environmental effects. But they must also be mindful of weak signals and small changes not significant enough to transform entrenched sociotechnical systems. They can over time transform bundled practices, stabilize and become the new normal, eventually leading to broader change.

Moreover, food practices are connected to other sociotechnical systems like water management and transportation. Several sociotechnical systems can be adjusted at once by considering urban food systems as a complex of social practices (Cohen and Ilieva 2015). This provides an opportunity for cross-sectoral work. The practice approach induces organizational innovations, such as the creation of interdepartmental teams or multistakeholder task forces to work on more sustainable urban food systems, while suggesting that urban planning goals should be rethought, but not only in terms of land use, economic activities or infrastructure. Practices prompt reflection on the replication or reconfiguration of everyday practices that influence urban development. This generates new urban development expectations: a shift in focus to the elements that shape social practices; drawing up policies for sets of practices to enable withdrawal from conventional administrative silos; and a move away from models that assume an ability to predict behavioural changes based on interventions to boost individual awareness and information.

Approaches drawing on the theory of practices that are presented here have the advantage of not channelling attention towards economic, sociological and demographic determinants of individuals, as is often the case in consumer surveys. They can also be used to study the material, economic and social environment in which individual practices are carried out (Shove et al. 2012; Dubuisson-Quellier and Plessz 2013). Focusing more on the environment of practices so as to gain insight into the related behaviours broadens the prospects of policies geared towards influencing behaviours. They are intended to play a role in environmental change rather than boosting consumer awareness.

These approaches shed new light on policy instruments that local urban governments have at hand to enhance food systems and their sustainability. In dealing with urban management issues, food can serve as a tool to jointly meet various sectoral objectives borne by local urban governments in terms of health, wellbeing, ecology, economy, social equity, etc. Practice-based approaches offer a new framework to gain further insight into urban food sustainability determinants and to identify efficient levers for policymakers. They provide fresh opportunities for dialogue between researchers and policymakers.

Sustainable Development Applied to Urban and Food Issues

A final approach to review the complexity of food systems and formulate tailored policies should also be mentioned, i.e. sustainable development applied to urban and food issues. Sustainable development is an instrument for assessing the way societies work. Paul James and his colleagues developed an innovative sustainable development model applied to urban problems, and more recently to urban food issues, in a project carried out between 2007 and 2014 that was funded by the UN Global Compact Cities Programme in partnership with Metropolis and other international organizations. The Circles of Social Life approach aims to support cities, neighbourhoods and communities in the sustainable planning process. It combines qualitative and quantitative sustainability indicators, while drawing on a diverse range of actors with complementary expertise, to generate a holistic picture of the overall situation. This method has been applied particularly in Johannesburg, Melbourne, New Delhi, São Paulo and Tehran.

Towards a Holistic Understanding of Food Systems Via Circles of Social Life

Paul James

There is an Irish joke that provides an instructive way of thinking about useful beginnings and sustainable directions. The tale describes a disoriented traveller in

rural Ireland asking directions of a local. The local begins to give detailed directions and each time falters, finally saying, "If it was meself that was going to Letterfrack, faith, I wouldn't start from here."[6] In addressing the question of sustainable urban food policies, we suggest the same thing, i.e. not beginning with the very issues that directly concern us most: food, urban settings, sustainability or policymaking. When focusing on the immediate areas of interest of specialists and professionals, the latter tend to conclude that their specific area is the most important starting point, while excluding all other possibilities.

Where then should the complex process of systematizing issues related to sustainable urban food policies be started? The usual place to begin is by approaching the food issue as an activity or economic value chain. But this starting point is restrictive with regard to urban sustainability, political power and cultural significance issues.

In Search of an Alternative Holistic Approach

One alternative—the circles of social life approach—begins with the question of the human condition, which encompasses food. Then how can we begin to depict that condition in a holistic way while identifying the food policy domains and subdomains? Most pressingly, how can we do so without being overwhelmed by the usual starting point of economics?

This is what food system analysts have started doing. For example, Geoff Tansey and Tony Worsley's work (1995) does this through a three-domain model. They begin with the biological domain (i.e. the living processes used to produce food), the economic and political domain (i.e. the power exercised over the food system) and the social and cultural domain (i.e. personal relationships, community values and cultural traditions that influence the way people use food) (ibid, p. 4). This blanket approach is much better than the commonly applied triple bottom line approach,[7] which includes three sustainable development spheres (Fig. 4.5).

The triple bottom line approach effectively considers economics as the master domain, with the environment as an externality that is costed against the economic aspects in accounting terms. The social domain pools all elements that do not fit the other two domains, including human rights, land rights, cultural identity, gender issues, etc. Hence, analysts' approach to the food system thus tends to better account for the social complexity, i.e. considering the economics without making it the starting point for all analyses. However, as soon as we start to look at the starting point for the work of Geoff Tansey and Tony Worsley, it quickly becomes clear that the prevailing complexity was not completely accounted for. Like the road to Letterfrack, the directions taken to develop a positive model for food system sustainability can soon get complicated. If one of their domains is biological, where in this approach

[6] The Hibbert Journal, vol. 22, 1924: p. 417.

[7] By the triple bottom line approach, the sustainable development concept is applied to the business sector.

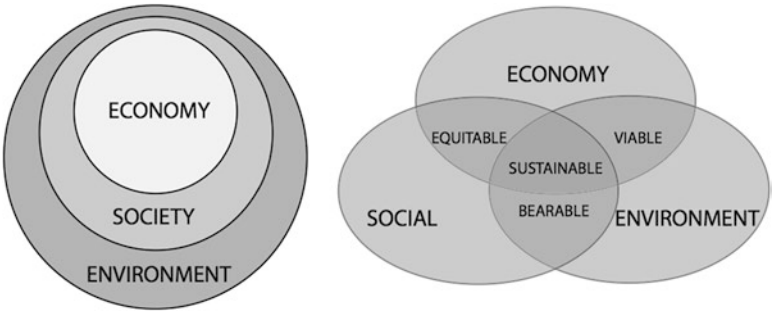

Fig. 4.5 Two depictions of the triple bottom line approach

are non-living and non-biological things which are so critical in food system functioning (e.g. nonorganic fertilizer and cadastral maps)? If their second domain is economic and political, does this mean that all economic questions are solely or primarily power issues? However, when striving to understand what it means when a peasant-farmer in the Andes sows seed in harrowed ground, it is essential (even if only for policy and analytical purposes) to separate questions of power—e.g. who controls the legal rights to seed reproduction of that seed—from economic questions such as what form of agricultural production frames seed sowing. Finally, if their third domain is cultural, where can the culture of capitalism, commodity fetishism and ideologies of growth be analysed? These too are cultural issues, but none of them begin with personal relations or cultural traditions. In short, their domains do not offer adequate generality and analytical coherence.

This underlines the importance of choosing the right methodological framework when conducting such studies. For circles of social life, circles of sustainability and circles of food, we worked with dozens of experts and local representatives worldwide and set up a lengthy dialogue process (James et al. 2015).[8] We sought to identify domains that would enable us to gain insight into the life of a traditional farmer respecting customs in the Andes and that of an agricultural futures trader in Paris. Four domains were first defined: economic, ecological, political and cultural. All of these were treated as social domains that could only be separated analytically, with the social domain always encompassed by and grounded upon the natural (Fig. 4.6).

Defining Social Domains

The ecological is defined as a social domain that focuses on practices, discourses and material expressions that occur at the crossroads between the social and natural realms. We recognize the distinction between these two realms in traditional (cosmological) and modern (scientific) understandings, with the natural being a context

[8] For further information on associated projects, see also: www.CirclesofSustainability.org and www.CirclesofFood.org

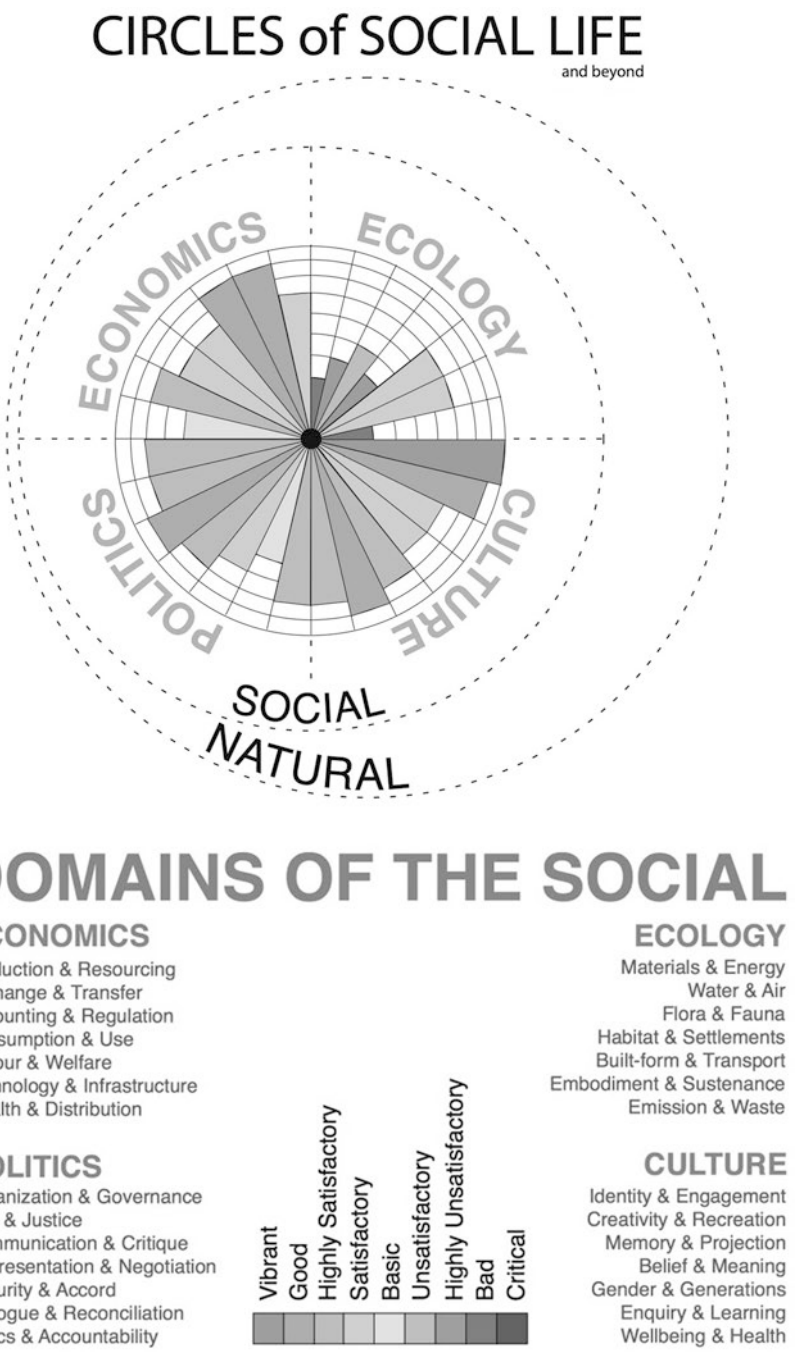

Fig. 4.6 Circles of social life understood in terms of four domains

of the social realm. But we enhance these two realms with human engagement with and within nature. This means that the ecological domain is focused on questions of interconnection between the social and natural, including the human impact on the environment and the place of humans in the environment. Foods may be sourced from nature, but as soon as they are grown, harvested or consumed they are no longer simply natural.

The economic is defined as a social domain that focuses on practices, discourses and material expressions associated with the production, use and management of resources. Here the resource concept is used in a broad sense, even in settings where resources are not instrumentalized or reduced to a means to achieve other ends. This allows us, for example, to compare different forms of food production and consumption. Although the economics domain was only differentiated as a named area of social life and deliberately practiced as a separate domain in the early modern period, by this definition it can be used in a broad range of places and time periods.

The political is defined as a social domain that focuses on practices and meanings associated with basic issues of social power as they pertain to the organization, authorization, legitimation and regulation of a social life held-in-common. This domain thus extends beyond the conventional sense of politics to include social relations in general. It bridges the public/private divide. The key related concept is a 'social life held-in-common' as many political issues bear directly on the sustainability of social life in general and food in particular. Consumption of a food in a certain way is political and thus concerns power.

The cultural is defined as a social domain that focuses on practices, discourses and material expressions, which express the continuities and discontinuities of the social meaning of a life held-in-common over time. Culture can be trivially defined as, 'how and why we do things around here'. The 'how' is how we practice materially, the 'why' emphasizes the meanings, the 'we' refers to the specificity of a life held-in-common, and 'around here' specifies the spatial and implicitly temporal particularity of culture. The culture concept had its beginnings in agriculture and cultivation, with subsidiary senses of 'honour with worship' of the word *cultura*, which in the sixteenth century was linked to the understanding of human growth and development (Williams 1976). This has obvious implications for food sustainability.

Seven subdomains are defined for each of these domains to provide tools for assessment, monitoring and evaluation. The approach strives to achieve sustainability and resilience through a combination of qualitative and quantitative indicators. It sets up a conceptual framework for investigating problems faced by communities and is intended to be applicable in very different neighbourhood, city and regional contexts.

Circles of Food in Practice

This method is currently being developed by Sustain: The Australian Food Network, with the aim of working with municipalities on their respective food systems.[9] Over the past 18 months, we have been working jointly to develop a food-profile process.

The first step in this process was to develop a food charter based on the four domains. The set of principles of the charter can be found online at: http://www.circlesoffood.org/principles.

Associated with these principles, the second step involved developing a set of questions for each of the four domains, their seven subdomains and seven aspects of each subdomain, for a total of 196 questions on food sustainability.

When taking the ecological domain as an example, the first subdomain is 'materials and energy' (Fig. 4.6). The following is a series of questions that were posed for the seven aspects of this food system subdomain:

1. Availability and abundance: how sustainable is the use of resources to produce food in the immediate region?[10]
2. Soil and fertility: to what extent are areas of arable land in the immediate region suitable for growing a variety of food produce?
3. Minerals and metals: how sustainable is the use of fabricated metals such as steel and aluminium in the food system across the broader region?[11]
4. Electricity and gas: is the electricity used in the various stages of the food system produced through ecologically appropriate and/or renewable means?[12]
5. Petroleum and biofuels: is the local food system overly dependent on fossil fuels?
6. Renewable energy and recyclable materials: does the local food system use recyclable materials?
7. Monitoring and reflection: does local monitoring of resource use result in the implementation of positive strategies relevant to the local food system?

The questionnaire is focused on the present period and the projection limits are the next 30 years, or one generation, according to the United Nations' definition of sustainable development. The idea is to meet current needs without compromising those of the next generation.

The series of questions are linked to indicators and a nine-level quality scale was drawn up. *Critical* is at the negative end of the spectrum, referring to an aspect of the food system requiring critical or urgent change now to ensure continuing basic viability over the next 30 years. *Vibrant* is at the positive end of the spectrum, refer-

[9] Project led by Kathy McConnel and Nick Rose.

[10] 'Immediate region' here means the area in question and its hinterlands. 'Material resources' includes all resources from water, food and energy to concrete and steel.

[11] 'Broader region' means within 3 h reach by land transport.

[12] Unless qualified by the adjective 'local', the 'food system' concept refers to the whole system upon which the local area depends—from local to global.

ring to an aspect of the food system that is currently active in reproducing vibrant social and environmental conditions enabling positive long-term advancement for the next generation and beyond. *Basic* is in the middle of the spectrum, referring to a quality that, at a pressure level equivalent to that of other levels, enables a basic balance to be achieved to meet the needs of the next generation over the coming period.

We suggest that each assessment ideally include 3–10 people from the targeted urban area who are specialists in different and complementary fields. In 2015, we conducted food assessments in three municipalities: Yarra Ranges with more than 100 people involved, including members of civil society, Whittlesea with 10 experts and Ararat with about 25 people representing regional organizations. In each case, when assessing the four social domains, we entered into the profile assessment process through discussion sessions on critical issues in the municipality. We asked each group to annotate their reasons for giving certain scores linked to these critical issues.

Food policies are currently being developed on each of these municipalities on the basis of the study findings. The future of this project will depend on how the method works in practice and contributes to developing a prosperous food system both in places where it is implemented and elsewhere.

Conclusion

This presentation of various approaches that are geared towards gaining insight into the complexity of the sustainable urban food issue highlights the promising potential of an integrated approach. The complexity of the topic warrants application of a combination of approaches. A systemic and cyclical view of food enables us to consider the activities, flows and sets of stakeholders involved and thus to understand the system as well as the underlying dynamics. The food system concept—recognized and used by scientific communities and food system stakeholders—thus helps to build a common vision of the complexity of urban food system sustainability.

The territorial approach to food systems in urban regions has the advantage of providing a framework for analysis and practice. It is an opportunity to facilitate political-scientific exchange and thus identify new prospects in the researcher-decision maker dialogue. It also provides a way to dovetail food sustainability and urban sustainability approaches and thus to focus maximum attention on a variety of determinants and levers.

Some of the theoretical approaches presented in this chapter already have practical applications through the development of local stakeholder support tools or measurement and assessment tools. Many food strategy action plans or documents outlined in the grey literature are structured according to a food system framework represented by a chain of activities (production, processing, distribution, consumption, waste management). They sometimes also include sectors like health and cul-

ture. To support the emergence of an urban food policy, practical application begins by an assessment of the situation, generally based on an analysis of socioeconomic activities (Carey 2011; Conley et al. 2011). Combinations of different analysis tools are implemented according to stakeholders' viewpoints and the local setting (territorial diagnosis from flow or lifecycle analyses or via qualitative methods, food desert mapping, food mile calculations or the ecological footprint, etc.).

However, urban food policymaking processes have timeframes of variable length and may be of different forms. The local history and political calendars are essential elements that preclude their emergence (chapters "History of Urban Food Policy in Europe, From the Ancient City to the Industrial City; Benoit Daviron, Coline Perrin, Christophe-Toussaint Soulard" and "Cities' Strategies for Sustainable Food and the Levers They Mobilize; Jess Halliday"). Some policies are promoted and identified at the international scale, while others are more discrete. Cities already have an impact on the food system through instruments that they use for management of land, school catering, social sector, economic activities, waste collection and disposal, etc. They sometimes have a targeted impact, e.g. on vulnerable populations, subsequently leading them to reflect on broader food issues. At other times, cities set up a crosscutting programme to coordinate sectoral initiatives to deal with food issues.

This diversity of processes questions the conceptual frameworks used to analyse and facilitate the formulation of urban food policies in all their forms and timeframes. The approaches outlined in this chapter inform us on two levels of understanding of this issue, i.e. the food system and its sustainability, and urban public action. These two levels are encompassed within broader frameworks for understanding sustainable development. These combined approaches can lead to the formulation of a monitoring and action framework at the crossroads between urban food system sustainability issues and levers implemented by local urban governments (chapter "Reconciling Sustainability Issues and Urban Policy Levers; Nicolas Bricas, Christophe-Toussaint Soulard, Clément Arnal").

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