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High Level Panel of Experts on Food Security and Nutrition

Extract from the Report[1]

Agroecological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition

Summary and Recommendations

SUMMARY

Food systems are at a crossroads. Profound transformation is needed to address Agenda 2030 and to achieve food security and nutrition (FSN) in its four dimensions of availability, access, utilization and stability, and to face multidimensional and complex challenges, including a growing world population, urbanization and climate change, which drive increased pressure on natural resources, impacting land, water and biodiversity. This need has been illustrated from various perspectives in previous HLPE reports and is now widely recognized. This transformation will profoundly affect what people eat, as well as how food is produced, processed, transported and sold.

In this context, in October 2017, the UN Committee on World Food Security (CFS) requested its High Level Panel of Experts (HLPE) on FSN to produce a report on *"Agroecological approaches and other innovations for sustainable agriculture and food systems that enhance food security and nutrition"* to inform its discussions during the Forty-sixth CFS Plenary Session in October 2019.

[1] HLPE. 2019. Agroecological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome 2019. Full report forthcoming at *www.fao.org/cfs/cfs-hlpe*.

In this report, the HLPE explores the nature and potential contributions of agroecological and other innovative approaches to formulating transitions towards sustainable food systems (SFSs) that enhance FSN. The HLPE adopts a dynamic, multiscale perspective, focusing on the concepts of transition and transformation. Many transitions need to occur in particular production systems and across the food value chain to achieve major transformation of whole food systems. Both incremental transitions at small scales and structural changes to institutions and norms at larger scales need to take place in a coordinated and integrated way in order to achieve the desired transformation of the global food system.

As highlighted by the HLPE (2016), transition pathways combine technical interventions, investments, and enabling policies and instruments – involving a variety of actors at different scales. In its previous reports, the HLPE (2016, 2017) highlighted a diversity of food systems across and within countries. These food systems are situated in different environmental, sociocultural and economic contexts and face very diverse challenges. Hence, actors in food systems will have to design context-specific transition pathways towards sustainable food systems (SFSs). Moving beyond this context-specificity, the HLPE (2016) identified the three following intertwined operational principles that shape transition pathways towards SFSs for FSN: (i) improve resource efficiency; (ii) strengthen resilience; and (iii) secure social equity/responsibility.

This report starts from the recognition of human rights as the basis for ensuring sustainable food systems. It considers that the seven PANTHER principles of Participation, Accountability, Non-discrimination, Transparency, Human dignity, Empowerment and the Rule of law should guide individual and collective actions to address the four dimensions of FSN at different scales.

This report and its recommendations aim at helping decision-makers, in governments and international organizations, research institutions, the private sector and civil society organizations, design and implement concrete transition pathways towards more SFSs at different scales, from local (farm, community, landscape) to national, regional and global levels.

AGROECOLOGY: TRANSITION PATHWAYS TOWARDS SUSTAINABLE FOOD SYSTEMS

1. Agroecology is a dynamic concept that has gained prominence in scientific, agricultural and political discourse in recent years. It is increasingly promoted as being able to contribute to transforming food systems by applying ecological principles to agriculture and ensuring a regenerative use of natural resources and ecosystem services while also addressing the need for socially equitable food systems within which people can exercise choice over what they eat and how and where it is produced. Agroecology embraces a science, a set of practices and a social movement and has evolved over recent decades to expand in scope from a focus on fields and farms to encompass whole agriculture and food systems. It now represents a transdisciplinary field that includes all the ecological, sociocultural, technological, economic and political dimensions of food systems, from production to consumption.
2. Agroecology is a transdisciplinary science, combining different scientific disciplines to seek solutions to real world problems, working in partnership with multiple stakeholders, considering their local knowledge and cultural values, in a reflective and iterative way that fosters co-learning among researchers and practitioners, as well as the horizontal spread of knowledge from farmer to farmer or among other actors along the food chain. Initially the science was focused on understanding field-level farming practices that use few external inputs but high agrobiodiversity, emphasize recycling and maintenance of soil and animal health, including managing interactions among components and economic diversification. The focus has since expanded to include landscape-scale processes, encompassing landscape ecology and, more recently, social science and political ecology related to the development of equitable and sustainable food systems.
3. Agroecological practices harness, maintain and enhance biological and ecological processes in agricultural production, in order to reduce the use of purchased inputs that include fossil fuels and agrochemicals and to create more diverse, resilient and productive agroecosystems. Agroecological farming systems value, *inter alia*: diversification; mixed cultivation; intercropping; cultivar mixtures; habitat management techniques for crop-associated biodiversity; biological pest control; improvement of soil structure and health; biological nitrogen fixation; and recycling of nutrients, energy and waste.

4. There is no definitive set of practices that could be labelled as agroecological, nor clear, consensual boundaries between what is agroecological and what is not. On the contrary, agricultural practices can be classified along a spectrum and qualified as more or less agroecological, depending on the extent to which agroecological principles are locally applied. In practice this comes down to the extent to which: (i) they rely on ecological processes as opposed to purchased inputs; (ii) they are equitable, environmentally friendly, locally adapted and controlled; and (iii) they adopt a systems approach embracing management of interactions among components, rather than focusing only on specific technologies.
5. Social movements associated with agroecology have often arisen in response to agrarian crises and operated together with broader efforts to initiate widespread change to agriculture and food systems. Agroecology has become the overarching political framework under which many social movements and peasant organizations around the world assert their collective rights and advocate for a diversity of locally adapted agriculture and food systems mainly practised by small-scale food producers. Social movements highlight the need for a strong connection to be made between agroecology, the right to food and food sovereignty. They position agroecology as a political struggle, requiring people to challenge and transform the structures of power in society.
6. There have been many attempts to set out principles of agroecology in the scientific literature. This report suggests a concise and consolidated set of 13 agroecological principles related to: recycling; reducing the use of inputs; soil health; animal health and welfare; biodiversity; synergy (managing interactions); economic diversification; co-creation of knowledge (embracing local knowledge and global science); social values and diets; fairness; connectivity; land and natural resource governance; and participation.
7. An agroecological approach to SFSs is defined as one that favours the use of natural processes, limits the use of external inputs, promotes closed cycles with minimal negative externalities and stresses the importance of local knowledge and participatory processes that develop knowledge and practice through experience, as well as scientific methods, and the need to address social inequalities. This has profound implications for how research, education and extension are organized. An agroecological approach to SFSs recognizes that agri-food systems are coupled with social-ecological systems from the production of food to its consumption with all that goes on in between. It involves agroecological science, agroecological practices and an agroecological social movement, as well as their holistic integration, to address FSN.
8. Agroecology is practised and promoted in various locally adapted forms by many farmers and other food system actors around the world. Their experience underpins a continuing debate about the extent to which agroecological approaches can contribute to design SFSs that achieve FSN at all levels. This debate revolves around the following three critical issues. (i) How much food needs to be produced to achieve FSN; centred on whether FSN is mainly a problem of availability or more an issue of access and utilization? (ii) Could agroecological farming systems produce enough food to meet global demand for food? (iii) How to measure the performance of food systems, taking into account the many environmental and social externalities that have often been neglected in past assessments of agriculture and food systems?
9. There is no single, consensual definition of agroecology shared by all the actors involved, nor agreement on all the aspects embedded in this concept. While this makes it hard to pin down exactly what is agroecology and what is not, it also provides a flexibility that allows agroecological approaches to develop in locally adapted ways. There can be tensions and diverging views between science and social movements around whether social and political dimensions are critical for agroecology to be effectively transformative and whether these dimensions should be distinguished from agroecological practices and techniques focused at field and farm scales. There are emerging efforts to define which agricultural practices are agroecological or not, allied to discussions about convergence or divergence with organic agriculture, which is more prescriptive, and about the development and use of certification schemes.
10. There has been much less investment in research on agroecological approaches than on other innovative approaches, resulting in significant knowledge gaps including on: relative yields and performance of agroecological practices compared to other alternatives across contexts; how to link agroecology to public policy; the economic and social impacts of adopting agroecological approaches; the extent to which agroecological practices increase resilience in the face of climate

change; and how to support transitions to agroecological food systems, including overcoming lock-ins and addressing risks that may prevent them.

11. Five phases have been identified by Gliessman (2007) in making agroecological transitions towards more sustainable food systems. The first three operate at the agroecosystem level and involve: (i) increasing input use efficiency; (ii) substituting conventional inputs and practices with agroecological alternatives; and iii) redesigning the agroecosystem on the basis of a new set of ecological processes. The remaining two steps operate across the whole food system and involve: (iv) re-establishing a more direct connection between producers and consumers; and (v) building a new global food system based on participation, localness, fairness and justice. While the first two steps are incremental, the latter three are more transformative.

INNOVATION FOR SUSTAINABLE FOOD SYSTEMS

12. **Innovation** in this report refers to the process by which individuals, communities or organizations generate changes in the design, production or recycling of goods and services, as well as changes in the surrounding institutional environment. Innovation also refers to the changes generated by this process. Innovation includes changes in practices, norms, markets and institutional arrangements, which may foster new networks of food production, processing, distribution and consumption that may challenge the *status quo*.
13. **Innovation systems** are the networks of organizations, communities, enterprises and individuals within which changes are generated and spread. **Innovation platforms** are initiatives or efforts bringing together diverse stakeholders to create space for co-learning and collective action that support transitions towards SFSs for FSN.
14. Conventional views of innovation in agriculture have often focused on the introduction and spread of adoption of new technologies. Recently greater emphasis has been placed on promoting: (i) inclusive and participatory forms of innovation governance; (ii) information and knowledge co-production and sharing among communities and networks; and (iii) responsible innovation that steers innovation towards social issues.
15. Innovations in agriculture and food systems are distinct from those in many other sectors, because ecological processes and social interactions have a central role. Therefore, adaptation to local environmental and social conditions is critical in the innovation process. Food producers have intimate knowledge of the agroecosystems within which they act, so that agri-food innovation systems may draw heavily on local knowledge and practices.
16. This report describes several innovative approaches to SFSs and clusters them in two main categories: (i) **sustainable intensification of production systems and related approaches** (including climate-smart agriculture, nutrition-sensitive agriculture and sustainable food value chains) that generally involve incremental transitions towards SFSs; and (ii) **agroecological and related approaches** (including organic agriculture, agroforestry and permaculture) that some stakeholders consider to be more transformative. While the former category starts from a premise that, to address future challenges, productivity per unit of land needs to increase in a sustainable manner, which is what is meant by sustainable intensification, the latter emphasizes reducing inputs and fostering diversity alongside social and political transformation focused on improving ecological and human health and addressing issues of equity and governance.
17. The report highlights the points of convergence and divergence existing among these different innovative approaches, building its comparative analysis upon the following nine characteristics: (i) regenerative production, recycling and efficiency; (ii) biodiversity, synergy and integration; (iii) economic diversification versus specialization; (iv) climate change adaptation and mitigation; (v) knowledge generation and dissemination; (vi) equity; (vii) labour versus capital intensification; (viii) connectivity versus globalisation; and (ix) governance and participation. Each characteristic is described in a dynamic way, as a spectrum of various possible positions lying between two opposite poles.
18. Sustainable intensification and related approaches are viewed as contributing most strongly to FSN by improving availability and stability, as well as to the operational principles of resource efficiency and resilience. In contrast, agroecological and related approaches are viewed as contributing

substantively to the access and utilization dimensions of FSN and to the third principle of social equity/responsibility. Participation and empowerment are central in these approaches.

19. This analysis identified the potential utility of adding ecological footprint as a fourth operational principle for SFSs to adequately capture how consumption patterns affect what is produced and how ecologically degradative and regenerative practices have impacts beyond those that occur through resource efficiency, since resource-efficient practices can still be degradative. Ecological footprint expresses the impact of food consumed by a defined group of people measured in terms of the area of biologically productive land and water required for production and to assimilate the wastes generated. It contributes to assessing sustainability; its trend over time indicates to what extent transitions towards SFSs are occurring.
20. The comparative analysis of approaches also identified a possible opportunity to consider adding the emerging concept of "agency" as a fifth pillar of FSN to capture the importance of people's participation in decision-making around how the food they eat is produced, processed, stored, transported and sold. "Agency" refers to the capacity of individuals or communities to define their desired food systems and nutritional outcomes, and to take action and make strategic life choices in securing them.

DIVERGING PERSPECTIVES ON HOW TO ACHIEVE FOOD SYSTEM TRANSFORMATION

21. The HLPE identifies in this report five main groups of interacting factors that may act as barriers to innovation: (i) governance factors; (ii) economic factors; (iii) knowledge factors; (iv) social and cultural factors; and (v) resource factors.
22. While there is a global consensus emerging around the transformation needed in agriculture and food systems, there is no agreement on which innovative approaches should be promoted to foster this transformation. Six controversial issues are presented in this report, each summarized in the six following paragraphs of this summary. They illustrate and highlight key differences among innovative approaches that affect both the action of drivers on innovation and potential barriers to transitions. They relate to: (i) the size of agricultural enterprises; (ii) the deployment of modern biotechnologies; (iii) the deployment of digital technologies; (iv) the use of synthetic fertilizers; (v) biofortification; and (vi) biodiversity conservation strategies. Characterizing these controversial issues is fundamental to understand the possible blockages and make relevant recommendations on how best to address them.
23. There is an increasing recognition that economies of scale in agriculture are context-dependent and vary with the extent to which environmental and social externalities are factored into performance measurement metrics. Smaller farms may often be labour-intensive, as opposed to capital-intensive, and while overall yields (assessed through the land equivalent ratio) may be high for polycultures, the yield of a single staple crop may often be lower than in large-scale monocultures. Economies of scale, which may exist within current regulatory frameworks, subsidies and avoided costs of externalities (impact of pollution, lowering soil carbon or providing less rural labour), would require interventions to avoid market failures resulting in continued degradation of agroecosystems associated with the increased scale of operation. While diversity has sometimes been associated with smaller farm sizes, large-scale farming operations are also starting to experiment with transitions towards more agroecological practices, through diversification that enhances both performance and resilience. So, the issues that are discussed in relation to farm size actually revolve around diversification, which is applicable at multiple scales with supportive public policies, research and civil society initiatives.
24. Despite substantial uptake of gene modification (GM) technology, debates continue to be polarized with public concerns about safety, environmental impacts, concentration of power within food systems and the ethics of gene modification. Some people consider that the uncertainties linked to modern biotechnologies may be addressed through research on a case-by-case basis. However, most agroecological proponents do not consider modern biotechnologies as part of a transition towards SFSs because, as presently constituted, there are conflicts with core agroecological principles associated with ecology, democratic governance and sociocultural diversity. Recent calls for a global observatory for gene editing propose increased scrutiny, dialogue and deliberation on

the use of biotechnologies. On a global scale, modern biotechnologies are *de facto* part of the transition towards SFSs because they are already a significant component of the agricultural systems of a number of countries. In contrast, in agri-food systems where input-intensive models have not been adopted, solutions may be found that do not necessarily rely on the adoption of biotechnologies used elsewhere. The suggested observatory would help analyse the diversity of situations.

25. Digital technologies, if more widely adopted, could, according to sustainable intensification proponents, contribute to improve the sustainability of food systems. Technology transfer, farmer education and a transdisciplinary approach involving all actors (scientists, farmers, industry, governments) are considered necessary to realize the potential of digital technologies. Proponents of agroecological approaches emphasize a need to focus on democratic governance, agency and knowledge systems, to scrutinize *what* is being attempted through the use of digital technologies, *by whom*, and *what kinds* of future food systems are being fostered through their application. Agroecology proponents are not in opposition to digital technologies but often have concerns about the way they are currently used and controlled. Public policies aimed at improving the access to digital agricultural technologies could be used in better connecting producers and consumers as well as facilitating citizen science.

26. Use of synthetic fertilizers has been a major source of yield gains in agriculture as well as of environmental pollution resulting both from their manufacture and their use in farming. The economic cost of environmental pollution in contexts where large quantities of fertilizer have been applied have often outweighed the economic value of increased agricultural yield. Use of fertilizer, often associated with pesticides and modern crop varieties, has been and still is subsidized in many contexts. Where inorganic fertilizer is used without organic additions, soil structure and biotic function may decline, contributing to land degradation. Small-scale farmers using a lot of purchased inputs have sometimes become vulnerable to debt, especially where climate change exacerbates the risk of crop failure, while the use of fertilizer has been the foundation for other farmers to exit poverty. There has been much progress recently in more efficient use of fertilizer through microdosing and integrated soil fertility management that combines the use of organic and inorganic amendments. The viability of different strategies for maintaining soil fertility in high-yielding agricultural practices is highly context-dependent, in relation to soil type, the nature of the farming system and what sources of fertilizer are locally available. While nitrogen can be biologically fixed by incorporating legumes in cropping practices and nutrient cycling can be enhanced through the use of agroecological practices, replacing the phosphorus which is removed with crop products is more challenging, especially if there are no locally available rock phosphate resources. Knowledge gaps have been observed on locally appropriate strategies for maintaining soil fertility that are environmentally sustainable at the same time as being economically viable for farmers.

27. Growing a diverse mix of crops is often contrasted with biofortification of staple crops as alternative strategies to address nutritional deficiencies. Biofortification involves increasing the nutritional value of crops through conventional plant breeding (e.g. beta-carotene rich orange-fleshed sweet potato; iron-rich beans, rice and pearl millet; and quality protein maize), transgenic methods (e.g. betacarotene-rich “golden” rice) or agronomic practices (e.g. zinc-rich wheat). Biofortification has resulted in improved nutritional outcomes in specific contexts but there is less information about its impacts on other dimensions of FSN. Diversified production has been positively correlated with improved FSN through both direct consumption and sale of products increasing income that then confers greater FSN. Critics suggest that biofortification may contribute to reliance on single food solutions that may be an inherently risky and “less-resilient” approach than to maintain a diversity of crops and the knowledge required to grow, process, prepare and eat them. The two strategies can be integrated with producers and consumers being offered informed choices about adopting biofortified crops, diversified production or both.

28. There is a long-standing debate about the extent to which conserving biodiversity within agricultural landscapes (land sharing) can contribute to meeting conservation goals as opposed to maximizing the land area available only for conservation purposes through maximizing agricultural production on the land area devoted to it (land sparing). Agroecological approaches to FSN challenge the assumptions underlying this apparent dichotomy. First, in terms of whether conservation friendly agricultural practices are necessarily low-yielding and, second, the extent to which the impacts on biodiversity of chemical-intensive agriculture are confined to the areas where it is practised. There

is growing consensus that the overall impact of agriculture on insect and other biodiversity is reaching alarming proportions that exceed planetary boundaries.

29. Looking across the six controversial issues, it is possible to identify knowledge gaps around specific metrics of food system performance required to guide food system transitions and to clarify critical decisions that need to be made, including opportunities for reformulating the controversial issues towards the design of solutions on the one hand, or political choices among divergent views on the other. It is clear that market forces, left to themselves, are unlikely to result in transitions towards SFSs. This is because there are many externalities associated with production, processing and distribution of food that are not priced and because the power exerted from the increasingly concentrated agri-food input and retail sector often works against addressing these externalities. People can exert pressure to close market failures through their purchasing decisions, but this is only possible if there are: (i) affordable products produced sustainably; (ii) products that are labelled so that consumers can exert their choices; and (iii) the information about how food has been produced is both available and trusted. There are moves within the private sector to upgrade value chains and establish and participate in certification schemes that may be either centrally run or more participatory in nature. Under appropriate circumstances, these may guarantee sustainability and equity along food chains and can contribute to enabling consumers to choose sustainably produced food facilitated by an appropriate food environment (HLPE, 2017). Government policy, regulation and moves towards true pricing aim at internalizing all ecological and social effects of production in the price of food, enabling markets to function in ways that would foster transitions towards SFSs. This requires harnessing connections between transdisciplinary science that can understand how social-ecological systems work, and social movements and civil society organizations that can trigger and sustain the change necessary to foster transitions towards SFSs.

DESIGN OF INSTITUTIONAL ENVIRONMENTS THAT SUPPORT TRANSITIONS TOWARDS SFSS

30. A considerable inertia, manifest in public policies, corporate structures, education systems, consumer habits and investment in research, favours the currently dominant model of agriculture and food systems, representing a series of lock-ins. In the dominant model, environmental and social externalities are not properly considered and, therefore, not appropriately factored into decisions influencing the development of food systems. To overcome this inertia and challenge the status quo, it is imperative to create a level playing field on which different approaches can be equitably compared. This requires redirection of investments and efforts to design and implement innovative approaches, including agroecological approaches, that provide concrete alternatives to the dominant model and open transition pathways towards SFSs.

31. Designing supportive public policies to foster transitions towards SFSs may include shifting public support towards more diversified farming systems. Given that many smallholder farmers are vulnerable to food insecurity and malnutrition, encouraging them, through appropriate public support (HLPE, 2013), to use agroecological methods would have a double impact, addressing both FSN and transitions to SFSs simultaneously. Public support measures that enable producers, regardless of their scale of operation, to make greater use of sustainable food production methods could include removing subsidies for synthetic inputs while giving incentives for sustainable food production methods, and for managing multifunctional landscapes including wild species. A substantial barrier to premium pricing for sustainably produced food is that market prices usually do not include the cost of negative externalities of production, nor reward the positive benefits of systems with positive ecological impacts.

32. Key changes in agriculture and food policies that could contribute to transitions towards SFSs for FSN include: putting greater emphasis on health and nutritional benefits; implementation of true cost accounting; focusing effort on areas where evidence suggests the fastest progress can be made in achieving FSN outcomes, such as education, particularly girl's education; measures to support the creation of decent and safe forms of employment, particularly for young people, but also for marginalized groups such as farmworkers and migrants; and putting greater emphasis on processing, distribution, market and consumption aspects of food systems including creating

participatory guarantee schemes that build stronger socio-economic relationships between producers and consumers.

33. Barriers to diversification of food systems include intellectual property protection and seed legislation, which might need significant change, depending on the national legal context. Seed legislation that supports the exchange and access to seeds from genetically heterogeneous varieties, including traditional crops, is an important component of this. Other barriers include large-scale land acquisitions that result in loss of access to natural resources for local populations and can worsen the FSN status of small-scale producers and the rural poor. Support for customary land rights for small-scale producers, and respect for the Voluntary Guidelines on Responsible Governance of Tenure for Land, Fisheries and Forest, adopted by CFS in 2012, would strengthen the ability of small-scale food producers and the rural poor to implement agroecological practices thanks to improved access to land, forests and water resources.

34. Comprehensive performance metrics, covering all the impacts of agriculture and food systems, are a key requirement for rational decision-making. The relevance of metrics is scale-specific. The performance of individual practices needs to be measured in relation to their purposes. This may involve measuring quantities like crop yield, soil organic carbon content, or income from sale of products with consideration of the variability of performance across contexts. Practices are integrated within farms or livelihood systems, making the total factor productivity of farm enterprises or smallholder livelihoods a key integrated metric at household level. At landscape scale, the concept of land equivalent ratio can be applied to ecosystem services to derive a multifunctionality metric that sums the effects of agriculture on all provisioning, regulating and cultural ecosystem services weighted by their relative societal value, in the place they are provided. Operationalizing such a metric requires development of policy processes that can be implemented at local landscape scales (10–1 000 km^2) at which many ecosystem services first manifest, and at which social capital among land users is required to manage territorial resources. For whole food systems, an ecological footprint represents an integrated metric that takes into account both what people consume and how it is produced, processed, transported and used.

35. The utility of ecological footprint in developing national and international policy has been recognized, although refinement of accounting methods is required to fully capture the concept of biocapacity, taking account of degradative as opposed to regenerative agricultural practices, and trade-offs between different ecosystem services. A key reason for distinguishing ecological footprint from resource efficiency, as operational principles, lies at the heart of the differences between agroecological and sustainable intensification approaches to transitions to SFS, because it is possible to have high resource use efficiency at the same time as having a negative ecological footprint. A key practical requirement for sustainable agricultural production is the use of practices that are regenerative rather than degradative. In whole food systems, diet, resource use and waste along food chains all become important, together with appropriate metrics that measure ecological, social as well as economic performance of alternative options.

36. The reconfiguration of the relationship between formal scientific research and the local knowledge and experience of farmers, rural and urban communities and other actors along food value chains, many of whom are in the private sector, has proved to be useful. Taking steps to achieve greater integration of local and scientific knowledge, and of knowledge along food chains, has two key dimensions. Firstly, investment in strengthening capacity around supporting local innovation. Secondly, fundamental reconfiguration to address knowledge gaps and span boundaries between social movements, operating with strongly held convictions that motivate action towards more sustainable agriculture and food systems at grassroots level, and formal research systems that are sometimes perceived to be antagonistic rather than supportive of the knowledge base on which decisions can be made.

37. Investments in agriculture and food systems research and development (R&D) have evidenced impact. Between 2000 and 2009, global expenditure on agricultural R&D increased by 3.1 percent a year on average (only 2.3 percent a year in low-income countries), from USD 25.0 billion to USD 33.6 billion, almost half of this increase being spent in China and India. FAO estimates that three-quarters of the investments in agricultural research and extension are realized in G20 nations. Global R&D investments are focused mainly on a few major staple crops, mostly cereals, while other nutritious crops (such as pulses, fruits and vegetables, as well as the so-called orphan crops) are often neglected. The private sector also heavily invests in food system

R&D and is increasingly interested in value chain upgrading to ensure environmentally and socially sustainable supply chains leading to co-investment with public funds around key sustainability issues including adaptation to climate change.

38. The involvement of the next generation of food producers in transitions to SFSs is too low. The lack of immediate benefits, poor agricultural support services, lack of information about appropriate technologies and practices, land degradation and poor infrastructure are some of the factors identified as disincentives for young people to be involved in agriculture. Recognizing the particular constraints and challenges that young people face in trying to establish diversified farming systems and food enterprises, including access to land, credit and information, is important. Digital technologies present new opportunities to engage young people.

39. Agroecology initiatives that advocate for women's formal rights are essential. These ensure land access, more equitable family and community relationships, and reorientation of institutions and organizations to explicitly address gender inequality. This latter inequality is a key barrier to transitions to SFS in many contexts. There is increasing momentum in the policy arena for gender transformative actions that address gender inequality in agriculture and food systems. These actions aim to challenge the underlying causes of gender inequality, such as norms, gender relations in households and society, and institutional structures that perpetuate discrimination and imbalances, rather than merely addressing its symptoms. They seek to achieve more equitable involvement of women and girls in decision-making, control of resources and control of their own labour and destiny. A sufficient proportion of the population in a community must be involved to ensure that the needed structural changes will be lasting and pervasive. Addressing gender inequality requires recognition of: (i) women's central roles in agriculture and food systems; and (ii) the often-high labour demands in holistic agricultural management systems, making greater income equality for those providing important labour.

40. Public education and awareness raising that use democratic, grassroots approaches are key elements for transforming agriculture and food systems. They can be combined with active involvement of diverse civil society organizations and private sector initiatives in governance forums at different scales. This results in individual citizens and civil society organizations having greater agency in respect of how their food is produced, processed, transported and sold. Global institutions that play a key role, such as global trade organizations and international financial institutions, need to be transparent and democratically accountable, particularly challenging in relation to inclusion of marginalized rural and urban, low-income communities.

CONCLUSION

41. The CFS can serve as a model of inclusive civil society and private sector involvement and a starting point for implementing transitions towards FSN. Strategies and planning for implementing agroecological approaches at different scales (local, territorial, national, regional and global) can help achieve this fundamental transformation of food systems by: setting long-term goals; ensuring policy coherence across sectors (agriculture, trade, health, gender, education, energy and environment); and involving all relevant actors through consultative multi-stakeholder processes.

RECOMMENDATIONS

There is no "one-size-fits-all" solution to realizing the transformation of food systems globally required to achieve food security and nutrition (FSN). It will require supporting a diversity of transitions from different starting points, along different pathways, adapted to the local conditions and challenges faced in different places by different people. The following recommendations, distilled from the deliberations of this report, aim to help decision-makers develop concrete actions that will encourage and support the innovation required at local, territorial, national, regional and global scales to follow appropriate transition pathways towards sustainable food systems (SFSs) that enhance FSN.

1. PROMOTE AGROECOLOGICAL AND OTHER INNOVATIVE APPROACHES IN AN INTEGRATED WAY TO FOSTER TRANSFORMATION OF FOOD SYSTEMS

All stakeholders involved in food systems (including: States, local authorities, intergovernmental organizations (IGOs), civil society and the private sector, research and academic institutions) should learn from agroecological and other innovative approaches concrete ways to foster transformation of food systems by improving resource efficiency, strengthening resilience and securing social equity/responsibility.

In particular, they should:

a) take into account and value the diversity of food systems and their contexts across scales when developing transition pathways to SFSs;

b) use relevant performance metrics for food systems that consider all environmental, social and economic impacts of food production and consumption;

c) recognize the importance of improving the ecological footprint[2] of food systems as an operational principle for transitioning to SFSs, and thereby encourage appropriate consumption alongside agricultural and other food production practices that maintain or enhance, rather than deplete, natural capital;

d) encourage integration of transdisciplinary science and local (including indigenous) knowledge in participatory innovation processes that transform food systems.

Specifically, CFS should:

e) consider the emerging importance of the concept of 'agency' and the opportunity to add it as a fifth pillar of FSN with the view to progress towards the realization of the right to adequate food.

2. SUPPORT TRANSITIONS TO DIVERSIFIED AND RESILIENT FOOD SYSTEMS

States and IGOs should:

a) Support diversified and resilient production systems, including mixed livestock, fish, cropping and agroforestry, that preserve and enhance biodiversity, as well as the natural resource base, exploring:
   i. **redirecting** subsidies and incentives that at present benefit unsustainable practices, to support transition towards SFSs;
   ii. **supporting** use of participatory and inclusive territorial management planning to identify and foster locally sustainable practices and to protect common natural resources at different levels (landscape and community, national, regional and global);
   iii. **building** adaptation of international agreements and national regulations on genetic resources and intellectual property to better take into account farmers' access to diverse,

[2] Ecological footprint puts the food consumed by a given population in relation to the bioavailable land and water resources required to produce it and absorb its associated waste. It can be improved by reducing consumption and waste, as well as through more efficient production.

traditional and locally adapted genetic resources, as well as farmer-to-farmer seed exchange;

iv. **strengthening** the regulations on the use of chemicals harmful for human health and the environment in agriculture and food systems, promoting alternatives to their use and rewarding practices that produce without them;

v. **building** social capital and inclusive public bodies at territorial landscape scale (10–1 000 km^2) so that policy processes can be implemented at a scale where the provision of, and the trade-offs among, key ecosystem services (provisioning, regulating, supporting and cultural) can be managed.

b) **Promote** healthy and diversified diets as an avenue to support transitions towards more sustainable, diversified and resilient food systems through:

i. education and awareness;

ii. appropriate food labelling and certification;

iii. support for low-income consumers and the use of public procurement policies, including school feeding programmes.

c) **Support** food value chain innovation platforms, incubators and aggregation mechanisms[3] in which private sector actors, as well as public bodies, invest in and reward sustainable food producers and the production of public goods, exploring:

i. **supporting** the development of local and regional markets, processing hubs and transportation infrastructures that provide greater processing and handling capacities for fresh products from small and medium-sized farmers adopting agroecological and other innovative approaches and improve their access to local food markets;

ii. **encouraging incentives** for young entrepreneurs, women and community-led enterprises[4] that capture and retain value locally, recognizing and addressing their specific constraints and needs;

iii. **harnessing** the use of recent developments in digital technologies to strengthen the links between food producers and consumers including through brokering sustainable finance initiatives and market incentives;

iv. **adapting support** to encourage local food producers, food enterprises and communities to build recycling systems by supporting the reuse of animal waste, crop residue and food processing waste in forms such as animal feed, compost, biogas and mulch.

3. STRENGTHEN SUPPORT FOR RESEARCH AND RECONFIGURE KNOWLEDGE GENERATION AND SHARING TO FOSTER CO-LEARNING

States and IGOs, in collaboration with academic institutions, civil society and the private sector should:

a) increase investments in public and private research and development, and in national and international research systems to support programmes in agroecological and other innovative approaches, including to improve technologies;

b) develop and support transdisciplinary research conducted through innovation platforms that foster co-learning between practitioners and researchers, and horizontal dissemination of experience among practitioners (e.g. farmer-to-farmer networks, communities of practice and agroecological lighthouses);

[3] Aggregation mechanisms refer to ways of bulking outputs or inputs to improve market access as sometimes achieved through cooperatives.

[4] Community-led enterprises engage directly with local people, with a lead partner that is a charity, social enterprise, not-for-profit or member (cooperative) organization and has a sustainable business plan aiming at viability beyond grants or public funding.

c) encourage explicit coverage of "transitions to SFSs" in school and university curricula, integrating hands-on, experiential learning;

d) ensure that training programmes for agricultural extension and public health workers are promoting learning processes and the use of adequate technologies as well as a better understanding of the role of agroecological practices for nutrition and human, animal and environmental health;

e) establish and develop effective technology transfer mechanisms to enhance the adoption of technologies in agroecological and other innovative approaches by farmers/producers and other stakeholders involved in various stages of value chains of food commodities;

f) address power imbalances and conflicts of interest in relation to the generation, validation and communication of knowledge about food production and processing, by valuing different sources of knowledge and bridging gaps between knowledge generated and transmitted through social movements on the one hand, and the scientific sector on the other.

4. STRENGTHEN AGENCY[5] AND STAKEHOLDER ENGAGEMENT, EMPOWER VULNERABLE AND MARGINALIZED GROUPS AND ADDRESS POWER INEQUALITIES IN FOOD SYSTEMS

States, IGOs and, as appropriate, local authorities should:

a) develop strategies to promote transitions towards SFS setting long-term goals at national and regional levels, ensuring policy coherence across sectors at different levels, bringing together public administrations responsible for, and other relevant stakeholders involved in, agriculture, forestry, trade, health, gender, education, energy and environment;

b) explore ways for trade agreements and rules to better support transitions towards more sustainable agriculture and food systems;

c) support inclusive and democratic decision-making mechanisms at all levels in food systems and take specific measures to ensure the participation of marginalized and vulnerable groups[6] most at risk of food insecurity and malnutrition;

d) in order to favour agroecology and other innovative approaches towards SFSs, ensure legal protection of customary land and natural resources access and tenure rights for small-scale food producers and food-insecure people (small farmers, pastoralists, fisherfolk, forest-dependent people, indigenous peoples) through formal instruments consistent with international legal frameworks,[7] and through national regulation of large-scale land acquisitions;

e) recognize gender equity as a key driver of agroecology and other innovative approaches and support gender transformative policies, programmes and actions that challenge the underlying causes of gender inequality within food systems with respect to norms, relationships and institutional structures, in particular by ensuring that laws and policies improve gender equality and address gender-based violence;

f) strengthen linkages between urban communities and food production systems to favour transitions towards SFSs, specifically by including consumer cooperatives and multi-stakeholder platforms focused on local and regional markets, and increasing investment in food rescue for re-distribution of food to vulnerable people;

g) strengthen food producers' and consumers' associations, organizations and cooperatives that build capacities, create and exchange knowledge with a view to facilitate the adoption of agroecological and other innovative approaches that foster transitions towards SFSs.

[5] "Agency" refers to the capacity of individuals or communities to define their desired food systems and nutritional outcomes, and to take action and make strategic life choices in securing them.

[6] The HLPE (2017) distinguished the vulnerable people with specific nutrient requirements (such as young children, adolescent girls, pregnant and lactating women, the elderly and ill people), and the marginalized people with less control over their diets (such as the urban and rural poor, as well as some indigenous peoples).

[7] For example: UN Declaration on the Rights of Indigenous Peoples; CFS Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security (VGGT); Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW).

5. ESTABLISH AND USE COMPREHENSIVE PERFORMANCE MEASUREMENT AND MONITORING FRAMEWORKS FOR FOOD SYSTEMS

States and IGOs, in collaboration with academic institutions, civil society and the private sector, should**:**

a) develop practical, scientifically grounded and comprehensive performance metrics and indicators of agriculture and food systems as a basis for assessment, policy implementation and investment decisions, including total factor productivity of livelihoods, land equivalent ratio multifunctionality of landscapes and ecological footprint of food systems, as well as impacts on beneficial organisms, dietary diversity and nutritional outcomes, women's empowerment, income stability and employment conditions, as appropriate;

b) redirect public and private investment and specifically agricultural subsidies to support farms based on the comprehensive performance metrics set out in 5a that assess their sustainability and impact on FSN;

c) recognize the importance of true cost accounting for negative as well as positive externalities in food systems and take steps to effectively implement it where appropriate;

d) recognize that, providing farmers/producers and other stakeholders comply with public policy and safety standards, participatory guarantee systems are a valid means to certify organic, ecological and agroecological producers for local and domestic markets, which are often the most feasible for low-income, small-scale producers to access;

e) promote rigorous, transparent and inclusive assessments of modern biotechnology, including support for a global observatory for gene editing;

f) undertake holistic assessments of positive and negative employment and labour characteristics in agriculture to underpin policies and regulations that favour transitions towards SFS, while ensuring decent conditions for farm labour and strengthening the health of farm and other food system workers.

FAO should:

g) encourage data collection at national level, documentation of lessons learned and information sharing at all levels, to facilitate the adoption of agroecological and other innovative approaches and foster transitions towards SFSs;

h) in collaboration with member countries, assess and document the contribution of agroecological and other innovative approaches to food security and nutrition at national and global levels.

CFS should:

i) establish transparent, accountable and inclusive mechanisms to monitor if and how these recommendations are being implemented using clear metrics within a specified timeframe;

j) raise awareness of the importance of the contribution of agroecological and other innovative approaches to achieving most of the 2030 Sustainable Development Goals and to advancing the Koronivia Joint Work on Agriculture (KJWA) at national level and consequently at regional and global levels.