

4th Note on Critical, emerging and enduring issues

High Level Panel of Experts on Food Security and Nutrition (HLPE-FSN) of the
Committee on World Food Security (CFS)

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HLPE-FSN V0 drafts are deliberately presented early enough in the process – as a work-in progress, with their range of imperfections – to allow sufficient time to give proper consideration to the feedback received so that it can play a really useful role in the elaboration of the report. It is a key part of the scientific dialogue between the HLPE-FSN Steering Committee and the rest of the knowledge community.

This V0 draft may be thoroughly corrected, modified, expanded and revised after the present consultation.

In order to strengthen this draft, the HLPE-FSN would welcome submission of material, evidence-based suggestions and references in particular addressing the specific questions of the e-consultation.

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The Committee on World Food Security (CFS), the foremost intergovernmental and international evidence-based and multistakeholder platform related to food security and nutrition, mandated its High Level Panel of Experts on Food Security and Nutrition (HLPE-FSN) to “identify emerging issues, and help members prioritize future actions and attentions on key focal areas” (FAO, 2009, p. 9).

In October 2013, the CFS requested that the HLPE-FSN produce a note on critical and emerging issues affecting food security and nutrition (FSN). The request was made in the context of the CFS’s ongoing discussion on the selection and prioritization of its activities.

The HLPE-FSN published the first such note in 2014. In 2015, at its 42nd Plenary Session, the CFS decided that the HLPE-FSN note would be updated at least every four years, depending on funding availability and the HLPE-FSN workload, and released in time to be used as the starting point for the process of elaborating the following CFS multiyear programme of work (MYPoW). The second and third notes were published respectively in 2017 and 2022.

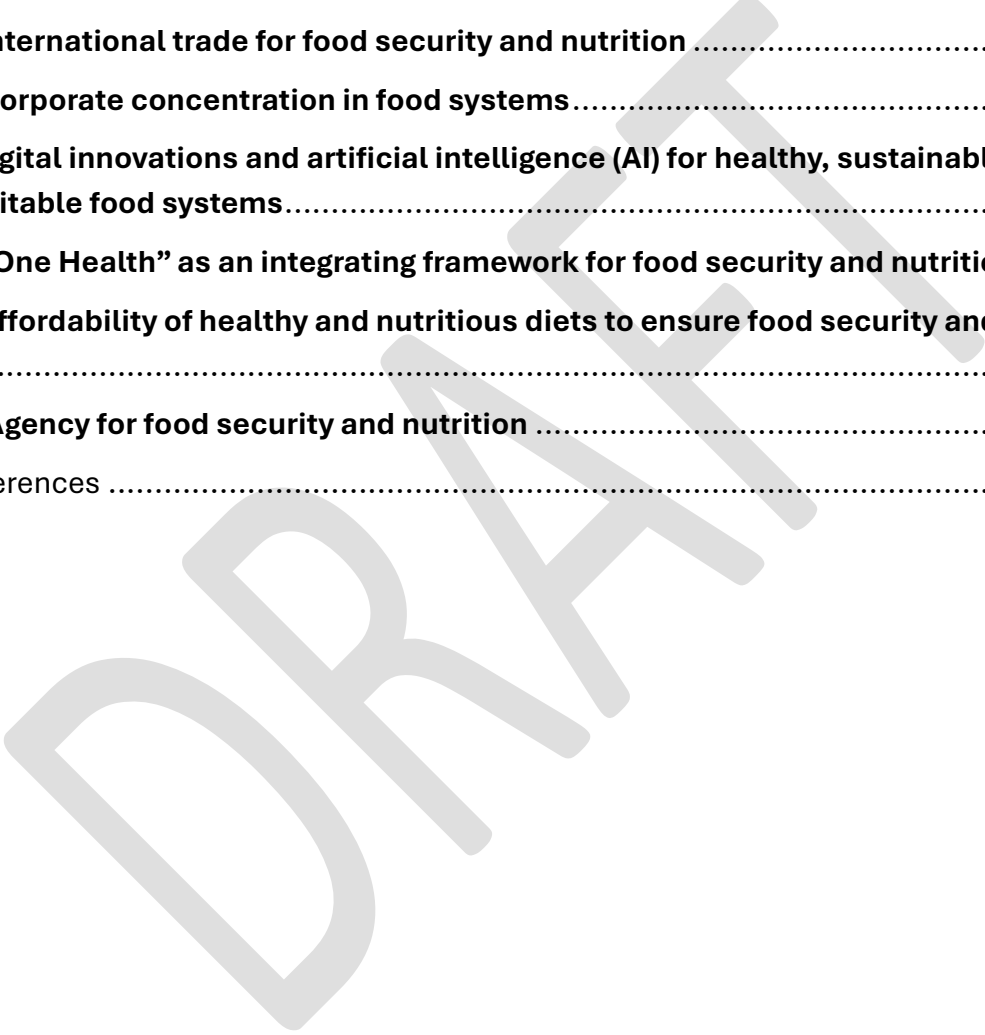
“A critical issue is an issue that has a profound influence on one or more of the dimensions of food security, either directly or indirectly, positively or negatively. This influence might be global or might affect one or more particularly vulnerable populations. [...] An emerging issue is an issue for which there are concerns that it could become critical in the future. This can be the case, for instance, when its effects on food security and nutrition are not well known, but seem to be increasing, often quickly. It can also be the case for long-standing issues, but for which the direct or indirect impact on food security has only recently started to be appreciated. Emerging issues can include changes on long-standing issues, or new developments, such as new technologies”. (HLPE, 2014 p). In 2022, the Steering Committee noticed that several of the critical concerns that were proposed for inclusion in the note have been persistent or recurrent issues for FSN, such as climate change, natural disasters and conflicts. To express this reality, the Steering Committee added the term “enduring” to the title of the note (HLPE, 2022).

The present note gathers a range of issues identified by the HLPE-FSN Steering Committee, taking into account the 3 previous notes as well as the activities already conducted by CFS. Several rounds of discussions were conducted by two successive Steering Committees. and submitted to public consultation in April 2026 for inputs and feedback.

This 4th note on Critical, Emerging and Enduring Issues for Food Security and Nutrition, will be discussed at CFS 54 as a first input into the development of the new CFS MYPoW.

List of issues

- 1. Advancing the post-2030 Development Agenda through food systems transformation..... 5**
- 2. Achieving food security and nutrition in climate crises..... 8**
- 3. Food security and nutrition, and the three Rio Conventions: Biodiversity, Desertification and Climate 11**
- 4. Geopolitical uncertainty and polycrises: how to predict and prevent impacts on food security and nutrition 14**
- 5. International trade for food security and nutrition 18**
- 6. Corporate concentration in food systems..... 22**
- 7 Digital innovations and artificial intelligence (AI) for healthy, sustainable, and equitable food systems..... 25**
- 8. “One Health” as an integrating framework for food security and nutrition..... 29**
- 9. Affordability of healthy and nutritious diets to ensure food security and nutrition 33**
- 10 Agency for food security and nutrition 36**
- References 39**



1. Advancing the post-2030 Development Agenda through food systems transformation

As the 2030 Agenda for Sustainable Development approaches its conclusion, progress towards the SDGs remains off track, particularly for Zero Hunger (SDG 2) (United Nations, 2015; FAO et al., 2023). Progress toward food security and nutrition-for-all has been slow and uneven. Billions of people cannot afford a healthy diet, and global food insecurity has increased since 2019 (FAO et al., 2025). On current trajectories, nearly 600 million people will face hunger by 2030 (FAO et al., 2024), placing SDG 2 at serious risk. Persistent malnutrition reflects structural failures in food system governance.

Hunger, food insecurity, and all forms of malnutrition persist globally, driven by climate change, conflict, migration and population displacement, health and diseases, economic volatility, supply chain disruptions, policy and market distortions, widening inequities – including unequal access and ownership of resources, corporate concentration, and other power asymmetries in markets and governance-, and environmental degradation (FAO et al., 2023; IPCC, 2022). These trends demonstrate that achieving food security and nutrition (FSN) for the world's poorest is a systemic and persistent challenge that cannot be resolved through isolated or sector-specific interventions (HLPE, 2020).

Food systems are central to FSN as they encompass all actors, activities, and processes involved in food production, processing, distribution, consumption, and disposal, ensuring that food is available, affordable, safe, nutritious, and culturally appropriate (FAO, 2018). At the same time, food systems contribute significantly to greenhouse gas emissions, biodiversity loss, land and water degradation, and pollution, while often failing to provide living incomes for workers and food producers (FAO, 2021; IPCC, 2022). As such, food systems sit at the intersection of human health, livelihoods, equity, climate resilience, and ecosystem sustainability.

A food systems perspective reveals the multidimensional nature of FSN. The six interlinked dimensions of food security – availability, access, utilization, stability, sustainability, and agency – are shaped by economic structures, governance arrangements, social norms, and power relations across food systems (HLPE, 2020). Incremental or siloed policy responses tend to address only one dimension at a time, often generating trade-offs or unintended consequences elsewhere. For example, policies focused solely on increasing productivity may undermine environmental sustainability or dietary quality (FAO, 2021), while social protection measures that overlook food environments or the structure of food markets may fail to improve nutrition outcomes (FAO et al., 2023).

Food systems transformation, therefore, offers a unifying framework for simultaneously addressing hunger, malnutrition, inequity, and environmental degradation (HLPE, 2020). A systems approach enables policymakers to identify synergies and manage trade-offs across agriculture, health, trade, environment, social protection and other interconnected systems. However, these synergies and trade-offs reflect political priorities and underlying power asymmetries, rather than neutral technical assessments.

In the post-2030 context – characterized by climate extremes, geopolitical tensions, tightening fiscal constraints, and rapid technological change – addressing these challenges will require integrated approaches that explicitly engage with both policy coherence and the political choices that shape how trade-offs are resolved in order to safeguard FSN for present and future generations (IPCC, 2022).

A core issue is the persistence of fragmented governance and siloed policies in addressing FSN. Under the 2030 Agenda, implementation has often remained sector-specific, limiting policymakers' ability to manage complex interactions across economic, social, and environmental domains (HLPE, 2020; United Nations, 2015). These fragmented approaches go beyond institutional shortcomings: they reflect competing policy objectives and entrenched sectoral interests that frequently relegate nutrition, equity, and environmental sustainability behind priorities such as productivity and economic growth.

Food systems illustrate the costs of fragmentation, the tensions and trade-offs that arise from competing political and economic priorities, and opportunities for integration. Unsustainable production and consumption patterns contribute to climate change, biodiversity loss, contamination, and ecosystem degradation (FAO, 2021; IPCC, 2022). These pressures undermine food availability, quality, and stability. At the same time, inequality, fragile value chains, high levels of corporate concentration, and trade disruptions affect food affordability and access, particularly for vulnerable populations in both low- and high-income countries (HLPE, 2023). Diet-related noncommunicable diseases coexist with undernutrition leading to multiple burdens of malnutrition, thus highlighting structural failures in food environments and food utilization (FAO et al., 2023).

Emerging challenges – such as technological disruption, climate-induced shocks, conflicts, and shifting and unpredictable geopolitical dynamics – are intensifying these pressures (IPCC, 2022; FAO et al., 2023). Without a coherent food systems approach, and without confronting the structural political and economic drivers that sustain fragmentation, these trends risk further entrenching food insecurity, nutritional inequities, and environmental degradation (HLPE, 2020).

Addressing these challenges requires deliberate food systems transformation supported by coherent policies and inclusive governance (HLPE, 2020).

Key actions include:

- Putting nutritious food as a human right at the heart of policymaking, governance, and programmes (UN General Assembly, 1966).
- Promoting integrated policy frameworks that align agriculture, nutrition, health, environment, trade, and social protection objectives while reforming public budgets, subsidies, and fiscal and investment incentives to support healthier, more equitable, and sustainable food systems (HLPE, 2020).

- Identifying, analyzing, and addressing power asymmetries that negatively impact food security and nutrition in access and ownership of resources, corporate concentration, and governance (Chicoma & Reynolds, 2025).
- Supporting diversified, resilient, and sustainable production systems, including agroecological approaches and sustainable fisheries and aquaculture (FAO, 2021).
- Improving food environments and local and territorial food systems to make healthy diets affordable and accessible through regulatory measures, public procurement, market shaping policies, and consumer information (FAO *et al.*, 2023).
- Strengthening inclusive governance mechanisms that enable participation, transparency, and accountability across food systems, including stronger safeguards against conflicts of interest and undue influence (HLPE, 2023).
- Leveraging science, technology, and innovation, including digital tools and One Health approaches, while addressing risks related to access, equity, and data governance (HLPE, 2020).

Despite growing evidence, important knowledge gaps remain. These include limited data on food system trade-offs and distributional impacts; insufficient understanding of how power asymmetries along value chains affect FSN (HLPE, 2023); and gaps in assessing the long-term impacts of technological innovations on equity and sustainability (HLPE, 2020). More integrative, forward-looking analysis is needed to support policy coherence and anticipatory governance. There are also knowledge gaps regarding how food systems transformation can help unlock the other five UN global SDG transitions (energy, digital connectivity, education, jobs and social protection, and climate change, biodiversity loss and pollution), which is critical for shaping an effective post-2030 development agenda (United Nations, 2015).

Food systems transformation is directly aligned with the mandate of the Committee on World Food Security (CFS) to promote policy coherence and inclusive governance for FSN (HLPE, 2020). As an intergovernmental, multistakeholder platform, CFS is uniquely positioned to address complex, cross-sectoral challenges that no single institution or sector can resolve alone. CFS can provide a neutral space for dialogue on difficult trade-offs related to trade, climate action, biodiversity conservation, technology, and equity (HLPE, 2023). Its inclusive structure allows governments, civil society, the private sector, UN agencies, and other stakeholders to jointly examine emerging risks and opportunities for FSN in a rapidly changing global context. By focusing on food systems transformation in the post-2030 agenda, CFS can help reenergize multilateral cooperation, support integrated policy responses, and ensure that FSN remain central to future development pathways (United Nations, 2015).

2. Achieving food security and nutrition in climate crises

Climate change is affecting food security and nutrition through multiple interacting pathways, and these impacts are expected to intensify in the coming decades. Rising temperatures altered precipitation patterns, droughts, floods, and extreme weather events are disrupting agricultural productivity, livestock systems, fisheries, and the stability of food supply (Fanzo et al., 2024; IPCC, 2023). Beyond these direct impacts on production, climate change also affects food environments by increasing food price volatility, disrupting transport and distribution systems, and undermining the livelihoods of farmers, fishers, and other food system workers (Owino et al., 2022). Climate change may also alter the nutritional quality of foods themselves. Elevated atmospheric CO₂ concentrations have been shown to reduce concentrations of key micronutrients such as iron and zinc in staple crops, posing risks for populations already vulnerable to nutrient deficiencies (Myers et al., 2014; Ter Haar et al., 2025). These processes are driven largely by human activities, particularly fossil fuel combustion, land-use change, and agricultural practices that contribute to greenhouse gas emissions and environmental degradation (IPCC, 2023). The consequences for nutrition are already visible, including increased food insecurity, reduced availability of diverse and nutrient-rich foods, and heightened risks of undernutrition, micronutrient deficiencies, and diet-related non-communicable diseases (Owino et al., 2022; Fanzo et al., 2024). Without rapid mitigation and adaptation measures, climate change is projected to exacerbate these trends and further widen existing inequalities in food access and health outcomes worldwide (IPCC, 2023).

Climate impacts are greatest in fragile terrestrial and aquatic agroecosystems and low-income countries with limited adaptive capacity. However, climate change increasingly poses systemic challenges across food systems, threatening the reliability of local and global food supplies and supply chains (Abebaw, 2025). These threats are compounded by risks linked with conflict and domestic and geopolitical instability. For instance, before the civil war in Syria in 2011, a severe drought, whose likelihood was increased by anthropogenic climate change, contributed to agricultural collapse, rural displacement, and rising socio-economic pressures that interacted with political and economic grievances. This illustrates how climate stress can act as a threat multiplier within broader polycrises that may destabilize societies (Gleick, 2014; Kelley et al., 2015; Selby et al., 2017). Countries least responsible for climate change bear the brunt of its impacts. The ten hungriest countries account for just 0.08 percent of global carbon emissions, while G20 countries generate about 80 percent (Allafta, H., & Opp, C. (2024)). This imbalance is likely to increase by 2030, with climate-related hunger greatest in Sub-Saharan Africa, South Asia and Southeast Asia (Baba Ali et al., 2024).

Climate-driven biodiversity loss, soil degradation, and transgression of other planetary boundaries further erode long-term food system sustainability (Crippa et al., 2021). These pressures are reinforced by subsidies and investment policies especially in high-income countries that often favour a small number of staple crops that are climate sensitive rather than more diverse, nutritious and climate-resilient options.

Agricultural policies, incentives, finance and regulations should prioritize systemic resilience and accelerate adaptation to long-term climate change, short-term climate shocks and extreme weather. At the same time, it is essential to examine why adaptation remains slow despite mounting evidence of climate impacts, including the political economy of subsidies, taxes, regulations and financial flows that shape food systems, and the continued marginalization of food security and nutrition within climate governance.

Production technologies and practices must ensure sustainability under changing climates. This requires redesigning and deploying systems that reduce structural vulnerability to climate shocks, while promoting holistic agricultural approaches - such as agroecology and other sustainable models - that accelerate climate adaptation, enhance functional biodiversity, restore soil and water cycles, reduce dependence on external inputs, sustain ecosystems and natural resources, and contribute to food security and nutrition. This should be done by:

- 1) Transitioning to culturally acceptable, resilient, and nutritious foods from diverse crops
- 2) Improving natural resource management and sustainable production systems
- 3) Building resilience to weather extremes and resistance to novel pests and diseases through diversified and adaptive production systems
- 4) Breeding both staple and underutilised crops that are adapted for harsh climates and extreme weather.

Policies should support these transitions through subsidies and support systems that reduce structural barriers, protect climate-affected small producers and promote crop diversity. This includes repurposing existing subsidies, incentives and other public support that currently encourage production systems that degrade ecosystems, pollute water, erode soils and do not improve food security and nutrition, and redirecting them toward climate-resilient technologies, agronomic practices, and agro-processing methods. It also includes incentives and programs that help ensure that food that is fit for human consumption is easily accessible to food insecure consumers, rather than lost or wasted.

Ensuring affordable healthy diets requires support for sustainable production and incomes, and physical and market access for diverse nutrient-rich foods. Biofortification of staples is insufficient without broader diversification including adopting nutrient-dense underutilized crops. Evidence is needed to support policies, and public investments that enable adaptation, while ensuring climate finance reaches the regions and populations most affected by climate change:

- 1) Climate adaptation for food and nutrition security, especially in low-income countries.
- 2) Institutional mechanisms that protect food security and nutrition during climate induced crises
- 3) Transition to nutrient-dense, climate-smart and economically viable food products.

CFS should work on linking climate, food, and nutrition security policies. Research and policy actions on climate, food, and nutrition security need to be integrated if we are to achieve the aims of SDG2 by 2030. The CFS Voluntary Guidelines on Food Systems and Nutrition (CFS, 2021) explicitly connect climate resilience with nutrition. They also provide guidance on aligning policies, laws, programmes, and investment to address hunger and malnutrition in all its forms.

CFS has a comparative advantage and can act as a strategic entry point for dialogues around climate, food and nutrition. The HLPE-FSN can support CFS by producing evidence-based guidelines for food systems that are diverse and climate-resilient, supply nutritious crops that are affordable to the poor, and promote accountability for FSN commitments.

HLPE-FSN can support CFS, its members and participants. At the request of CFS, in 2012 the HLPE-FSN produced a report on Food Security and Climate Change (HLPE, 2012), which, along with CFS recommendations built upon it, played ultimately a considerable role in the change of perspective towards food security and adaptation in the negotiations on agriculture and climate change. Since then, the impacts of climate change are clearly felt in food systems all over the world with both new scientific findings and results of adaptation on the ground. As highlighted by the HLPE-FSN “There is a need for an updated, comprehensive synthesis of the science and evidence on the compounded impacts of climate change, biodiversity loss and land degradation, as well as of the policies implemented to address these challenges, on food security and nutrition and the progressive realization of the right to food.” (HLPE, 2025). Such a synthesis could help answer the following issues.

Key questions

- 1) How to anticipate climate-related risks to food and nutritional security?
- 2) How to identify synergies between technological innovation and people-centred approaches?
- 3) How to design equitable food systems that are more diverse, climate-resilient, and nutritious?

3. Food security and nutrition, and the three Rio Conventions: Biodiversity, Desertification and Climate

The HLPE-FSN note *Tackling climate change, biodiversity loss and land degradation through the right to food (HLPE, 2025)*, highlighted that climate change, biodiversity loss and land degradation are immediate threats to food systems, food security and nutrition, and the enjoyment of human rights. It is, therefore, essential for policy coherence to better integrate food security and nutrition in the implementation of the three Rio Conventions (the UN Framework Convention on Climate Change (UNFCCC), the Convention on Biological Diversity (CBD), and the Convention to Combat Desertification (UNCCD)).

The effects of climate change, biodiversity loss (CBD) and land degradation are deeply interconnected and their impacts cascade across all dimensions of food security and nutrition: availability, access, utilisation, stability, agency, and sustainability. Their impacts are felt most acutely by marginalised populations who depend directly on natural resources for livelihoods and diets. At the same time the action taken to address each of these challenges can, in turn, impact FSN. For instance, a reforestation project for carbon sequestration that restricts access to communal lands, while addressing climate and land degradation (UNFCCC/UNCCD), can directly impair food access and availability, and undermine livelihood stability and community agency. This shows how isolated environmental actions can inadvertently exacerbate food insecurity.

The 2025 HLPE-FSN note thus positioned the right to food as a unifying framework for addressing these interlinked challenges rather than as a parallel or secondary concern. With the lens of right to food, the HLPE-FSN note showed the need for more coherent, equitable and people-centred policies. It also showed the critical role of land, fisheries, forests and tenure governance as a decisive factor shaping the success or failure of efforts to address climate change, biodiversity loss and desertification while ensuring food security and nutrition.

Implementation of the three Rio conventions remains fragmented. Climate mitigation, conservation and development policies remain largely confined to sectoral silos. This has often resulted in trade-offs, social conflict and unintended harm to food systems, particularly where environmental initiatives restrict access to land, water or forests without adequate safeguards. While the note identified opportunities for policy coherence and synergy, it did not provide a detailed roadmap to translate principles into practice. An HLPE-FSN report could:

- Consolidate emerging evidence on integrated, rights-based approaches across diverse agro-ecological and socio-political contexts.
- Analyse governance failures and political economy dynamics that perpetuate policy incoherence across the Rio Conventions and food systems.
- Provide practical guidance for aligning national implementation of the Rio Conventions with human rights obligations, particularly the right to food, and with CFS policy instruments such as the Voluntary Guidelines on the Responsible Governance

of Tenure of Land, Fisheries and Forests in the Context of National Food Security (VGGT).

- Propose how to strengthen the resilience of food systems and communities through secure tenure, agroecological transitions, and biodiverse diets, as a critical outcome of coherent policy implementation across the Rio Conventions and the right to food.

Secure tenure over land, water, fisheries and forests must be a central pillar of a full-fledged HLPE-FSN report. While multiple factors enable action, tenure security is not a technical or sector-specific issue; it is a foundational cross-cutting enabler and a key determinant of whether climate, biodiversity and land restoration policies support or undermine food security and nutrition.

For climate adaptation and resilience, insecure tenure discourages long-term investment in sustainable practices. Farmers and communities lacking recognised rights have limited incentives to restore degraded land, adopt agroecological approaches or manage water resources sustainably, all of which are essential for climate mitigation and adaptation. Secure tenure provides the stability required for sustained stewardship of natural resources.

For biodiversity conservation, growing evidence, including assessments by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), demonstrates that territories governed by Indigenous Peoples, and local communities with secure customary rights, like other effective area-based conservation measures (OECMs), often achieve biodiversity outcomes comparable to, or better than, formally designated protected areas. These governance systems and knowledge practices are critical to *in situ* conservation. Conversely, conservation and climate initiatives that ignore tenure rights frequently lead to displacement and conflict and, eroding both biodiversity and food systems.

To ensure food security and nutrition, secure tenure rights to access and use productive resources are a non-negotiable precondition for the right to food, a principle enshrined in the VGGT. Tenure insecurity, therefore, represents a failure in the implementation of this global standard, while eroding agency and being the primary structural driver of vulnerabilities like dietary homogenization and displacement. The VGGT thus provide the essential lens for the analysis: understanding how climate or market policies impact FSN must start by asking who holds power over resources.

The CFS VGGT provide an existing international framework for linking food systems, environmental objectives and human rights. The VGGT can help translate national commitments towards the three agreements — on climate action, conservation and the fight against desertification — into tangible outcomes in the territories where these actions are meant to unfold. It is in that concrete space — the governance of land, water and territories — that the three agendas can be aligned without any of them losing their specificity or autonomy.

A comprehensive HLPE-FSN report could examine how the VGGT can be operationalised more systematically within the implementation of the Rio Conventions by:

- Integrating VGGT principles and Free, Prior, and Informed Consent (FPIC) as mandatory safeguards within climate and biodiversity finance, including projects supported by the Green Climate Fund and the Global Environment Facility.
- Incorporating clear tenure-related indicators – such as legal recognition of collective lands or mechanisms for resolving land and resource conflicts – into Nationally Determined Contributions, National Adaptation Plans, and National Biodiversity Strategies and Action Plans.
- Strengthening accountability through community-led monitoring and accessible grievance mechanisms linked to environmental and food system interventions.

Key outputs would include practical policy tools, strategies and pathways, such as assessment frameworks, model indicators (e.g., Dietary Species Richness to measure biodiversity's contribution to nutrition, Hanley-Cook, et al. 2025), or other model indicators and guidance for community engagement, shifting the debate from justification to implementation. This could include developing a core set of tenure security indicators (such as the percentage of nationally recognized community lands or the existence of operational grievance mechanisms) to be integrated into national reporting frameworks for the UNFCCC, CBD, and UNCCD, One input that could be taken into account is the Land and Governance Situation Report (FAO, ILC y CIRAD, 2026).

Key questions

- 1) To achieve policy coherence, how can the three Rio Conventions be implemented more coherently at national level to avoid trade-offs that undermine food security and nutrition?
- 2) To guarantee land Tenure and rights, how can the VGGT and the right to food be operationalised within the UNFCCC, CBD and UNCCD frameworks, including through tenure security indicators in national reporting?
- 3) To achieve equitable and responsible outcomes, how can we have more inclusive governance mechanisms to ensure Indigenous Peoples, local communities and other marginalised groups participation in climate, biodiversity and land restoration policies, including FPIC, community-led efforts?

4. Geopolitical uncertainty and polycrises: how to predict and prevent impacts on food security and nutrition

Geopolitical uncertainty in the world today is high and increasing, which has significant implications for global food security and nutrition. Geopolitical uncertainty refers to the “fog of war” resulting from adverse political events (e.g., the ongoing war in Ukraine, the 2026 conflict in the Middle East) and weakened global governance (like the rise of nationalist authoritarian regimes) (Caldara & Iacoviello, 2022; A key characteristic of geopolitical uncertainty is that it is hard to quantify and hence predict, in contrast to the risks of specific events, which are measurable and predictable.

Geopolitical uncertainty disrupts investment and production in agriculture, forestry and fisheries, shapes international trade policy, reduces cereal and fertilizer trade, limits market access, heightens food price volatility, weakens individual agency and undermines sustainability, affecting all six dimensions of food security. According to WFP, in 2025, 69 percent of acutely food insecure people -219 million people- were living in fragile or conflict affected countries (WFP, 2025). These impacts are often irreversible, with many adverse impacts having intergenerational consequences for human development.

Furthermore, the threat of geopolitical uncertainty is significantly intensified by polycrises, defined as the confluence of two or more interconnected hazards (such as war and extreme weather events) in the same space and time (Lawrence et al., 2024). These overlapping hazards create combined impacts on human welfare more severe than the sum of individual crises impacts, the so-called excess burdens.

There is a growing body of research in both political science and climate research trying to predict adverse political violence or weather events (Rød et al., 2024). Such knowledge can be used to inform anticipatory action, whereby assistance to potential victims of shocks is delivered before the event occurs. Flooding for example, can be predicted a few days or even weeks in advance. While targeting may remain a challenge, it is usually cheaper to help households prepare for a shock than to help them adjust to coping with an actual loss from violence or bad weather.

The scientific literature identifies several critical knowledge gaps regarding the intersection of geopolitical insecurity and food security and nutrition (Vesco et al., 2024). First, while a range of adverse shocks such as terror attacks or extreme weather events can each weaken food security and nutrition, the challenge with the impact of geopolitics is that it is hard to model and hence hard to predict. As the global order is undergoing rapid and even accelerating change, it becomes harder to predict future geopolitical shocks, preventing anticipatory action in this domain.

Second, while geopolitical uncertainty weakens food security and nutrition, the reverse can also be true, with significant implications for political stability and governance (Martin-Shields & Stojetz, 2019). Rising food prices can drive socio-political unrest, as observed recently in Iran, Sri Lanka, and Kenya. Yet the mechanisms of this endogenous relationship between political uncertainty and food insecurity and malnutrition are not well understood.

Third, there is an absence of a unifying micro-level theory of polycrises that explains how interconnecting hazards lead to compounding human impacts via social dynamics (Verwimp et al., 2019). While individual hazards are well-documented, the empirical patterns of how different hazard characteristics—such as intensity, frequency, and duration—interconnect or accumulate remain undocumented at scale. Furthermore, the specific causal transmission mechanisms linking geopolitics to nutritional outcomes, through economic, social and institutional channels, are not yet well understood.

Fourth, significant data gaps persist. Food security and nutrition are not well measured in acute crisis zones. There is also a lack of data and rigorous analyses in humanitarian, fragile, or early post-conflict settings. From a policy perspective, there is a relative dearth of evidence concerning the effectiveness of interventions that attempt to reduce food insecurity and violent conflict simultaneously. The specific role of security interventions in affecting household resilience and food security also remains understudied.

Addressing the impacts of geopolitical uncertainty and the polycrises requires a transition from reactive relief to proactive or anticipatory planning. Such planning demands integrated, data-driven decision making focused on boosting resilience at all levels (Dall and Schneider, 2025). Intervention strategies must also look deeper into the micro-level, building on a model of how individuals and households, rather than countries, behave and adapt in the face of multiple interlocking crises. Anticipatory planning can help to diversify agricultural value chains and strengthen local food systems, making them more resilient in the face of multiple shocks and risks. Advanced tools like remote sensing, mobile phone technology, and machine learning are critical for monitoring crop yields and conflict dynamics in areas where physical access is dangerous, which can be used to develop anticipatory and predictive capabilities.

Politically, the “triple nexus,” i.e., the coordination of humanitarian relief, development aid, and peacebuilding (also referred as the humanitarian-peace-development (HPD) nexus), is essential to prevent households from falling into polycrisis traps. Triple nexus thinking requires integrated policies that can include social protection systems and support for livelihoods and markets. Governments must enhance their administrative capacity and legitimacy, including on the ground, as state effectiveness is strongly correlated with reduced food price volatility and undernourishment. Post-conflict settlements should not merely restore pre-war models but aim to build back better economies, rewarding pro-social, peaceful behaviour. Crucially, formal social safety nets and local state institutions must be scaled up to support inclusive entitlements and fragile, informal networks, such as kinship-based transfers, which frequently collapse under the combined strain of conflict and climatic shocks.

Critically important is shifting the paradigm from the reactive planning common today to prediction and anticipatory action. Modern early warning systems increasingly rely on data-driven approaches to forecast food crises and displacement before they peak. By checking for conflict anomalies and localised probability distributions to identify unexpected violence, researchers can help policymakers implement preventative interventions rather than just reactive ones.

Finally, interventions must be tailored to the specific vulnerabilities and needs of people at the local level, the so-called distributional effects. For example, national systems that promote community-organised or decentralised school feeding can be more effective than general food distribution for ensuring education outcomes during conflict because it remains de facto conditional on attendance and it can strengthen informal markets if food is purchased locally. Combining multiple interventions (e.g., pairing food aid with fortification of basic food stuffs and providing productive household assets) can also create positive synergies that relief alone cannot achieve. Ultimately, these efforts must aim to break the vulnerability cycles that keep communities trapped in protracted humanitarian emergencies in the face of repeated multiple shocks.

The Committee on World Food Security (CFS) has a unique role, drawing on the HLPE-FSN's evidence-based policy recommendations. As early as 2004, the Voluntary Guidelines on the Right to Food emphasized that “food should never be used as a means of political and economic pressure”, grounding this principle in international humanitarian law.

The CFS Framework for Action for Food Security and Nutrition in Protracted Crises (2015) remains highly relevant, especially with its human rights-based approach. Nevertheless, effective implementation and adaptation to new political and legal realities are urgently needed. In July 2024, the HLPE-FSN released the issues paper “Conflict-induced acute food crises: potential policy responses in light of current emergencies”, which provided an analysis of the situation in Gaza and Sudan and highlighted the risks of famine (HLPE, 2024).

On 24 July 2025, the CFS convened its fourth “Collaborative Governance Dialogue on Food Security and Nutrition in Protracted Crises” in Rome. Discussions addressed the challenges of protracted crises, the use of food as a weapon of war, and the urgent need to build resilient food systems. CFS 52nd Plenary recommended government and all stakeholders to address food insecurity and all forms of malnutrition including in contexts of humanitarian emergencies, conflict, including armed conflict, and natural disasters, crises and occupation, by promoting coherent and well-coordinated humanitarian assistance and development programmes, such as resilience building, while also upholding efforts to achieve development, and National and International Human Rights obligations, particularly the progressive realization of the right to adequate food, as well as International Humanitarian Law¹.

The CFS provides an inclusive and legitimate platform uniquely positioned to integrate humanitarian, human rights, and development perspectives across the triple nexus. No other global body offers such an integrated policy space to prevent deliberate starvation, safeguard food systems, and promote inclusive pro-poor post-conflict recovery. Elevating this issue within the CFS Work Programme would fill a glaring governance gap and reaffirm the CFS leadership in shaping coherent global responses.

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https://www.fao.org/fileadmin/user_upload/bodies/CFS_52/CFS52_REP/NQ517_CFS_2024_52_Final_Report_en.pdf

An HLPE-FSN report on this topic, drawing on the unique interdisciplinary mix of skills of its members, could inform state practice in times of heightened geopolitical uncertainty, enhance integrated humanitarian, development and peacebuilding interventions, and civil society initiatives while ensuring accountability for the right to food and adequate nutrition in polycrises settings.

Key questions

- 1) How do multiple crises shape FSN differently compared to single crises?
- 2) Which groups of people are particularly affected by losses of FSN as a result of geopolitical uncertainty?
- 3) What interventions do we know help protect FSN in polycrises and against geopolitical uncertainty, and what knowledge gaps remain concerning interventions?
- 4) Which additional data do we need to collect to better support FSN and anticipatory action?

DRAFT

5. International trade for food security and nutrition

International trade plays a central role in global food security by helping countries compensate for domestic production shortfalls, diversify food supplies, and stabilize prices. While trade is critical for food-deficit low-income countries (van Berkum, 2021), the current food production landscape, dominated by a small number of major exporting countries, has heightened the exposure of certain nations to food system vulnerabilities (Wang and Dai, 2021).

In principle, international trade should neither be considered inherently beneficial nor inherently harmful for FSN; its effects vary by context and depend on how trade interfaces with domestic production and market structures (Zimmermann and Rapsomanikis, 2023). The impacts of trade hinge critically on governance choices, power relations, and the coherence of policies across sectors such as health, agriculture, and environment (FAO, 2024). The central challenge is thus to shape trade rules and related policies so that they support food security, nutrition, and broader sustainable health objectives, while avoiding outcomes that exacerbate malnutrition, environmental degradation, or social inequities.

Until recent decades, globalization of food systems was largely driven by trade liberalization, export-oriented agricultural models, and extensive use of subsidies, particularly in the Global North (FAO et al., 2023). Multilateral and bilateral trade agreements under the World Trade Organization (WTO) framework reduced tariffs and non-tariff barriers, facilitating large-scale cross-border flows of agricultural commodities and processed foods. However, the playing field remained deeply uneven: high subsidies and other incentives – largely affordable to high-income countries – distorted competition and undermined agricultural sectors in low- and middle-income countries, weakening their capacity to generate decent incomes and food security (IISD, 2026).

At the same time, the institutional architecture underpinning this liberalized system has entered a period of sustained strain. The WTO's dispute settlement mechanism has been effectively paralyzed since 2019 due to the inability to appoint members to its Appellate Body, leaving the organization without a fully operational system to issue final and binding rulings (Fiorini et al., 2020; Bhan et al., 2025). As geopolitical tensions intensify and tariff measures re-emerge, observers increasingly question the durability of the post-1995 rules-based trade order. In this evolving context, trade governance is shifting toward regional agreements, strategic industrial policies, and more fragmented forms of economic coordination, with important implications for food security, nutrition, and policy space.

International trade plays a necessary role in filling structural and temporary food gaps, particularly for countries facing limited arable land, water scarcity, or climatic constraints (Niu, 2025). It can enhance food availability, support dietary diversity, and stabilize supplies during shocks such as conflict or extreme weather events (FAO et al., 2023). Trade liberalization under the WTO framework – and increasingly through regional, bilateral, and strategic trade arrangements beyond it – has contributed to expanded food availability in many contexts. However, these same dynamics have reshaped food systems in structurally uneven ways. They have fostered consolidation of agri-food value

chains, reduced policy space for domestic food system regulation, and increased import dependence in many low- and middle-income countries (Clapp, 2016 – see also section 6 on corporate concentration).

A further complexity caused by climate change that, in general, is expected to reduce the agricultural productivity of equatorial and lower latitude regions while possibly creating opportunities to expand productivity in some areas, most notably northern climates. One possible implication of this might be a relative shift northward in global food production capacity and increased countries such as Canada and Russia that stand the most to gain from projected changes. This scenario implies new global interdependencies that may be amplified by trade (see Hannah et al, 2020 KC et al. 2023)

Beginning in the 1990s, the globalization of trade and investment accelerated the expansion of transnational food manufacturers, processors, and supermarket chains into low- and middle-income countries, fundamentally transforming domestic food environments. This supermarket revolution increased the availability and affordability of highly processed products rich in refined grains, vegetable oils, added sugars, and salt (Hawkes, 2006; Reardon & Timmer, 2012; Hawkes, 2008). The aggressive cross-border marketing and distribution of ultra-processed foods (UPFs) further reinforced these dietary shifts (Monteiro et al., 2019). As a result, many countries now face a dual burden: persistent undernutrition and micronutrient deficiencies alongside rising prevalence of overweight, obesity, type 2 diabetes, and other diet-related noncommunicable diseases (Swinburn et al., 2019; Batal et al., 2018).

At the same time, policy choices in many low- and middle-income countries prioritized export-oriented production while underinvesting in diversified supply for domestic markets – an imbalance that has heightened vulnerability to price volatility and external shocks (Aragie et al., 2023; Chicoma & Reynolds, 2025). These structural dependencies became particularly visible during the COVID-19 pandemic and subsequent climate-related disruptions and geopolitical tensions, which exposed the fragility of highly globalized supply chains (Laborde et al., 2020; Emediegwu, 2025). Although rising chronic disease burdens were not the principal driver of the current rethinking of trade, the accumulation of systemic shocks has renewed attention to food sovereignty, domestic production capacity, and regionalized trade as strategies to enhance resilience, even as such shifts raise concerns about protectionism and unequal impacts on food-import-dependent countries (Fraser & Newman, 2026).

These nutrition and resilience challenges are inseparable from environmental and animal health impacts. Trade-driven intensification of crop and livestock production, mainly but not exclusively in the Global North, has contributed to biodiversity loss, greenhouse gas emissions, water pollution, antimicrobial resistance, and compromised animal welfare (IPES-Food, 2017; Willett et al., 2019), underscoring the need to assess trade through a One Health lens (see also section 8 on FSN and One Health).

Agricultural subsidies and trade rules continue to play a decisive role in shaping global food systems, even as the institutional architecture governing them undergoes significant changes. Current subsidy structures, particularly in high-income countries, remain heavily oriented toward commodity crops and industrial livestock systems, reinforcing production patterns associated with diets high in refined grains, sugars, and animal-

source foods (OECD, 2022). Under the WTO framework, disciplines were designed to constrain certain forms of trade distortion; however, in practice, they have limited the ability of many low- and middle-income countries to support diversified, nutrition-sensitive production while permitting continued large-scale support for environmentally intensive agricultural models in wealthier economies (Clapp, 2021).

In the current context, marked by the prolonged paralysis of the WTO's Appellate Body and a shift toward bilateral, regional, and strategic trade arrangements, the uneven distribution of power in global trade governance becomes even more consequential. With weakened multilateral enforcement and growing reliance on negotiated or ad hoc trade measures, power asymmetries risk becoming more entrenched. Large transnational corporations continue to exert significant influence over trade negotiations, standards, and value chains, while small-scale producers and low-income consumers often have limited voice in shaping outcomes (Clapp, 2021). These dynamics complicate efforts to align trade with health, nutrition, environmental sustainability, and equity objectives, particularly in the absence of a fully functioning multilateral dispute system capable of mediating competing interests.

A new approach to trade and FSN must go beyond a narrow focus on food safety. International standard-setting bodies such as the [Codex Alimentarius](#) can be strengthened to better integrate chronic disease prevention, food composition, labelling and marketing into trade-relevant standards, while preserving governments' regulatory space (Thow et al., 2018). Repurposing agricultural subsidies toward diversified, agroecological, and nutrition-sensitive production is essential, particularly in the Global North, while maintaining support for livelihood-based agriculture in the Global South. This was proposed by India and other developing countries who have argued that international trade rules should provide greater policy space for measures that support domestic food security, such as the creation of a "food security box", allowing implementation of policies such as public food procurement, strategic grain reserves, and food subsidies aimed at improving food access and rural livelihoods, even if these measures involve market interventions (Matthews, 2014; Sharma, 2016; Clapp, 2017). Such trade policy reforms could support healthier diets, reduce environmental harms, and create more level playing fields in international trade (FAO et al., 2023). Strengthening shorter and more regional supply chains (including local, traditional, and informal markets) can enhance resilience, reduce environmental footprints, and support local livelihoods, while complementing international trade where it is necessary and beneficial (IPES-Food, 2020).

CFS, with the ability to convene states, UN agencies, civil society, Indigenous Peoples and the private sector, can raise awareness on relations between trade and FSN, provide a platform for stakeholders to discuss potential actions to improve trade's contribution to FSN. It can further promote the elaboration of voluntary guidelines by member countries and participant to encourage policies for nutrition-sensitive food systems, policies that regulate unhealthy food environments, including the cross-border spread of ultra-processed foods, and align trade rules with commitments on health, climate, biodiversity and human and animal rights, thereby supporting more equitable, accountable and nutrition-oriented global food system governance (Swinburn et al., 2019; Thow et al., 2018).

CFS can provide space to consider, assess and advance possible policy responses to these **key questions**:

- 1) How can CFS support countries, through national policies across agriculture, nutrition, food security, health, and environment, in assessing and addressing the impacts of international trade on food security and nutrition to avoid increasing malnutrition, environmental degradation, and social inequities?
- 2) How can CFS facilitate dialogue and evidence on the implications of power asymmetries in global food trade, including the role of transnational corporations and value chain concentration, and their impacts on food security and nutrition?
- 3) How can CFS support countries in assessing and managing the food security and nutrition implications of climate-driven shifts in agricultural production capacity, including increased reliance on international trade for some countries because of climate pressures?
- 4) To address growing uncertainty in global trade governance, how can CFS support countries in navigating a more fragmented and less predictable multilateral trade environment to maintain stable, equitable, and nutrition-sensitive food trade flows, while mitigating risks to food security and nutrition arising from weakened coordination and dispute resolution mechanisms?

6. Corporate concentration in food systems

Corporate concentration – the growing dominance of a small number of firms across food systems – has become a structural factor shaping FSN (Hernández et al., 2023). With dominance already extreme in key nodes – e.g., the top four firms control roughly 50–60 percent of the global commercial seed market and about 70 percent of the pesticide market, and the top five grain traders account for an estimated 70–90 percent of global grain trade – corporate power now extends across food processing, retail, and into other interrelated sectors such as fisheries, aquaculture, finance, and digital platforms (Clapp et al., 2025; IPES-Food, 2017; Chicoma & Reynolds, 2025). The decisions and behavior of these corporations can have a disproportionate impact on markets, ecosystems, and on livelihoods and agency.

Upstream, high concentration in seeds, agrochemicals, fertilizers, and global grain trading leaves a small number of firms with disproportionate control over key inputs and commodity flows (Howard, 2016; Hernández et al., 2023). Downstream, food processing and retail are highly consolidated in many contexts, allowing dominant firms to shape food availability, access, diets, marketing - including the expansion of ultra-processed products and other unhealthy products, and to influence policies (Monteiro et al., 2013).

Concentration is also increasing in less examined but critical sectors. In fisheries and aquaculture, vertically integrated corporations – globally and nationally – now exert significant control across capture, harvesting and farming, license ownership, processing, and export markets, often operating transnationally and marginalizing small-scale producers (Chicoma & Reynolds, 2025; Österblom et al., 2015; Fernández-González et al., 2021). In the livestock sector, mid to downstream concentration in processing and slaughter markets, feedlots, distribution and breeding can affect pricing relationships between producers and processors, trading practices, incentives for innovation, and producer and consumer agency (Deconinck, OECD/FAO, 2021; Pudenz and Schulz, 2024). In forestry, there is some evidence of corporate concentration in wood pulp production (Coelho et al., 2023) and timberland ownership (Korhonen et al., 2016) with impacts on supply, barriers to entry, supply chain integration, and geographic diversification.

Corporate power is also consolidating in financial and digital domains. Financial actors play a growing role in land, infrastructure, and food companies, contributing to the financialization of food systems and prioritizing short-term returns over FSN outcomes (Clapp and Isakson, 2018). At the same time, concentration in digital platforms, data infrastructures, and advertising gives a small number of firms substantial influence over food environments, consumer attention, and the promotion of ultra-processed foods (Fretes et al., 2025; WHO, 2018; Carroll et al., 2024).

Despite persistent narratives that frame concentration as a source of efficiency, economies of scale, innovation, and lower food prices, a growing body of evidence shows that corporate concentration often undermines FSN through multiple, interrelated mechanisms (HLPE, 2020). In fact, more than 90 percent of the world's farms are family farms, and they produce roughly 80 percent of global food in value terms (Lowder et al., 2021), casting doubt on the claim that high concentration is necessary to feed the planet.

First, concentration increases systemic fragility and vulnerability to shocks. When critical functions– such as input provision, processing capacity, or retail distribution– are controlled by a small number of firms, disruptions can rapidly affect availability and access. Highly concentrated supply chains tend to be optimized for efficiency rather than resilience, reducing diversity (IPES-Food, 2017; Gomez et al., 2021; Merkle et al., 2021). Yet concentration does not necessarily yield efficiency gains; moreover, market power distorts pricing (Sexton, 2013).

Second, concentration affects economic access to food in complex and uneven ways. In some contexts, dominant processors and retailers can offer lower consumer prices through scale and purchasing power. However, this buyer power is often exercised asymmetrically, allowing firms to depress prices for smallholder farmers and wages of supply chain workers, while capturing a disproportionate share of value, with mixed and sometimes adverse effects on affordability, livelihoods, and food access for low-income populations (Clapp et al., 2025; IPES-Food, 2016).

Third, concentration shapes nutrition outcomes through food environments and marketing. Highly concentrated markets for ultra-processed foods and sugar-sweetened beverages enable dominant firms to mobilize vast advertising budgets, shape consumer preferences, and resist or delay public health regulations. Evidence shows that a small number of firms dominate global markets for sugary drinks and packaged foods, with significant implications for diet-related non-communicable diseases (Driessen et al., 2025; WHO, 2024).

Fourth, concentration undermines livelihoods, agency, and local food availability, particularly for small-scale farmers, fishers, and food system workers. Vertical integration and asymmetric contracting can lock producers into dependent relationships, reduce bargaining power, and limit their ability to supply local or territorial markets, with indirect effects on food security and nutrition at community and national levels (HLPE, 2019).

Fifth, concentration associated with industrial food systems can disproportionately affect ecosystems globally, aggravating environmental pressures, natural resource depletion, land conversion, biodiversity and habitat loss, nutrient pollution, and climate emissions, thereby, weakening the ecological foundations that sustain food security (Fakhri, 2025; Sylvester et al., 2024; Jwaideh et al., 2025; Boakes et al., 2024)

Finally, corporate concentration enables disproportionate influence over policies and governance. Large corporations are better positioned to shape trade rules, competition policy, food standards, nutrition regulations, and sustainability narratives, often through lobbying, revolving doors, and private standard-setting. This policy influence can constrain governments' policy space to pursue FSN objectives and weaken accountability mechanisms (Ruggeri Laderchi et al., 2024; Lara-Mejía et al., 2025).

CFS can provide a legitimate intergovernmental space to consider, assess and advance possible policy responses to corporate concentration from a food systems perspective, supported by evidence generated by the HLPE-FSN. This includes the following:

- 1) How can FSN objectives be integrated into competition and antitrust policies, moving beyond narrow price-based assessments to include impacts on nutrition and food security, with a food systems perspective (FAO, 2015)?
- 2) How should unfair and abusive contracting and labour practices be regulated, including buyer power abuses, opaque pricing, and exclusionary practices that undermine livelihoods and food access (FAO, 2024)?
- 3) How can shorter, more diversified, and territorial food supply chains be strengthened through public investment in infrastructure, public procurement, and market access for small and medium-scale producers, including through traditional food markets (HLPE, 2019)?
- 4) What measures can be taken to reduce undue corporate influence in food and nutrition policy, through conflict-of-interest safeguards, transparency requirements, and stronger public governance of food systems (Friel et al., 2023)?
- 5) How can national food system market concentration assessments be undertaken to improve information, indicators, targeted regulation, and to provide a baseline for government monitoring and measurement of policy actions?

The HLPE-FSN can also evaluate where knowledge gaps persist, despite growing research and evidence. For example, there is a need for stronger causal analysis linking concentration to FSN outcomes (Keenan et al., 2023), and expanded research beyond traditional sectors, including fisheries, aquaculture, logistics, finance, digital platforms, and advertising (Chicoma and Reynolds, 2025). There is also a need for more comparative evidence on which policy interventions to promote competition effectively improve FSN, as well as on how public policy can strengthen state institutions and collective organizations – such as cooperatives and farmer associations – to build countervailing power in concentrated markets.

7 Digital innovations and artificial intelligence (AI) for healthy, sustainable, and equitable food systems

Digital innovations – including artificial intelligence (AI), machine learning, predictive analytics, and automated decision systems – are increasingly deployed in food production, processing, trade, marketing, and retail. Hence, digital innovations have direct and growing implications for food security and nutrition. AI systems increasingly shape decisions across the food chain, from farm-level input use and risk forecasting to logistics optimization, pricing algorithms, food marketing, and consumer choice architectures.

When governed in the public interest, digital tools and AI-driven systems can support sustainability, resilience, transparency, equity, and healthier diets. However, when poorly governed, AI-enabled and digital technologies risk exacerbating inequities, concentrating power, distorting food environments, and undermining equitable access to nutritious food. Thus, ensuring digital innovations and AI advance food security and nutrition is a critical policy priority (Schroeder et al., 2021; Harikrishnan et al., 2025).

Digital innovations – including AI, sensors, robotics, digital platforms, blockchain, Internet of Things, Geographic Information Systems, and cloud computing– are often framed as inevitable and inherently beneficial drivers of efficiency and innovation. AI is frequently presented as a transformative solution to productivity gaps, climate risks, and supply chain inefficiencies. In practice, however, they are not neutral tools. Their impacts on FSN depend on access to data, connectivity, digital infrastructure, and technical capacities (Rotz et al., 2019).

As also explored by the HLPE-FSN 2022 report, digital tools and AI systems can potentially improve the efficiency of resource utilization, strengthen supply chain transparency, expand market access, support public policy and governance, and influence food environments in ways that promote healthier diets. Precision technologies and data analytics can reduce input use, anticipate climate and pest risks, and improve productivity. AI-enabled forecasting models can enhance early warning systems for food insecurity, climate shocks, and price volatility. Digital traceability systems can enhance food safety and sustainability oversight. Digital platforms can reduce transaction costs and connect producers to markets. Digital public infrastructure can strengthen policy design and implementation. AI applications are also increasingly shaping food environments through personalized marketing, recommendation systems, dynamic pricing, and digital retail interfaces – directly influencing dietary choices and nutrition outcomes.

Nonetheless, structural challenges limit these benefits. Digitalization and AI adoption often impose uneven costs and benefits, with small-scale and subsistence producers, workers, and marginalized communities facing barriers related to affordability, infrastructure, digital literacy, and trust (Hackfort, 2021). The data requirements of AI systems may further marginalize producers lacking connectivity, standardized data systems, or bargaining power. Corporate concentration and platform monopolies intensify control over markets, data, and value capture (Prause et al., 2021; see also section 6. Corporate concentration). Weak data governance raises concerns around

ownership, rights over data access and use, privacy, cybersecurity, and system resilience, which can in turn amplify the market power of actors already dominant in the sector, while undermining diverse food systems and the public good (Rotz et al., 2019).

While digital tools can help boost diversity (Weersink et al., 2018), current trajectories in AI and digital agriculture often favour extractive, monocultural production models, marginalizing agroecological approaches and Indigenous and local knowledge (Lajoie-O'Malley et al., 2020). Algorithmic bias may also arise from skewed training datasets that privilege industrial production systems over diversified, context-specific models. Political dysfunction and dependence on externally controlled infrastructures could constrain policy autonomy and inclusive governance (Nirmanani, 2025).

Addressing these challenges requires deliberate technical and political action. Strong data governance frameworks are needed to clarify data ownership, access, use, transparency, privacy, cybersecurity, and alignment with public objectives. These frameworks should also address algorithmic transparency and accountability for AI-driven decisions affecting producers and consumers.

Competition policy, antitrust enforcement, and platform regulation should address excessive concentration and abusive practices in digital and food markets. Regulators may also need new tools to oversee algorithmic coordination, data monopolies, and AI-enabled market manipulation. Public investment in open, interoperable digital public infrastructure can reduce dependence on proprietary systems and improve inclusivity.

Innovation policy and public funding should support agroecology, diversified food systems, small-scale fisheries, and Indigenous and local knowledge (Shelton et al., 2022). AI research and development agendas should explicitly prioritize sustainability, nutrition sensitivity, and equity rather than solely productivity gains. Finally, democratic governance must be strengthened through conflict-of-interest management, regulatory oversight, and strategies to safeguard techno-sovereignty (Barrett et al., 2020). Moving beyond basic connectivity toward meaningful economic impact will require the global community to push for bridging the digital divide for smallholder farmers with a focus on infrastructure (i.e., reach) and human capital (i.e., digital literacy) (Liu et al., 2025).

Key knowledge gaps remain regarding the impacts of digital innovations on food security and nutrition across regions, production systems, and social groups. Evidence is limited on how digital tools affect nutrition outcomes, food environments, and dietary patterns, particularly in low- and middle-income countries (Benfica et al., 2023). There is especially limited evidence on how AI-driven marketing, pricing, and recommendation systems influence dietary quality and ultra-processed food consumption.

There is insufficient understanding of effective models for collective data governance, producer-controlled platforms, and public-interest digital infrastructure. More research is also needed on how digital technologies can be designed to support agroecology, biodiversity, and culturally appropriate diets rather than reinforcing industrial food systems ultra-processed foods (Suarez and Adibi, 2025).

The governance of digital innovation and artificial intelligence within food systems cuts across agriculture, nutrition, trade, technology, human rights, and sustainability—areas within the mandate of the Committee on World Food Security (CFS). AI governance raises distinct questions regarding transparency, accountability, equity, and the right to food that require multilateral coordination. As a multilateral, inclusive, and science-informed platform, CFS is uniquely positioned to address the cross-sectoral and political dimensions of digitalization that individual agencies or national governments cannot address alone. Engagement by CFS can help ensure that digital transformation aligns with global FSN objectives and the right to food and that the digital innovation and artificial intelligence in the post 2030 development agenda adequately address their risks and opportunities for food security.

Leveraging its legitimacy and inclusive structure, the CFS could provide essential guidance on equitable data governance and AI accountability frameworks for digital food systems. It can serve as a vital forum to promote cross-sector collaboration, balancing innovation with food security needs. CFS could also convene dialogue on ethical AI principles for food systems, including fairness, inclusivity, transparency, and human rights alignment. Unlike other bodies, the CFS ensures that digital transformation remains accountable to the public interest and centered on the perspectives of affected communities.

A full HLPE-FSN report could tackle the following **key questions**:

- 1) How do digital tools and AI-driven systems affect nutrition outcomes, dietary patterns, and food environments – particularly in low- and middle-income countries where evidence remains thin?
- 2) What role do AI-powered marketing, pricing, and recommendation systems play in shaping dietary quality – including their potential contribution to rising ultra-processed food consumption?
- 3) What governance models best enable producers and communities to retain control over agricultural data – including collective data governance frameworks and public-interest digital infrastructure?
- 4) How can digital technologies be designed to actively support agroecology, biodiversity, and culturally appropriate food systems rather than defaulting to industrial food system priorities?
- 5) What multilateral governance frameworks are needed to ensure AI and digital innovation in food systems advance food security, nutrition, and the right to food – particularly as these issues cut across agriculture, trade, human rights, and sustainability mandates?

The HLPE-FSN can analyse the complex issues concerning digital innovation and artificial intelligence within food systems, synthesize existing evidence to identify risks, opportunities, and knowledge gaps, and provide analysis on critical dimensions such as power, equity, governance, data ownership, and platform concentration, algorithmic bias, explainability, and systemic risks associated with AI deployment. Ultimately, an HLPE-

FSN report can inform CFS policy discussions, helping members design coherent, rights-based approaches to digital food systems in support of achieving global FSN.

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8. “One Health” as an integrating framework for food security and nutrition

Introduced in the early 2000s and championed by the UN One Health Quadripartite (WHO, WOA, FAO, UNEP), One Health is a vital, integrated approach recognizing that human, animal, plant, and environmental health are inextricably linked (Pitt and Gunn, 2024). One Health is increasingly critical as environmental degradation, climate change and land pollution drive global health risks, exemplified by the COVID-19 pandemic. Evidence has long shown that approximately 60 percent of emerging infectious diseases originating in animals (Jones et al., 2008), with three quarters of the over 30 new human pathogens that have emerged in the recent decades (WHO, 2023). More recently the One Health Joint Plan of Action 2022–2026 (FAO, et.al. 2022) reaffirmed that “most emerging infectious diseases in humans (more than 60 percent) are of zoonotic or animal origin, with the majority of these (around 70 percent) originating in wildlife”. This underscores the need for an integrated approach is urgent. Furthermore, excessive antimicrobial use in livestock and aquaculture is accelerating antimicrobial resistance, posing a severe threat to both public health and food systems (Zhao et al., 2021).

Food systems are central to interconnected risks spanning human health, animal health and welfare, ecosystems, and food security and driven by current production and consumption patterns. These systems contribute to malnutrition, disease, antimicrobial resistance, and environmental degradation, and disproportionately affect vulnerable populations. Applying a One Health approach can promote food security through accessible, nutritious, and sustainable diets, thus, mitigating these systemic, interconnected risks (Arredondo-Rivera et al., 2024). By breaking down sectoral silos, One Health supports deployment of more coherent policies and investments that simultaneously protect health, eliminate inequities, sustain ecosystems, and ensure stable, nutritious food supplies. As such, One Health provides a compelling policy framework for integrating health, food security, nutrition, and environmental sustainability.

Unhealthy dietary patterns are a leading risk factor for noncommunicable disease and premature death worldwide (Ronto et al., 2018). Despite international efforts, current challenges demand a more systemic approach to sustainable nutrition (Gu et al., 2024). The One Health framework offers an excellent opportunity to assess the interdependencies between food systems and global health and promote dietary practices that are sustainable and equitable.

Food systems are increasingly affected by overlapping health, environmental, and socio-economic risks. Human health challenges include persistent hunger, micronutrient deficiencies, maternal and child undernutrition, diet-related noncommunicable diseases, and vulnerability to pandemics. Because animal health threats such as zoonotic diseases, antimicrobial resistance, and outbreaks undermine livelihoods and food security, promoting good health enhances human nutrition, establishing a reinforcing, bidirectional relationship. Plant health challenges, including crop losses, declining genetic diversity and increasing global reliance on just a few species of staple crops, and climate stress, reduce food availability and diet quality (Chiffolleau et al., 2024). Environmental degradation, manifested through climate change, soil degradation,

water scarcity, biodiversity loss, air pollution, and chemical contamination, further erodes the foundations of food security and nutrition (Garrido et al., 2025) and increases the emergence and spread of zoonotic diseases (Borham, 2025; Mishra, 2021).

These risks are mutually reinforcing. Extreme weather events resulting from climate change, combined with, for example, deforestation, soil degradation, and increasing urbanization, contribute to increased disease exposure, disrupt production, and result in escalating food prices. Environmental contamination and poor air quality increase health burdens and reduce labor productivity. Gender inequities, particularly those affecting female agricultural workers, magnify vulnerability to climate and health shocks and undermine household food security (Anjum and Aziz, 2025). Effective One Health action requires addressing the social and economic injustices that determine risk. Sustainable food systems are inseparable from the rights of their workers – especially women and migrants – who face heightened exposure to climate threats, disease, and human rights abuses. Without an integrated One Health approach, policy responses remain siloed and fragmented, less effective, and more costly, weakening progress toward achieving sustainable food security and nutrition (Ameyaw et al., 2025).

To advance One Health for FSN, it is essential to move from sectoral planning to integrated governance and financing. Current technical solutions are often hindered by institutional silos that fragment resources. Success requires multisectoral mechanisms with clear mandates and joint budgets, supported by innovative financing that rewards collaborative, cost-effective programs over isolated projects. This requires moving beyond technical coordination towards genuine policy coherence across agriculture, health, and environment mandates.

Advancing food security and nutrition through a One Health framework requires coordinated technical and political action (Bremner et al., 2023). Key priorities include strengthening cross-sectoral One Health coordination mechanisms by embedding nutrition and health outcomes in food, agriculture, trade, and climate policies and reinforcing veterinary, plant, aquatic animal, and public health systems. Coordinated, global intellectual and financial investments are needed in climate-resilient and nutrition-sensitive agriculture, livestock, fisheries, and aquaculture; integrated pest management; and sustainable land and water management. Additional actions include reducing non-therapeutic antimicrobial use, improving fertilizer and manure management, preventing pollution at source, and aligning air quality standards with WHO guidelines. Expanding monitoring, surveillance, and early warning systems for climate events, disease, food safety, and air quality are essential. Targeted, community level health and nutrition services should protect high-risk populations, particularly women and agricultural workers. Scale-neutral and region-neutral digital tools, including artificial intelligence, can support integrated decision-making and risk management when deployed within a One Health governance framework. Finally, evidence-based taxes, subsidies, and regulations ensure food security and nutrition by incentivizing healthy, sustainable food over processed alternatives, protecting both people and the planet.

Significant knowledge gaps persist regarding the effectiveness of One Health approaches in improving food security and nutrition outcomes across diverse contexts. There is limited evidence on the cost-effectiveness of integrated One Health investments

compared with sector-specific interventions, and on the links between environmental exposures, food systems, human nutrition, and chronic disease outcomes. Data gaps remain on gender-differentiated impacts of climate and health shocks, particularly for women in agriculture. There is also limited operational guidance on integrating One Health data, governance, and financing mechanisms at national and subnational levels.

Within the One Health framework, FSN are essential for systemic health. Policies that ensure affordable, stable diets do more than fight hunger; they reduce zoonotic risks and ecological damage, creating a more resilient link between human, animal, and environmental systems. One Health directly aligns with the mandate of the Committee on World Food Security (CFS) to ensure FSN for all through inclusive, coordinated, and evidence-informed policy processes. The integrated nature of One Health corresponds to CFS's role in addressing cross-cutting challenges spanning the different elements of food systems, from production to consumption to health impacts to sustainability. The CFS is uniquely positioned to support the policy coherence that One Health requires, moving beyond the sectoral silos that have historically hindered its operationalisation. CFS engagement can help ensure that One Health approaches explicitly prioritize achieving food security and nutrition and the right to food while avoiding fragmented or sectorally biased implementation.

CFS can provide guidance on applying One Health as an organizing framework for FSN, including principles for integration, equity, gender responsiveness, and accountability. It can convene governments, UN agencies, civil society, the private sector, and research institutions to identify synergies, manage trade-offs, and address conflicts of interest. CFS's comparative advantage lies in its inclusive governance model, legitimacy, and ability to translate scientific evidence into policy-relevant guidance that reflects FSN priorities.

The HLPE-FSN can synthesize interdisciplinary evidence on One Health and FSN, clarify pathways of impact, and assess the costs of inaction. It can identify best practices and policy-relevant lessons to promote food security and nutrition from an integrated One Health perspective, including, for example, those addressing gender, climate resilience, antimicrobial resistance, food safety, non-pesticidal pest management approaches, nutrient rich plant breeding, and seed systems. HLPE analyses can inform CFS policy convergence processes and support members and stakeholders in designing coherent, science-informed One Health strategies that advance FSN.

Key questions

- 1) What mechanisms are needed to achieve real policy coherence, rather than just technical coordination, across food, agriculture, trade, and climate policies?
- 2) How can food systems be transformed to simultaneously address malnutrition, zoonotic disease risk, antimicrobial resistance, and environmental degradation?
- 3) How can declining crop genetic diversity and increasing reliance on a small number of staple crops be reversed to improve diet quality and resilience?
- 4) How can One Health approaches be designed to explicitly protect the most vulnerable populations, particularly women, migrants, and agricultural workers, who face heightened exposure to climate, health, and human rights risks?

- 5) What is the cost-effectiveness of integrated One Health investments compared to sector-specific approaches, and how can this evidence base be strengthened?
- 6) How can monitoring, surveillance, and early warning systems be expanded and integrated across climate, disease, food safety, and air quality domains?

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9. Affordability of healthy and nutritious diets to ensure food security and nutrition

In 2024, an estimated 8.2 percent of the world's population suffered from hunger, meaning that 673 million people were affected by undernourishment, although the situation varied from country to country. In sub-Saharan Africa and Western Asia, the percentage increased, while it decreased in South America and South and South-East Asia (FAOSTAT). However, severe and moderate food insecurity increased in even more developed countries. Aside from undernourishment and micronutrient deficiencies, a third important nutritional challenge has been overweight and obesity, leading to the concept of the triple burden of malnutrition. In 2024, the number of people worldwide unable to afford a healthy diet stood at 2.60 billion (FAO, IFAD, UNICEF, WFP and WHO, 2025), with Africa being the most affected. The situation was worse for rural populations, particularly, women and children. The number of people who cannot afford a healthy diet has been estimated at 3 billion (Headey, Hirvonen and Alderman, 2024). Globally, nutrient adequacy costs 2.66 times the cost of subsistence daily energy (Bai, Alemu et al., 2021). Affordability of healthy and nutritious diets raises questions relating to the determinants of demand, supply and trade.

On the demand side, the situation has worsened due to food inflation and household budget constraints on non-food spending. Food price inflation has risen sharply since the COVID-19 pandemic and global conflicts and has not returned to its pre-2020 level globally. Food inflation has been affected by the war between Russia and Ukraine and restrictions on food exports. The resulting uncertainties have increased speculative activity in the food sector and contributed to a further surge in prices (Algieri, Kornher and von Braun, 2025). The Cost of a Healthy Diet (CoHD) increased 30 percent between 2020 and 2024 (FAO, IFAD, UNICEF, WFP and WHO, 2025). Nutrient-dense foods, particularly fruits, vegetables, and animal source foods are subject to price volatility and remain less affordable food categories, whilst ultra-processed foods are often cheaper and the increase in their consumption contributes to the rise of non-communicable diseases in all regions of the world. Food inflation impacts the most vulnerable groups, particularly, women and children, especially in low-income countries (Headey and Ruel, 2023), but also the poorest populations in high-income countries. To achieve a nutrient adequate diet for African women and children, affordability remains a major constraint taking into account cultural acceptability (Ameller, et al., 2025).

On the supply side, numerous factors can influence food prices and affordability of healthy foods. Food prices depend on (i) production levels and production costs (inputs – labour, energy, land, water, transport and logistics), (ii) geopolitical conflicts, (iii) climate shocks, changes and risks, (iv) market concentration (concentration of companies) and (v) agricultural and trade policies (production and input subsidies and other types of support mainly for commodities and cheap calorie production, export bias). There are large differences between countries in terms of self-sufficiency (sufficient food production or dependence on imported food). Many countries with food deficits are also net importers of crude oil and are the most vulnerable (Kirikkaleli and Darbaz, 2021). Climate variability and extreme events associated with climate change are an important factor affecting food prices, especially in the near term. It has been reported that low-income countries are more affected by price increases than high-income countries

subject to the same climate change (Parker, 2018). Moreover, highly perishable fruits and vegetables, which provide most micronutrients, experience higher seasonal price variations than foods that are easier to store and transport, such as cereals and legumes, nuts, or seeds. Reaching the Sustainable Development Goal of Zero Hunger requires renewed policy attention to seasonality in food prices and consumption (Gilbert, Christiansen and Kaminski, 2017). Coordinated fiscal and monetary approaches to deal with food price shocks can improve aggregate welfare (Ginn and Pourroy, 2019).

Affordability of adequate food is also a matter of real wages and incomes (Headey et al., 2024). Hence, there is also a need to explore how income and wages of different actors in the food systems have evolved and what kind of policies could be implemented to improve livelihoods and thus food access. Policies aimed at ensuring decent work and living wages, combined with social protection measures that help stabilize incomes after a shock, will improve affordability on the demand side (Cattaneo, Sadiddin et al., 2023). Evidence supports the use of transfers in kind and cash for FSN, though ensuring micronutrients adequacy for vulnerable groups may require specific interventions (Iannotti et al., 2024). Evaluating various policy instruments (such as vouchers and cash transfer) and tools addressed to the utilization dimension of food security (e.g., sanitary conditions, cooking facilities) is necessary to provide an understanding of the best measures for affordable healthy foods.

Analyses show that the surge in food prices between 2021 and 2023 had different characteristics and drivers than those observed in 2008 and 2012, requiring different policy responses (FAO, 2025). There is a need to revisit the first HLPE-FSN report on “Price volatility and food security” (2011) and to complement the subsequent CFS policy recommendations. The CFS policy recommendations on Price volatility (2011) acknowledged the G20 Action Plan on Food Price Volatility and Agriculture, called for the successful conclusion of the WTO Doha Round, and supported the Agricultural Market Information System (AMIS) and the AMIS Rapid Response Forum. The recommendations also linked to the HLPE-FSN reports on biofuels and social protection, as well as to a draft code of conduct for humanitarian emergency food stocks and the strengthening of food aid under the Food Aid Convention. The 2011 policy recommendations should be reviewed and complemented in light of new data and analysis of the last 15 years, including lessons learned from the 2021-2023 food price surge and its consequences. There is a need to dig deeper into the drivers of food costs, accessibility, and affordability and to share countries' experiences in advancing food affordability. CFS needs actionable policy recommendations on how to address the structural factors behind this challenge.

Key questions

- 1) What policy options exist to reduce inequalities in relation to the accessibility and affordability of healthy diets?
- 2) What are the lessons learned from occurrences of food inflation and high food prices compared to non-food prices? What was the distributional impact of higher prices of meat, fish, fruit, and vegetable products, compared to the price of less nutritious food, on FSN?
- 3) What is the role of trade in affordability of nutritious and sustainable food?

- 4) What policies including price controls, demand support, social protection, wage increases, have helped maintain access to affordable food? How have food affordability measures fared and which ones have worked well (in terms of improving nutrition)?
- 5) What policies have worked in enhancing the price stability of foods from food groups other than cereals? Specifically, how have social protection policies such as school feeding programmes helped improve access to nutritious food?
- 6) How to improve affordability of healthy diets, especially for those most marginalized in food systems (such as young people and women)?
- 7) How can investments in sustainable and resilient food systems reduce price volatility and lower the long-term cost of healthy diets?
- 8) What policies should be developed to mitigate price volatility caused by climate shocks while countering overall inflationary pressures, and how can contingency plans be formulated to prevent the risk of inflation?
- 9) What measures are being taken to protect and support agriculture, strengthen agricultural infrastructure, facilitate shorter supply chain, consider traditional and informal markets in the Global South to increase the adaptability of production to climate change, improve grain reserve systems and market efficiency?
- 10) What strategies can empower consumers to access healthy and nutritious food while maintaining its accessibility and affordability, given global uncertainty?

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10 Agency for food security and nutrition

In the 2020 report, *Food security and nutrition: building a global narrative towards 2030*, the HLPE-FSN proposed to broaden the understanding of food security from the widely accepted four dimensions of availability, access, utilization and stability by adding the two dimensions of sustainability and agency (HLPE,2020). This section elaborates on the agency dimension, to contribute to “strengthening and consolidating conceptual thinking about food security and nutrition” (HLPE 2020).

“Agency refers to the capacity of individuals or groups to make choices about what they eat, how that food is produced, processed and distributed, and to engage in policy processes that shape food systems. The protection of agency requires socio-political systems that uphold governance structures that enable the achievement of FSN for all” (HLPE, 2020).

Agency is grounded in human rights and is essential for the realization of the right to adequate food but is often not included and operationalized in food security policy instruments. Agency is critical for food security and nutrition for two primary reasons. First, agency is important as an end in itself, both inside food systems and for individuals’ FSN specifically. Agency goes beyond the traditional material access to food and encompasses voice, autonomy and participation in shaping food environments and policy processes. Enhancing agency strengthens autonomy, self-determination and dignity allowing people to shape food systems in ways that reflect their values, preferences, cultures, and rights (Clapp et al., 2022).

Second, agency is a basic capability (Sen, 1985) and is hence critical for the achievement of food security (Drèze and Sen, 1989) including all five other dimensions, that is, availability, access, utilization, stability, and sustainability. To illustrate, even where food is available, if women lack agency, they may eat meals after all other family members, thus they may not get adequate food or the most nutritious food. Agency also includes the control over productive resources, autonomy in productive decisions, freedom from exploitative contracts and from manipulation and disinformation, particularly about food choices. Without agency, individuals become passive consumers rather than active contributors to food systems. Finally, agency is also key to adaptive capacity and thus to the resilience of individuals, groups and systems (FAO, 2021; HLPE, 2025).

Agency of an individual also depends on the agency of collectives. If a group is denied access to resources or markets, individuals in the group may be unable to be well nourished. For example, members of marginalized groups may be denied access to land or face different market prices, constraining the capacity of all individuals belonging to the Scheduled Castes in India to be well nourished.

There are three major knowledge gaps to date. First, there is limited consensus on standard indicators and measurements for agency in food systems, hindering analysis, monitoring and evaluation. Second, more empirical research is needed on the causal links between strengthened agency and improved FSN outcomes across contexts and population groups and on effective interventions to strengthen agency and FSN jointly. Third, better documentation is needed on how specific governance arrangements, power structures and institutional practices enable or constrain agency.

Without agency, food security risks being fragile, inequitable and ultimately unsustainable. With its inclusive multistakeholder platform, normative policy convergence mandate, and neutral convening space, CFS has a comparative advantage to assess and promote the role of agency for FSN. Recognizing agency would reflect the evolving scholarly and policy thinking on food systems, fill a key conceptual gap not fully captured by the widely-accepted four pillars, and thereby help to complete the FSN framework. Agency addresses structural inequities and power imbalances, supporting CFS's commitment to transparent, democratic and accountable governance in food systems. Finally, enhanced agency is linked to adaptation and resilience and is crucial for responding to intersecting shocks like climate change, conflict, and market volatility. By including agency in future work streams, the CFS could identify constructive ways to explicitly address power, voice, inclusion, control, and governance within food security and nutrition, through different stakeholder lenses, as well as identify trade-offs and challenges.

Key questions

- 1) In what ways are agency critical to ensure FSN? The report can clarify the conceptual foundation of agency, its relation to the human right to food, and outline the ways it complements the other five dimensions of food security, thereby contributing the CFS consensus around a shared, operational definition.
- 2) What are the costs and benefits of ensuring agency in food systems? This requires an assessment of challenges, contested areas, costs and trade-offs of including agency in practice within food security and nutrition policies and programmes. It also requires study of the cost of not ensuring agency in terms of slowing the progress on SDGs, which could range from misallocation of resources to political instability and conflict.
- 3) What shapes agency and how, and for whom is agency currently constrained in today's food system? To establish a solid evidence base for policy convergence, the report should identify the structural drivers that limit agency (such as education, income, legal rights, institutions, and social, religious and cultural norms), groups most affected (women, marginalized groups, youth,

elderly, people with disabilities, indigenous peoples), and document impact of constrained agency on FSN outcomes.

- 4) How to enhance agency? The HLPE-FSN report could identify policies and institutional arrangements that have been shown to strengthen agency, enhance participation, voice, control and decision making by all sections of society in the other five dimensions of food security. The report can also identify measures at the group or collective level that can enhance individual agency.
- 5) Finally, what are the data gaps and methodological challenges to measure, analyze and monitor the role of agency in FSN?

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