Food System Concepts and Definitions for Science and Political Action

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For fruitful deliberations and concerted action at the science-political interface the very concept of food systems and drivers of change need to be clearly understood and employed by all

1 Introduction

Food systems exist at different scales: global, regional, national and local. Local food systems around the world are very diverse and location-specific. They share some key features, but any attempt to change them should reflect their uniqueness embedded in traditions, cultures, economic structures, and ecologies of locations. Change in food systems comes about through external and internal drivers as well as through feedback mechanisms between these drivers. External drivers are for instance from climate or health systems, internal drivers are for instance from

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productivity gains as a consequence of innovations or from changes in consumer behavior.

The way in which changes in food systems impact sustainability in its diverse social, economic, and ecological dimensions is critical. With the Sustainable Development Goals (SDGs) there is an accelerating momentum worldwide, to adopt systems approaches to bring consumption and production patterns together to achieve sustainable development through an integrated approach to food systems (United Nations 2020).

2 Defining and Conceptualizing Food Systems

A practical definition of food systems should meet two essential criteria:

- it should be suitable for the purpose at hand, which is to support the global and national collective efforts to bring about positive change in food systems, by accelerating progress on meeting the 2030 Agenda and the SDGs in particular end hunger, improve diets and protect ecologies; and
- it should be sufficiently precise to define the domains for policy and programmatic priorities, and it should be sufficiently general to not exclude any aspects of the economic, social, and ecological dimensions of sustainability.

The significance of criterion (1) is that the definition should guide not only scientific inquiry, but also actions of all types, toward a common purpose, i.e. food systems change and in the long run even food systems transformation (von Braun et al. 2020). The point of criterion (2) is to avoid the intellectual hubris that accompanies many efforts of characterizing and graphically depicting food systems' complexities in great detail. Efforts to map food systems visually may help scientists as well as decision makers to identify key interactions and the mechanisms, both natural and social, which regulate those interactions. Yet, food systems' maps that try to be fully comprehensive tend to collapse under the density and complexity of the interactions to be described and analyzed. At the other extreme, food systems' maps and models that focus too narrowly on a reduced set of phenomena gain apparent explanatory power at the price of realism, adequacy or the exclusion of important economic, social or bio-physical environmental forces. There is no clearly defined pathway out of this dilemma. Much depends on the relevant policy question as well as on the context and scale of the food systems under consideration.

Food systems embrace the entire range of actors and their interlinked value-adding activities involved in the production, aggregation, processing, distribution, consumption, and disposal (loss or waste) of food products, that originate from agriculture (incl. livestock), forestry, fisheries, and food industries, and the broader economic, societal, and physical environments, in which they are embedded (FAO 2018). The range of actors importantly includes science, technology, data, and innovation actors (Herrero et al. 2020).

Sustainable food systems are those that contribute to food security and nutrition for all in such a way that the economic, social, cultural, and ecological bases to generate food security and nutrition for future generations are safeguarded (Global Panel on Agriculture and Food Systems for Nutrition 2020). It should be noted that desirable food systems are necessary but not sufficient to assure good nutrition – even the best food system cannot assure good nutrition in a situation of poor hygiene, unclean drinking water, poor child care, and widespread infectious diseases. Moreover, the availability of plentiful and healthy food does not guarantee adequate consumption patterns or prevent excess body weight.

The concept of *food systems transformation* has been linked to the aspirations of the 2030 Agenda and refers to the objective of pursuing fundamental change of food systems, for instance, to aim for climate neutrality and achieving the SDGs. *Transformation* is a never-ending process in food systems. *Transition* is the movement from one state to another. And *evolution* is the process of change. These are not interchangeable terminologies. Most food systems need all three.

Conceptualizing food systems entails defining systems boundaries and systems building blocks and linkages among them, while simultaneously being connected to neighboring systems such as health, ecological, economy and governance, and the science and innovation systems (see Fig. 1). Food systems are in a continuous state of change and adaptation. For the Food Systems Summit this means to identify actions which enhance positive side-effects of or to remediate or mitigate negative side-effects of policies. The elimination of net-negative externalities of food systems in terms of ecology and health costs would guide toward recognizing the true costs and price of food. A sustainable circular bio-economy concept as an overarching systems frame, in which food systems are embedded, could be considered in the solution-finding process.

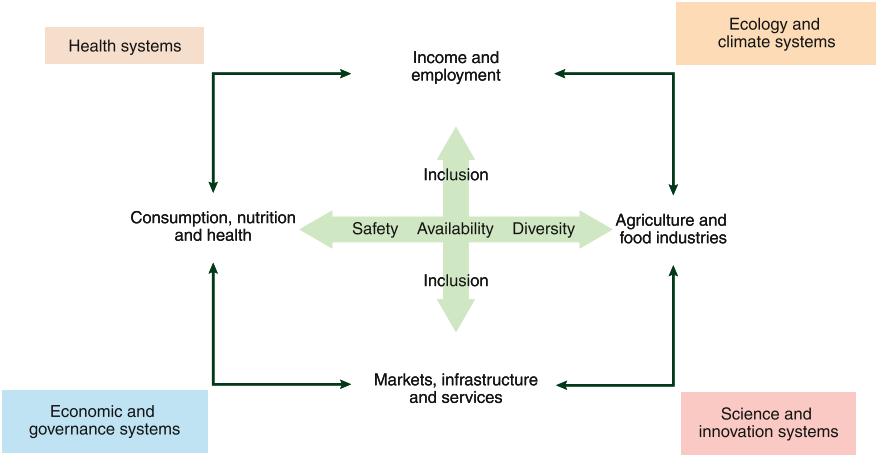

Fig. 1 The food system in the context of other systems (positive systems concept). (Source: designed by authors, adapted from InterAcademy Partnership (2018) and von Braun (2017))

3 An Action-Oriented Concept of Food Systems

Systems can be conceptualized from a *positive* or from *a normative* perspective. The *positive concept* attempts to design systems' structures and functions as they occur in the current real world and identify points of entry for desirable systems' change. The *normative concept* postulates a set of objectives and aims to shape the systems to serve the stated objectives. Both concepts aggregate and simplify real world structures and processes. Neither of these approaches escape the yardsticks of scientific evidence. For theoretical clarity of underlying value judgments, however, the two approaches need to be distinguished. As the Food Systems Summit is based on clearly stated objectives already defined in the SDGs, a *normative* approach is justified. Yet, normative approaches need to be put to the test by positive approaches in order not to steer into a dead end of unrealistic wishful thinking. Thus, normative and positive approaches are complementary. To build upon existing efforts, we suggest a concept of food systems that may help to frame action-oriented agenda setting, such as the one reflected in the five Action Tracks for the Food Systems Summit in support of the SDGs. These Action Tracks are described as:

1. Ensuring Access to Safe and Nutritious Food for All (enabling all people to be well-nourished and healthy);
2. Shifting to Sustainable Consumption Patterns (promoting and creating demand for healthy and sustainable diets, reducing waste);
3. Boosting Nature-Positive Production at Sufficient Scale (acting on climate change, reducing emissions and increasing carbon capture, regenerating and protecting critical ecosystems and reducing food loss and energy usage, without undermining health or nutritious diets);
4. Advancing Equitable Livelihoods and Value Distribution (raising incomes, distributing risk, expanding inclusion, creating jobs); and
5. Building Resilience to Vulnerabilities, Shocks and Stresses (ensuring the continued functionality of healthy and sustainable food systems).

The five *Action Tracks* capture various key opportunities and challenges of food systems and relate to one or more food systems components, but *they do not define a food systems concept* as such. Therefore, the pursuit of the Action Tracks needs to be conscious of an overarching food systems concept. Pursuing each Action Track in isolation from the others would lead to inefficient solution proposals that neglect system-wide effects. We thus offer a perspective that attempts to position the five Action Tracks in a food systems framework (Fig. 2): We expect food security and nutrition, livelihood improvements, and production with environmental sustainability; we want resilience to shocks (i.e. low variability, and a quick recovery from negative shocks); and we know that consumption patterns are a powerful lever for change. "Ensuring Access to Safe and Nutritious Food for All (enabling all people to be well-nourished and healthy)" is supported by the other four Action Tracks, yet there is also feedback from improved nutrition to the other four Action Tracks.

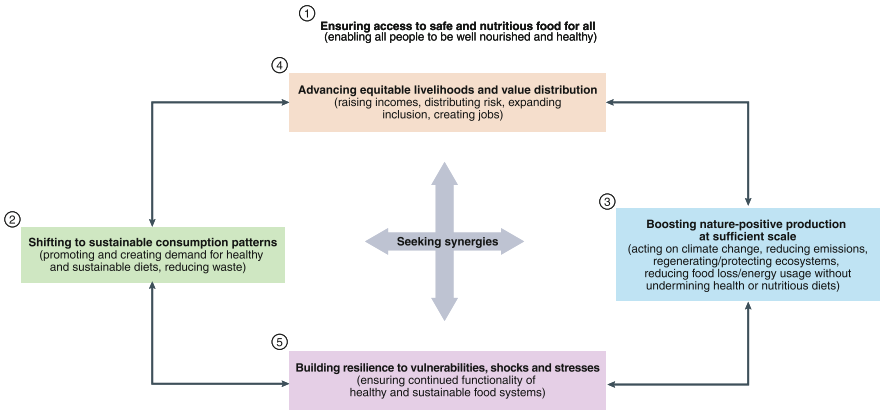

Fig. 2 Action Tracks in a Food System (a normative systems perspective). (Source: Designed by authors)

The Action Tracks need to consider functional relationships among them in systemic ways.

The systems perspective must not overlook some key cross-cutting issues and themes, which need due attention, for example, Covid-19 has highlighted the intertwining of food and health systems. Science and new and emerging technologies and innovations, including gene editing, digitization, Internet of Things, and Artificial Intelligence, are critical for improving productivity, efficiency, equity, and sustainability of food systems. The role of women and gender are important determinants for productive, healthy and sustainable food systems, and are fundamental for equity. Trade, market structures and dynamics of food industries require policy attention (OECD 2021). And there is a tendency to think of food systems as terrestrial systems only, but it will be vital to broaden the understanding of food systems to include their links to water cycles, oceans and fisheries.

4 Concluding Remarks

The discourse on food systems must not abstract from the issue of culture and values, making it seem as if it is merely a technical question. This especially - but not only - applies to the greatly diverse indigenous food systems, and the culture and knowledge embedded in them.

The Food Systems Summit needs to facilitate action to overcome systems failures that contribute to the hunger, malnutrition, and obesity problems; to the ecological problems of deforestation, green-house gas emissions, biodiversity losses and species extinctions; to the problems of poor livelihoods in farming communities especially of women and youth; and to the fundamental issues of food system related violations of rights – human right to food, broadly defined. The Summit needs to

come up with visions for food systems transformations in their respective contexts. While a strong sense of urgency is called for due to the big food systems malfunctioning, the time horizon of the food systems transformations needs to reach far beyond 2030, given demographic change, climate change, technological change and people – nature linkages in the Anthropocene.

If food systems shall deliver on the stated objectives (i.e. the SDGs), the Food Systems Summit needs to be open to new thinking, to new concepts, and to establishing new institutional and organizational arrangements. Addressing symptoms of systems failures will not be sufficient. Investing in science is essential to innovate, develop, and implement game-changing propositions that fit the respective food systems contexts. Science and policy have a lot to gain from cooperation through a strong and effective science – policy interface to help guide the follow up to the Summit (InterAcademy Partnership 2018).

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