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FOOD SYSTEMS

DEFINITION, CONCEPT AND APPLICATION FOR THE UN FOOD SYSTEMS SUMMIT

by

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ABSTRACT

The UN Food Systems Summit seeks to alter food systems to be healthier, safer, more sustainable, more efficient, and more equitable. This paper aims to inform the public and stakeholders interested in the Food Systems Summit about concepts and definitions of food systems and determinants of their change. To foster a clear understanding of food systems, especially with regard to the upcoming Food Systems Summit, we first present a general food systems concept. We then introduce a concept based on science that provides a definition that the Food System Summit can use with the five goal-oriented Action Tracks (serving SDG2) and their interlinkages. We suggest a food system definition that encompasses food systems thinking and the broad set of actors and drivers, embedding the concept of sustainability within it.

CONTENT

1. INTRODUCTION

The UN Food Systems Summit convenes to bring about actions that promise **change** towards achieving healthier and more sustainable and equitable food systems. As we head toward the Summit, the very concept of food systems needs to be clearly understood for fruitful deliberations and ultimately actions. Therefore, the main purpose of this paper is to inform about *concepts and definitions of food systems*. In this context, drivers and mechanisms of change of food systems need clarification. Conceptualizing *systems' change* is relevant for policy opportunities and for setting ambitious goals for the Food Systems Summit.

Food systems exist at different scales: global, regional, national and local. The 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. Change in food systems comes about through external and internal drivers as well as through feedback mechanisms between these drivers. These feedback mechanisms may be short-term or long-term, and some may come with long delays, such as the impact of greenhouse gas emissions manifesting in climate change. External drivers are forces outside of the food systems, for example, forces in climate or health systems. Internal drivers are forces within the food systems, for example productivity gains as a consequence of innovations. Population growth, urbanization, conflicts, and geopolitical instabilities are fundamental external drivers interacting with changes in food systems. Changes in consumer habits, for instance as a result of rising incomes, are another driver of great importance. Markets, trade, and infrastructures – increasingly combined with digitization – are cutting across internal and external drivers of food systems' change. Developments in the many scientific disciplines related to food systems, innovations, and technologies as well as their interlinkages with policies greatly impact food systems' change. These determinants of changes are also driven by the interests, needs, and accomplishments of farming communities, the agricultural inputs and food industries, distributors, and consumers' demand. Purposeful policy interventions attempt to influence all these forces of change, or their consequences, such as the loss of biodiversity. Policies, however, are also partly driven and re-defined by these drivers. Moreover, there are long-term natural and evolutionary biological change processes that also impact the multiple interactions within food systems. All drivers affecting food systems are subject to multiple systemic risks of hazards carrying uncertainties that often materialize in sudden occurrences of events. This is the case with COVID-19 and with locust swarms for example. Uncertainties, and more specifically their impacts on food systems, are difficult to predict and measure, but prevention with risk management and anticipation, including emergency preparedness and capacity to face them, may reduce their impacts.

Food systems have been continuously subject to change and adaption since they evolved with humankind, though change has been especially dramatic in the past 200 years. Food systems are bound to further change in the future given that we are developing towards an ever more urban society and that the world population will possibly be stabilizing at about 9 to 10 billion people only by the end of this century (Lutz 2020).

The way in which changes in food systems impact sustainability in its diverse social, economic, and environmental dimensions must be of key interest to us. The role of science and innovation is essential here, as some of the conflicting issues about food systems' changes can be remedied by innovations. We can note at the outset that there is an accelerating momentum worldwide, including in the United Nations, to adopt systems approaches to bring consumption and production patterns together to achieve sustainable development through an integrated approach to food systems.[1]

1 At the Rio+20 UN Conference on Sustainable Development in 2012, Heads of State converged around the idea that fundamental changes in our production and consumption patterns are indispensable to achieving long-term sustainable development. The realization that a global shift towards SCP would require the commitment of diverse actors across the globe spurred Heads of State at Rio+20 to adopt the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns (10YFP). See at: 10YFP Framework of Programmes on Sustainable Consumption and Production Patterns.

Food systems are incredibly diverse. Consider that the food systems of mega-cities in Africa, such as Kinshasa, are very different from the food systems of mega-cities in Asia, such as Tokyo. The food systems of rural South Asia with its public distribution systems at village levels are very different from food systems of rural Europe with its supermarket penetration. And the food systems of small island nations dependent on food imports in the Caribbean are very different from the food systems of large middle-income countries with domestic food industries and significant export potentials in South America.

With this paper we aim to inform the interested Food Systems Summit public. We discuss both *change that happens anyway* (i.e. drawing on a so called "positive theory" of systems) and *change that is actively pursued and goal-oriented*, especially within the context of the Sustainable Development Goals (SDGs) by, for instance, setting new norms (i.e., drawing on normative theories of systems). Food systems are not just technically functioning mechanistic clock works, but are embedded in values and cultures that need to be considered when "systems transformations" are proposed. Our goal is to assist in the understanding of food systems, their dynamics, their indirect effects, responses to exogenous influences, and impacts of policies through system linkages. Lastly, we seek to relate these concepts in helpful ways to the purpose of the UN Food Systems Summit.

2. A GENERAL FOOD SYSTEMS CONCEPT

Theory and Criteria

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

1. 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; and
2. 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 environmental 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. The point of criterion (2) is to avoid the intellectual hubris that accompanies many efforts of characterising 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 analysed. 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 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.

We distinguish between *systems theory and systems thinking* (Box 1) and suggest a definition of food systems that acknowledges the functional relationships in systems and is *normative* in relation to a given set of core objectives, such as the SDGs. This approach should not neglect basic principles of *systems theory*. For instance, a system that has no defined boundaries or whose building blocks connected by linkages and feedback mechanisms are ill-defined is a fuzzy concept.

Food *systems' boundaries* refer to specific scales as pointed out above (local, national, regional, and global), for different contexts (e.g., urban, rural), and may be shaped by interlink with other systems, such as the (decentralized) governance system and the health system. Boundaries may also dynamically change, for instance due to technology or infrastructure. However, as important as this established the-

oretical foundation is advancement of *systems thinking*, which entails broadening perspectives around food systems (such as planetary health), and within food systems (such as the important roles of culture and values).

Definitions of Current and Future Food Systems

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 natural environments in which they are embedded (building on definitions by FAO (2018) and others). Production includes, of course, farming communities but also pre-production actors, for example input industries producing fertilizers or seeds. The range of actors importantly includes science, technology, data, and innovation actors. They are partly integral to the food systems, and partly outside but of great influence, for instance, embedded in life science and health systems research. In food industries' processing, foods and non-foods result from interlinked value chains. Other relevant food systems actors include, for example, public and private quality and safety control organisations.

A *sustainable food system* is one that contributes to food security and nutrition for all in such a way that the economic, social, cultural, and environmental bases to generate food security and nutrition for future generations are safeguarded. 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 a sustainable food system entails normative aspects, because food systems use resources that typically do not offer absolute levels of sustainability. Thus, sustainable food systems incorporate an understanding of sustainability that reflects relative change in the sense of a change toward more versus less sustainability compared to a previous situation.

Box 1: On Systems Theory and Systems Thinking

Systems theory and system dynamics are established concepts that may assist in conceptualizing food systems, yet are conceptually rather restrictive. Systems theory is the study of systems. Important conceptualizations stem from W. Forrester who is a founder of the field of system concepts and dynamics (Radzicki and Taylor 2008). Forrester argues that a system is composed of regularly interacting or interrelating groups of activities. System dynamics is a methodology to frame, understand and discuss complex issues and problems. The best-known system dynamics model is probably *The Limits to Growth* (Meadows et al. 1972).

Systems thinking is a way of looking at the world rather than a description of how the world is. The term "food systems" invites us to think about a broader set of valued outcomes such as nutrition and health, livelihoods, and planetary health; to think about a broader set of factors that can influence these outcomes; and to think about synergies and trade-offs between all of these. People's values matter for how food systems thinking is shaped and in turn may shape policies.[1]

1 An important emphasis is placed on food and agriculture that are intimately connected to people's values. People differ in the values they hold relative to food and agriculture, and these value differences correlate with their behaviour as consumers and as citizens (further on these important aspects see OECD 2021).

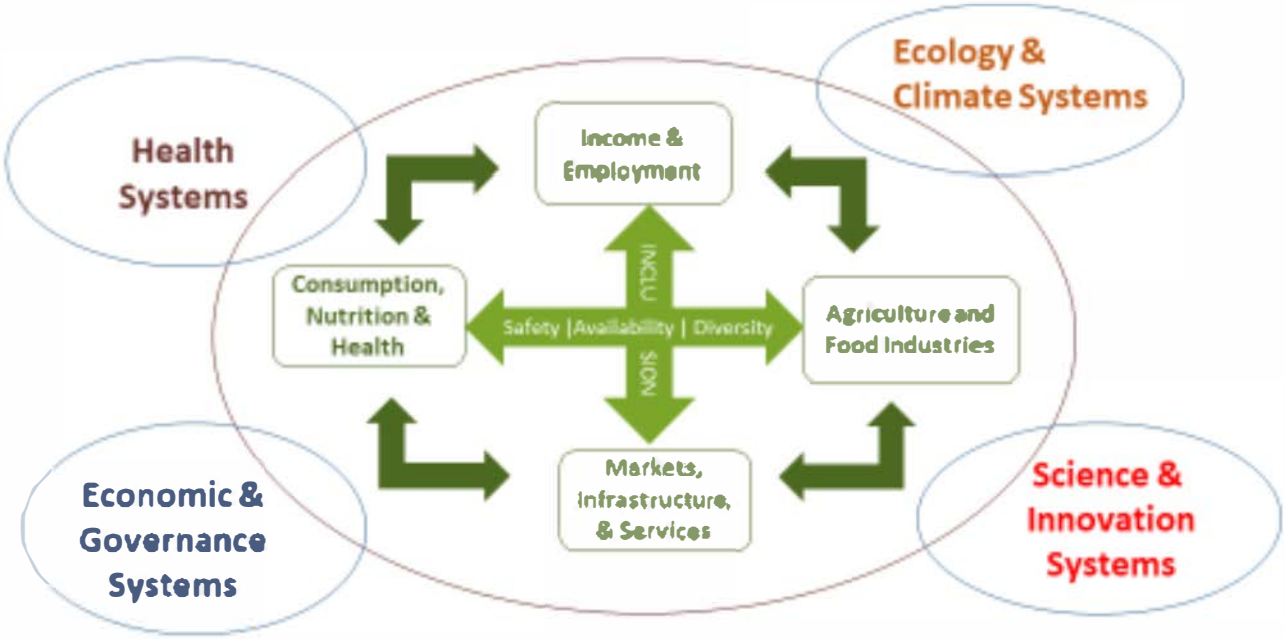
The concept of *food systems transformation* has been linked to the aspirations of the 2030 Agenda and refers to the objective of pursuing fundamental change of food systems, for instance, to aim for climate neutrality and achieving the SDGs. For analytical and monitoring purposes we suggest a more neutral, evidence-based terminology, which may distinguish between status and systems dynamics by referring to evolution, transition, and transformation. The idea of transformation as commonly used can refer to any large-scale change, whether intended or not, and whether beneficial or not to a specific goal, context, or geography. The Global Sustainable Development Report defined transformation as "a profound and intentional departure from business as usual" with the intentional departure being specified as "transformation toward sustainable development" (United Nations 2019).

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.

Concept of Food Systems

Conceptualizing food systems entails defining systems boundaries and systems building blocks and linkages among them, while simultaneously being connected to neighbouring systems such as health, ecological, economy and governance, and the science and innovation systems (see figure 1). The concept here is in support of developing sustainable food and nutrition systems, to deliver health and well-being, embedded in the transformation towards a sustainable circular bioeconomy.[2] Science and R&D play a role within each element and in the intersections among them for the food systems performance, and the science and innovation system impacts the functioning of system as a whole.

Figure 1: *The food system in the context of other systems (positive systems concept)*
Source: Adapted from InterAcademy Partnership (2018) and von Braun (2017).



Food systems are in a continuous state of change and adaptation. For the Food Systems Summit this means an encouragement to raise the question of which policies, innovations, and institutions are needed to enhance positive side-effects of or to remediate or mitigate negative side-effects of policies, programs, and other activities in or of relevance to food systems transformation. These are inherent to the fact that agriculture, food processing, etc. always use energy, taking nutrients from the land and water to convert them into food, while simultaneously generating a significant level of greenhouse gas emissions in the process of production, which is further augmented if food is wasted. Therefore, a sus-

2 On the concept of sustainable circular bioeconomy see the communique of the Global Bioeconomy Summit 2020 https://gbs2020.net/wp-content/uploads/2020/11/GBS2020_IACGB-Communique.pdf.

tainable circular economy concept as an overarching systems frame, in which food systems are embedded, should be considered in the solution-finding process.

Further food systems components and drivers need mentioning, but are not depicted in figure 1. For instance, the system may be impacted by external shocks, such as climate, health or economic shocks. Moreover, wars and violent conflict increasingly disrupt food systems. Macro-policies such as fiscal (tax and expenditure), monetary, financial, and trade policies may promote or hamper food systems. Therefore food systems concepts must consider political and economic forces of its disruptions, and need a political economy perspective (Pinstrup-Andersen and Watson 2011).

3. A FOOD SYSTEMS CONCEPT FOR THE UN FOOD SYSTEMS SUMMIT

Positive and normative Food Systems Concept

Any action proposals emerging from the Food Systems Summit need to consider the great diversity of institutional arrangements and organisational structures in food systems. The respective actors and their values in a particular context need to be considered as well. The food system is largely structured by private sector actors, including farmers, food manufacturers, traders, retailers, or food service businesses. At the same time, there are important features of cooperative and collective action arrangements among farming communities, like group formations by gender, with regard to rural savings and banking, etc. Also, there are industry clusters at large scales.

As mentioned earlier, systems can be conceptualized from a *positive* or from a *normative* perspective. The former concept, depicted in the previous section, attempts to design systems' structures and functions as they occur in the current real world as the basis on which a positive concept then identifies 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.

Action Tracks in the Food System

A normative concept and definition of food systems based on objectives embraces the *five Actions Tracks* listed below. Like any normative approach that states objectives, it is based on value judgments. Science needs to be transparent about value judgements. Normative definitions of sustainable and healthy food systems can be organised around intentional objectives. Areas of attention for policy and programme action and for building models of food systems that are aligned with the intentions as expressed in the 2030 Agenda can be facilitated. 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:

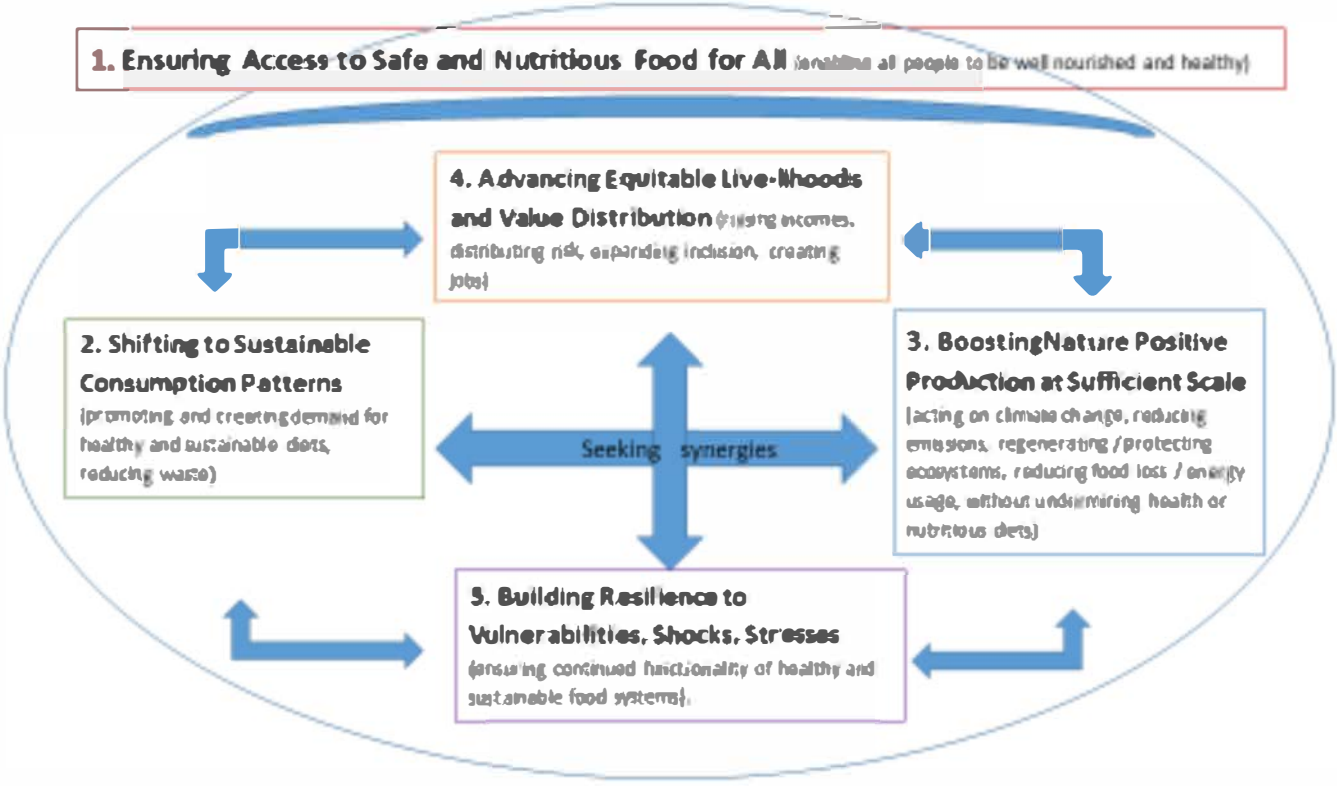
1. Ensuring Access to Safe and Nutritious Food for All (enabling all people to be well-nourished and healthy);
2. Shifting to Sustainable Consumption Patterns (promoting and creating demand for healthy and sustainable diets, reducing waste);
3. Boosting Nature-Positive Production at Sufficient Scale (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).

We note that some elements of the headings of the *Action Tracks*, such as "nature positive", imply a narrative that may be surprising and new, not rooted in the established research literature or in terminology of SDGs. We do not further elaborate the details of the Action Tracks here, as this is done detailed background papers.[3] Yet, 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.

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. The Tracks should better be understood as interlinked *Action Areas*. We thus offer an approach that attempts to position the five Action Tracks in a food systems framework (Figure 2). All the Action Tracks have their strong justification and they are not in a hierarchical relationship: 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

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



3 The background papers on Action Tracks by the Scientific Group are available at https://sc-fss2021.org/materials/scientific-group-reports-and-briefs/ .

the other four Action Tracks, yet there are also feedbacks from improved nutrition to the other four Action Tracks. The Action Tracks need to consider functional relationships among them in systemic ways.

Cross-cutting Systems Issues

The systems perspective must not overlook some key cross-cutting issues and themes, which need due attention, for example:

- Covid-19 has brought to the fore the intertwining of food and health systems, and going forward more attention will need to be paid on how to make food systems more resilient to health shocks and pandemics, just as more attention is being paid now on how to make food systems more resilient to weather and climate shocks.
- The important role of science and new and emerging technologies and innovations in improving productivity, efficiency, equity, and sustainability of food systems, including digitization, big data, Internet of Things, drones and Artificial Intelligence.[4]
- The role of women and gender are very important determinants for productive, healthy and sustainable food systems. Women's empowerment positively affects all the five Action Tracks.
- Besides gender inequalities, overall inequalities across classes, regions, rural-urban contexts, and social groups also influence whether food systems will transform to be healthier, more sustainable, and more equitable. Some food systems can be inequal or can breed inequalities through land and other asset ownership and market power relationships. The situation of the youth as well as of the elderly deserve particular attention.
- The inclusive transformation of smallholders will be imperative. Smallholders are not a homogenous group, and transformation of the small farm economy around the world will call for different policies to address the heterogeneity of smallholders, and attention to the long term nature of farming decisions.
- Lessons from indigenous food systems and related knowledge need to be systematically collected and considered for putting to work at scale, and they can also benefit from innovations and adaptations to changing circumstances.
- Strengthening sustainable food systems in marginalized areas and for marginalized communities will require the humanitarian and development communities to work more closely together in food systems transformation. The concept of rights based approaches need particular attention in these contexts.
- Trade, market structures and dynamics of food industries require policy attention. Appropriate anti-trust regulations need to address excessive concentrations. Intellectual property and food quality standards need transparent rules to incentivise the potential of food industries to contribute to healthy diets at affordable costs. Food industries' science capacities might be incentivized to serve public good innovations.
- There is a tendency to think of food systems as terrestrial systems only. It will be vital to broaden the understanding of food systems to include oceans / blue economy more fully given the tremendous current and potential future importance of fish and seafood to help assure healthy diets and address serious challenges in the management and exploitation of water-related natural resources, and the livelihoods of fishing and coastal communities (Costello et al. 2019).

These are a few of the cross-cutting issues and themes that need attention in food systems transformation. These and more cross cutting areas of action for attention by the Food Systems Summit are

4 Concerns need attention about a digital divide in access to these data as well as about the economic and social benefits of big data platforms that are able to amass extraordinary amounts of information on consumer behaviour and preferences.

being addressed in briefing papers from partners of the Scientific Group.[5]

As we stressed above, food systems are multi-dimensional and cut across many different sectors. Convergence of policies and actions will be needed at national and global levels of agriculture, health, water, sanitation, women and child welfare, and so forth to achieve healthy, sustainable, and equitable food systems. Understanding cross cutting issues require innovative quantitative modelling. Structural and change-related data are essential for analysing and modelling impacts of policies on food systems. There are tremendous opportunities for new data sources from remote-sensing, web-based, and cell-phone based data sources connecting to people that can facilitate new insights info food systems functions. Access and ownership matters related to these data need policy attention.

Considering Culture and Values

Food systems are closely related to people's values and cultures. Society demands from government and industry to make sure that food systems can be trusted. Considering and respecting people's values and their differences is therefore important for the Food Systems Summit in order to facilitate agreements on actions. Yet, differences do exist even around broad societal issues with relevance to food systems. This is for instance demonstrated by findings from the World Values Survey, a large-scale project to quantify cross-country differences and trends over time in people's values and attitudes (Inglehart et al. 2014). The 2011-14 World Values Survey asked respondents whether they think protecting the environment should be the priority, or whether economic growth and jobs should be prioritized. Interestingly, there is only a weak correlation between countries' overall level of economic development and the share of respondents prioritizing economic growth over protecting the environment. Moreover, even in countries with a clear preference for either option, there is typically a large minority choosing the other option; a national consensus is rare. This hints at the challenges of finding consensus among and within countries on food systems actions. Furthermore, values may change in the face of new technologies and advanced communication opportunities.

Change will not be achieved without respecting ethics and norms that govern food systems' operations. 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. Different societies may make different choices, based on their cultural traditions and local circumstances. For transformative policy approaches to be acceptable they will need to take into account values and cultural traditions.

Main Objectives

Linear hierarchical thinking would not do justice to food systems. The *Action Tracks need a systems frame* that defines sustainable food systems that deliver health and nutrition within the scope of the following three objectives:

Objective 1: End hunger and achieve healthy diets for all. Sustainable food systems must provide food and nutrition for all people. It is well-known that a focus only on promoting yield increases, calorie consumption, and low food prices is insufficient. Calorie consumption alone does not constitute a healthy diet. While it is difficult to define a high-quality, healthy diet in universal terms (Neufeld, Hendricks, and Hugas 2021), all assessments clearly indicate that healthy diets are more diverse and expensive than energy- and nutrient-adequate diets (FAO 2020; Hirvonen et al. 2019). While efforts need to be made to make healthy food accessible and affordable, it should be noted that lower food prices can hurt producers and discourage them from investing in technologies to protect the ecosystem, especially if ecosystem services related to food systems are not incentivized. It is important to understand the interactions between diets, health systems, and food systems to make progress towards the SDGs and their related targets in agriculture, inequality, poverty, sustainable production, consumption, nutrition,

5 A list of the planned Food Systems Summit Briefs is at https://sc-fss2021.org/materials/fss-briefs-by-partners-of-scientific-group.

and health.

Objective 2: Achieving Objective 1 does not automatically enable the ***sustainable use of biodiversity and natural resources, the protection of ecosystems and the safeguarding of land, oceans, forests, freshwater, and climate***, all of which are essential for protecting life in all its forms and which are a precondition for achieving social justice and robust, sustained economic development. Food systems operations to boost sustainable production must be compatible with ecosystem services. Yet, actions to promote the sustainable use of natural resources and mitigate the effects of climate change can limit current agricultural productivity. Sustainable food systems need to find ways to address this trade-off. Agro-ecological- and agro-forestry farming practices can be steps in this direction, along with innovations such as edible insect farming, vertical agriculture, and so forth. Like all systems innovations their performance needs to stand the test of evidence.

Objective 3: Eliminate poverty and increase income and wealth. Poverty and hunger are interlinked and reducing extreme poverty directly impacts the elimination of hunger and all forms of malnutrition. Eliminating poverty alone does not make healthy diets affordable for everyone. Moreover, the elimination of poverty is difficult to achieve while also protecting the environment and preserving ecosystems. Changing food systems need to ensure that people with a low income can access a healthy diet by enabling them to earn living wages.

In addition to these objectives, further criteria need to remain in perspective as they are linked to broader objectives of the 2030 Agenda. They include the above-mentioned cross-cutting themes, as well as the reduction of risks and the **fostering of food systems' resilience**;[6] and – importantly – also embrace respect for cultural principles and food traditions (Béné et al. 2019).

4. CONCLUDING REMARKS

Food systems transformation has to have a perspective on where we want to be headed. We then need to understand what is entailed in the transition to desirable food systems, and how to facilitate the evolution of such food systems. Thus, a vision for food systems transformation is required, and pursued with a strong sense of urgency. The vision is based on the SDGs. Yet, the time horizons of the food systems transformations need to reach far beyond 2030, given demographic change, climate change, technological change and people – nature linkages in the Anthropocene.

The purpose of this paper was to define and clarify concepts of food systems, and thereby facilitate more meaningful discourses and dialogues for the agenda setting processes toward the Food Systems Summit. The paper is not an agenda setting paper. The ambitious agenda of the Food Systems Summit is actually defined by the SDGs, and in particular the SDG No.2. The five Action Tracks are means to focus action and implementation. We provided a framework to emphasize their inter-connections as well as their linkages to the key goals.

The Food Systems Summit UN leadership has called upon the science communities of the world to constructively engage for achieving an action oriented Summit that is evidence based. The broad based science community is responding to that call. Science offers insights to accelerate the transformation to desirable food systems. Investing in science, i.e. research, scientific data, tools and capacity, is essential to innovate, develop, and implement game-changing propositions that fit the respective food systems contexts.

The summit needs to address systems failures that have contributed to the hunger, malnutrition, and obesity problems; to the environmental problems of deforestation, green-house gas emissions,

6 Food systems need to continue to function under risks and when coping with shocks and crises. This concerns regions that are experiencing conflict, climatic changes and natural disasters and is also globally the case, as food systems need to mitigate the impact of global crises, such as a pandemic, to protect food and nutrition security of people at all levels of development.

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 Food Systems Summit needs to offer propositions to address these failures and accelerate the transformation of food systems, and this is where science-based innovations come in, for instance innovations in policies for lowering the cost of healthy diets; innovations of institutions; innovations in technologies for plant breeding, animal health, new protein production; innovations in using digital opportunities, and many more.

Science and policy have a lot to gain from cooperation, but the independence of science must not be compromised to, for example, counter conventional wisdom or address policy and institutional failures with evidence-based insights. Science that produces new insights and technologies also needs to constantly seek the trust of society.

REFERENCES AND SELECTED BIBLIOGRAPHY ON FOOD SYSTEMS

For more resources, see https://sc-fss2021.org/materials/publications-and-reports-of-relevance-for-food-systems-summit/)

Barrett, Christopher B., Tim Benton, Jessica Fanzo, Mario Herrero, Rebecca J. Nelson, Elizabeth Bageant, Edward Buckler, Karen Cooper, Isabella Culotta, Shenggen Fan, Rikin Gandhi, Steven James, Mark Kahn, Laté Lawson-Lartego, Jiali Liu, Quinn Marshall, Daniel Mason-D'Croz, Alexander Mathys, Cynthia Mathys, Veronica Mazariegos-Anastassiou, Alesha (Black) Miller, Kamakhya Misra, Andrew G. Mude, Jianbo Shen, Lindiwe Majele Sibanda, Claire Song, Roy Steiner, Philip Thornton, and Stephen Wood (2020). Socio-technical Innovation Bundles for Agri-food Systems Transformation, Report of the International Expert Panel on Innovations to Build Sustainable, Equitable, Inclusive Food Value Chains. Ithaca, NY, and London: Cornell Atkinson Center for Sustainability and Springer Nature, 2020. https://www.nature.com/documents/Bundles_agrifood_transformation.pdf

Béné, C., Oosterveer, P., Lamott, L., Brouwer, I.D., de Haan, S., & Prager, S.D. 2019. When food systems meet sustainability – Current narratives and implications for actions. World Development, 113 (2019): 116–130. https://doi.org/10.1016/j.worlddev.2018.08.011.

Burlingame, B. & Dernini, S. (eds). 2012. Sustainable Diets and Biodiversity. Directions and Solutions for Policy, Research and Action. Food and Agriculture Organization of the United Nations (FAO), Rome, Italy. Available at: http://www.fao.org/3/i3004e/i3004e00.htm. (Accessed December 16, 2020).

Costello, C., L. Cao, S. Gelcich et al. 2019. The Future of Food from the Sea. Washington, DC: World Resources Institute. Available online at www.oceanpanel.org/future-food-sea

CFS (Committee on World Food Security). 2012. Coming to Terms with Terminology: Food Security, Nutrition Security, Food Security and Nutrition, Food and Nutrition Security. 39th Session, Rome, October 15-20, 2012. Available at: http://www.fao.org/docrep/meeting/026/MD776E.pdf. (Accessed December 16, 2020).

Dubé, L., Webb, P., Arora, N.K., & Pingali, P. 2014. Agriculture, Health, and Wealth Convergence: Bridging Traditional Food Systems and Modern Agribusiness Solutions. Annals of the New York Academy of Sciences, 1331 (1): 1-14. http://doi.wiley.com/10.1111/nyas.12602.

FAO (Food and Agriculture Organization of the United Nations). 2014. Sustainable food value chain development: guiding principles. FAO, Rome, Italy. Available at: http://www.fao.org/sustainable-food-value-chains/library/details/en/c/265156/. (Accessed December 16, 2020).

FAO. 2018. Sustainable food systems: concept and framework. Brief. FAO, Rome, Italy. Available at: http://www.fao.org/3/ca2079en/CA2079EN.pdf. (Accessed December 16, 2020).

FAO. 2020. A Framework for Promoting Food Systems Transformation Aligned to the 2030 Agenda and the Sustainable Development Goals. FAO, Rome, Italy.

FAO, IFAD, and WFP (Food and Agriculture Organization of the United Nations, International Fund for Agricultural Development, and World Food Programme). 2020. (and various years) The State of Food Insecurity in the World. FAO, Rome, Italy.

Fan, Shenggen, R. Pandya-Lorch, S. Yosef, Eds. 2014. Resilience for food and nutrition security. Washington, DC: IFPRI.

Food and Land Use Coalition. 2019. Growing Better: Ten Critical Transitions to Transform Food and Land Use.

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