Enhancing Science-Policy Interfaces for Food Systems Transformation *[ok? house style precludes use of punctuation in the title, and usually we don't use verbs at the start of a title, but I'd suggest 'Enhancing' works fine here]*

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[ok? please include a standard Competing Interests Statement]

Enhancing Science-Policy Interfaces for Food Systems Transformation

Standfirst *[ok? a short 2-3 line abstract accompanies Comments]:* The anticipated failure by many countries to achieve the Sustainable Development Goals by 2030 necessitaties the assessment of past and current mechanisms for science and policy to engage for food systems transformation. Options for enhancing existing partnerships, mandates and resources - or reimagining a new mission – for science-policy interfaces are explored here. ***[ok? please feel free to edit this standfirst to better reflect the terminology you have used in the Comment – the length and style of the Standfirst should be similar to this example, however]***

The global food system is facing major interconnected challenges, including climate change, natural resource depletion, biodiversity loss, malnutrition, food insecurity, inequity, and preventable ill-health *(1, 2)*, all of which are exacerbated by food systems fragmentation and policy incoherence. To address these challenges, a food system transformation is required that shifts humanity towards more healthy diets from sustainable food systems thus ensuring more equitable food and nutrition security (*3,4*). ***[ok? would suggest removing this material as it is well-known to the Nature Food audience; removing it will improve the flow towards the main point of the Comment – we edit this kind of material out of many submissions to the journal – it will also enable use of other references if you wish]***

Progress towards more sustainable, equitable, and fair food systems is hampered by several factors. These include gender inequality, a lack of representation from diverse value systems and Indigenous peoples' traditional knowledge, knowledge gaps on the interactions among food system activities, an under-appreciation of sustainability issues, and disjointed policies *(8)*. For instance, little information is available on the effects of trade regulation on the environment, dietary patterns, smallholder and

Indigenous Peoples' production systems, and aspects of gender equity *(9,10,12)*. Such gaps combine with divergent interests and values across constituency groups, leaving policy makers unsure about how to integrate food policies that support food systems transformation.[ok? would continue and end this paragraph with the next sentence: 'Therefore, ….. (or SPIs)'.Therefore, a major investment is needed in both a better, and more relevant knowledge systems, and more efficient science-policy interfaces (or SPIs). ***[ok? For the opening paragraph, I would suggest cutting material so that the salient point of the Comment – the need for better SPIs is introduced as early as possible].***

Efficient SPIs must deliver at least the following three priorities: integrate research and data across food systems to support multi-sectoral and cross-scalar policies that combine food and nutrition security, public health, environmental sustainability, and societal wellbeing and equity; provide a robust, transparent and independent synthesis and assessment of knowledge, including scientific evidence and insights from the relevant stakeholders; and provide a relevant, policy-related research agenda. Together, addressing these priorities will help ensure the legitimacy of policy advice through independent, transparent, credible and authoritative consensus on scientific evidence and other forms of knowledge, thereby helping overcome both controversies and uncertainties, and fill knowledge gaps *(11*).

Multiple groups and organisations are currently debating the best pathways to transform food systems, including the Scientific Group of United Nation Food Systems Summit (UNFSS), the High-Level Panel of Experts on Food Security and Nutrition (HLPE) of the UN Committee on World Food Security (CFS), and this group of authors, the High Level Expert Group (EG) of the European Commission. Here, our focus is on exploring potential options to enhance SPIs to better support food system transformation in the coming decade(s). ***[ok? would suggest moving this here to end the first section of the Comment; this is an adequate statement of the aim of the opinion piece].***

[ok? would suggest removing this as the Comment outline doesn't really need to be included]

ASSESSING CURRENT SPIs

Given the complexity, scale, and urgency of food systems transformation, better integrated and funded SPIs are needed to fulfil at least the key functions outlined in Figure 1. They must generate, collect, and integrate different forms of knowledge that build on the FAIR (findability, accessibility, interoperability, and reusability) data principles *(13, 14)*; support the forward-looking efforts focused on forecasting, modelling, and scenario-building needed to create multi-stakeholder dialogues on co-benefits and trade-offs, risks, and opportunities, as well as costs and benefits associated with pursuing specific strategies; facilitate the use of transferable lessons from multi-stakeholder and multi-level dialogues in food systems across the value chain from regional to global scale; and catalyze global and local institutional capacity-building to ensure that the generation and integration of knowledge support informed policy decisions, fair, equitable, and better practices, and progress-tracking. ***[ok? remove bullet points. If possible, restructure these points as sentences; I'd suggest moving this general paragraph above the specific details of the SPIs currently operating for food systems; ie, place theoretical detail relating to Figure 1 before the specifc operational detail of Table 1]***

Existing food-related SPIs play different functions and roles in the food systems landscape (Table 1). These include assessing the latest scientific literature, promoting a better understanding of food system conditions, catalyzing dialogue, and setting research/innovation priorities *(12)*. There is little overlap among these different SPIs in topical/sectoral focus, membership, modalities of governance, and relationships with UN, EU or other agencies offering secretariat support and funding. All SPIs offer unique and valuable contributions (e.g., reports, discussion fora, evidence for prioritization, scenario-building and policy advice). Yet, the current landscape lacks global, regional and national coordination

as well as scientific independence. Both are vital conditions to improve efficiency and bridge knowledge gaps about emerging issues such as local variability in food systems drivers and outcomes, the social justice dimension of value chains (e.g., fair wages, health and safety matters, and women's participation), multiple food system concerns (e.g., integrating climate models into local food systems and enhancing understanding of the drivers of household food choice) and co-create actionable knowledge with all relevant actors *(8, 10, 12)*.

EXPLORING POSSIBLE PATHWAYS

Three broad options are proposed below to frame discussions around developing and enhancing SPIs to support food systems transformation.

Increased partnership between existing SPIs *[ok? remove bullet/numbering system]*

There are many important panels and initiatives working as SPIs for food systems transformation, as outlined in Table 1 ***[ok? does this edit adequately convey your meaning?]***. The HLPE, for example, was established in 2010 as part of the United Nations -CFS. Other include the *Global Panel on Agriculture and Food Systems for Nutrition* (GLOPAN), the *International Panel of Experts on Sustainable Food Systems* (IPES-Food), the *Global Alliance for Climate-Smart Agriculture* (GACSA), and the *Food and Land Use Coalition* (FOLU). Many of these bodies have incorporated explicit food systems foci, as evidenced by HLPE's food systems and nutrition report and the Intergovernmental Panel on Climate Change's (IPCC) reports on global warming and the food systems. This landscape highlights the distinction between governmental/multilateral rooted SPIs (e.g., the CFS, HLPE) and other expert panels (e.g., IPBES-Food) that are more independent of political processes. Some of these initiatives and institutions have overlapping membership and cooperate to the extent permitted by prevailing mandates, funding, timelines, and interests. Altogether, this suggests there is the potential to better align activities,

indicators, data, workloads, resources, and integrate outputs. Some "low-hanging fruits" in this regard would be the development of collaborative outputs among panels and organizations, including those anchored in a formal inter-governmental setting such as the HLPE, IPCC, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), the Food and Agriculture Organization of the United Nations (FAO), the World Health Organization (WHO), the World Bank, and others.

Increasing collaboration between existing SPIs and other institutions or networks could provide new insights and enhance representation of stakeholders from all dimensions of food systems. For example, connecting existing expert panels could lead to a regular 'report of reports' that covers multiple dimensions of food systems and fosters innovative (and largely unpredictable) initiatives. However, achieving this goal would require overcoming many challenges, especially in creating synergies across bodies and disciplines, and ensuring the inclusion of civil society and private sector stakeholders.

Fostering collaboration (including publishing collaborative outputs) would entail re-allocating resources to collect, analyze, and disseminate comprehensive food systems data, information, and knowledge to help global bodies aggregate inputs into readily accessed and cross-referenced knowledge systems such as online portals. This would, ideally, be based on existing online portals such as the Food Systems Dashboard (https://foodsystemsdashboard.org/) and the Countdown on Health and Climate Change (https://www.lancetcountdown.org/data-platform). Financially, realigning the work and resources of existing SPIs (and other mechanisms for cooperation and networking) would not necessarily require expanding budgets or creating new institutions. However, to be effective, increasing partnerships between SPIs would require some organizations be resourced to provide overarching coordination, facilitate data sharing, and ensure multi-lingual and multi-cultural perspectives, along with gender parity and representation.

Enhanced mandate and resources for existing SPIs

A second option would be to significantly enhance both the mandate of, and resourcing for, existing SPIs to develop their capacity to meet more complex food system challenges and broaden their engagement to include under-represented regions as well as stakeholder groups. Doing so would ensure better interconnectedness, enhance data integration and accessibility, and create spaces for discussion open to all their stakeholders. For instance, existing SPIs could be empowered to conduct modelling-based assessments to find pathways to transform food systems for specific countries and regions with explicit consideration of local (including Indigenous) concerns, solutions, and innovations.

Currently, the CFS covers areas related to food security, and its HLPE provides assessments of specific issues related to food systems. However, neither has the mandate or the resource to address the full range of concerns associated with food systems transformation in all its dimensions and scales. The specific enhancements over current arrangements could focus on three key areas. The first is to better integrate knowledge frameworks, priorities, activities, and outputs from existing SPIs. The goal would be to develop more coherent and mutually agreed frameworks that include more diverse inputs, address a wider set of concerns, and bring science to bear on the search for efficient global, national, and local solutions. This would also involve more integrated agendas across SPIs and new mechanisms to foster methodological innovations *(15)*. A second strategy would be to enhance policy-relevant data sharing, analyses and other information. Such an effort should involve, for example, Africa's Regional Strategic Analysis and Knowledge Support System (ReSAKSS), the Global Open Data for Agriculture and Nutrition (GODAN), FAO, the WHO's Global Health Observatory, the World Trade Organization's (WTO) Committee on Trade and Development, as well as different regional networks that have direct links to national research centers such as the Asia-Pacific Association of Agricultural Research Institutions (APAARI), and the Forum of the Americas on Agricultural Research and Technology Development (FORAGRO). A third area for improvement could entail the development of better integrated networks of institutions (globally, regionally and nationally) to ensure that the 'voice' of

under-represented food systems actors is heard and to catalyze focused dialogues on problems and solutions across different geographies. Using existing bodies to create these dialogues may facilitate rapid structural adaptation, which may not need legislative amendment. This option, however, would also require existing SPIs to broaden mandates and responsibilities, expand membership and resources, and compromise on institutional or political remits to deliver on shared goals.

Establishing a new mission

In the lead up to the 2021 UN Food Systems Summit, some raised the need to create entirely new institutions with approved mandates and novel multi-scale scientific agendas – similar in scale and scope to the IPCC and IPBES, which respectively provide periodic assessments, reports, and advice on climate change and biodiversity *(15, 16)*. No such body exists for food systems, though CFS and HLPE do cover food security and assessment activities. Therefore, strong arguments have been put forward to create a new institution that would advise on integrated policies (covering production, processing, transportation, waste, trade) and link regional food systems transformation efforts with global initiatives, thereby offering support for improving diet/nutrition, the livelihood of smallholders, gender equity and environmental outcomes *(9, 16*).

This proposal has met considerable controversy. For instance, building an entirely new SPI for food systems would demand a level of inter-governmental or international effort (with a specific budget and multilaterally agreed terms of reference) that is difficult to imagine obtaining post-COVID-19, when fiscal resources are likely to be constrained among both donor and low- and middle-income countries. Critics have, therefore, expressed concerns about the risks involved in adopting such a time-consuming, politically uncertain, and resource intensive approach, which has also been criticized for duplication and for the difficulties involved in defining it through a democratic governance process *(17*).

CHARACTERISTICS OF EFFECTIVE SPIS AND WAYS FORWARD

It is unlikely that options one or two alone can provide the needed interface between science and policy to enable food systems transformation at local, national, and global levels. As for the third option, it is widely understood that scientific panels created by intergovernmental bodies (e.g., IPCC, IPBES) take many years to become established, funded and operational. This does not mean that things cannot be different in the future, but the track record suggests that major institutional innovations are time-consuming. Considering that the SDGs should be achieved within nine years, and that most countries are off track due to the pandemic, it is likely that an instrumental and realistic pathway may be a hybrid solution that blends several options. For example, creatively merging options two and three can provide a framework to boost short- and mid-term goals for food systems transformation, while taking into consideration legitimacy and inclusiveness, along with material and human constraints. Ideally, the new approach should enhance the resources and activities of current SPIs (e.g., CFS, HLPE; see Table 1), promote networking by creating a coordination body (with a new mandate and small budgetary allocation). This will collect, assess, and report on available data from all SPIs, national and regional governments, NGOs and private sectors, co-create knowledge and transform it into evidence for policy action in a transparent, independent, equitable, and legitimate fashion.

Existing SPIs would form the core building blocks of any such enhanced mechanism, which should deliver coordinated assessments and reporting for the entire food system, thereby promoting better cooperation among SPIs. There are many existing networks of networks (e.g., the GrowAsia Forum and the Food Action Alliance) that already foster multi-constituency engagement in food systems across multiple scales. These could be enhanced, better supported, and structurally linked to providers and users of information and knowledge of all kinds.

In determining appropriate option(s) to be pursued, at least four key principles must be kept front-and-center of the dialogue. First, all work must be credible, relevant, based on appropriate data, peer reviewed, and of genuine value to users. Second, any solution must put legitimacy and inclusiveness at

the heart of the design process. In other words, the legitimacy of SPIs needs to be driven by a transparent, open, and independent process and through a mandate that is widely supported by governments, civil society, UN mechanisms and other stakeholders. Third, any SPI should ensure the active participation and meaningful inclusion of all food systems actors. In this respect, SPIs should incorporate knowledge pluralism, value different perspectives and concerns, and encourage debates and consensus building around alternative solutions, while paying explicit attention to the voices and needs of different genders and historically marginalized groups. This can be achieved through transparency, independence of process, a mandate that is widely supported by governments, civil society, UN mechanisms and the private sector, and a structure that is open to participation from perspectives that have traditionally been marginalized. Effective SPIs must safeguard against vested interests of many kinds, including political and funder groups. Fourth, any pathway forward should explicitly strive to bring multiple co-benefits and work with local public and private stakeholders to design food systems that create new (green) jobs and support regional economic development while respecting local/Indigenous resources, knowledge and ownership *(18)* (Figure 1). Finally, transformative science is also needed to support policy and offer innovative solutions for food systems transformation *(12, 19)*. While existing streams of research and other approaches to evidence are important, they are often limited by disciplinary or contextual siloes or are funded to answer questions that are not always relevant to food systems transformation. Future resource commitments must promote, facilitate, integrate, and sustain new forms of transdisciplinary approach that help identify synergies as well as obstacles to change and support real world experimentation through mechanisms, such as "living labs" *(20)*, that help contextualize data and information.

In conclusion, most food systems stakeholders share the view that improved knowledge is needed to deliver food systems transformation *(8, 9, 10, 16)*. However, it is important to note that implementing effective approaches in this respect requires political investment and leadership, multistakeholder consultation, societal trade-off, a call for equity and a broader approach to knowledge-sharing and

capacity-building. A realistic analysis of where a country, region or city is starting from is essential to determine what kinds of SPIs will support transformative activities and determine priorities for capacity-building and investment across all stakeholder groups. This can be facilitated by including the political economy of policy action into the advice itself, alongside economic evaluation, the scalability of actions on the ground, a calculus of costs and benefits, and an assessment of winners and losers.

The SPI options presented here provide a potential framework to promote consensus around ways to achieve independent scientific interaction with policy needs at different scales. Establishing more effective food systems SPIs will require financial and political capital and time-defined dialogues that go beyond cooperation among existing SPIs to include other actors (including national and regional governments, the private sectors, and NGOs). These dialogues should be shaped by openness, inclusivity, transparency, scientific independence, and institutional legitimacy. The UN Food Systems Summit held in September 2021 provided some space for this discussion that should be furthered during the UN Climate Change Conference in the UK (COP26) and Nutrition for Growth in Tokyo. The global community must seize on this historic moment to formulate commitments that enhance SPIs and concretely help them to support the urgently needed transformations of our food systems.

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The group is composed of 19 individuals appointed in a personal capacity and who are acting independently and in the public interest. The views expressed in its report represent those of the EG members, and not the EC. The EG does not promote any political agenda or researchers' self-interest. https://ec.europa.eu/info/news/new-high-level-expert-group-assess-need-international-platform-food-systems-science-2021-feb-17_en

This manuscript is an independent exercise of the group which builds on the EG report. We acknowledge contribution from Karen Fabbri and Magdalena Gajdzinska for convening regular meetings and contributing strongly to our discussions.

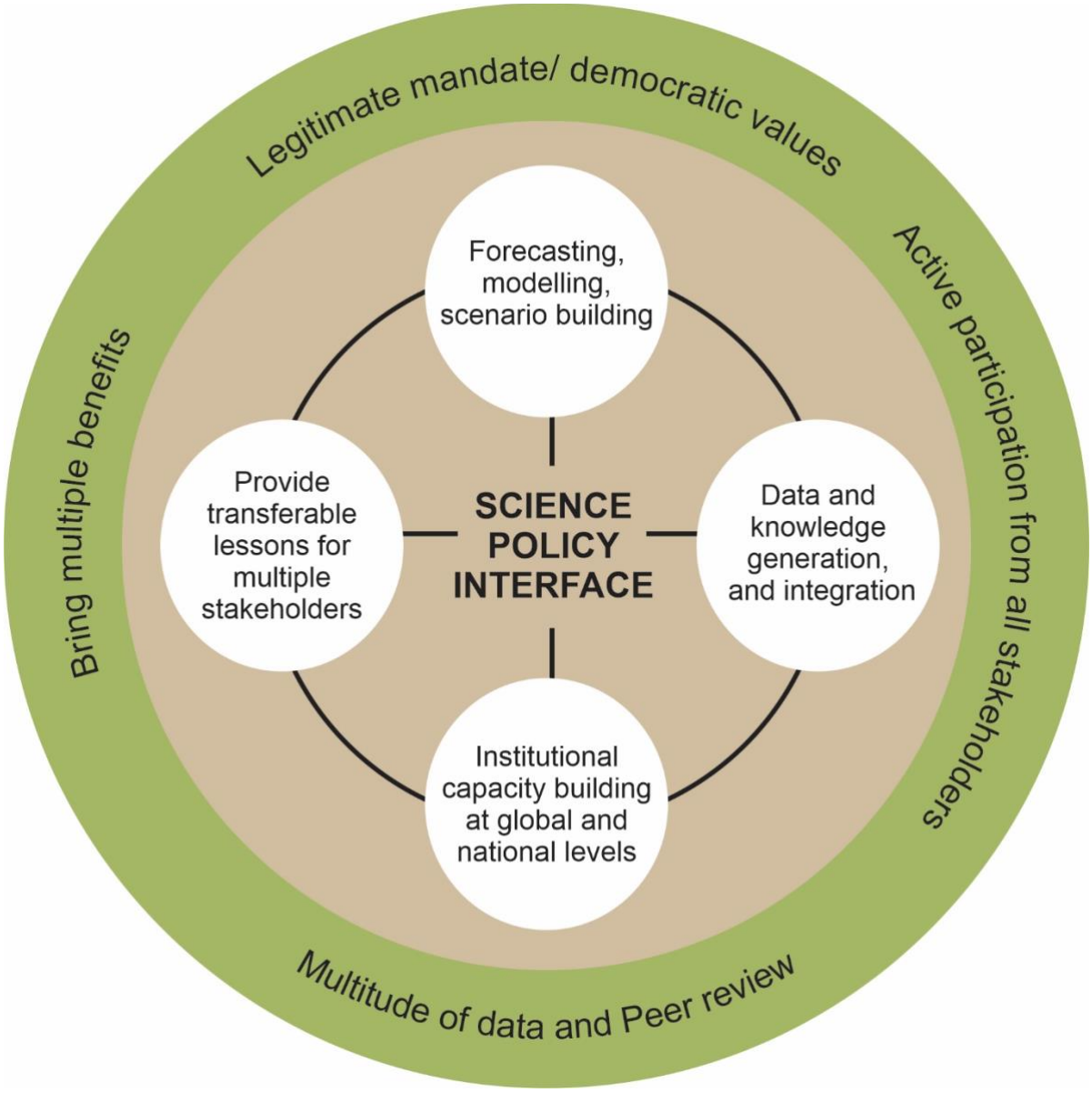

Figure 1. **Critical activities and key principles for science-policy interfaces**. The critical activities of a SPI should include generating, collecting and integrating all forms of knowledge, supporting forward looking efforts, creating multi-stakeholder dialogues, facilitating transferable lessons across the food systems, and catalyzing global and regional capacity building. These activities must be pursued under key principles including credible and relevant report – based on appropriate data gathering and peer reviewing, stakeholder consultations, and of genuine value to users. Legitimacy and inclusiveness derived from transparent, open and independent process and by a mandate that is widely supported. Active participation and meaningful inclusion of all stakeholders in the design and use of the knowledge system and explicitly focus on multiple co-benefits including supporting regional economic growth while respecting local/indigenous knowledge and ownership. ***[ok? display item titles must have a short***

bolded overview title, followed by unbolded explanatory notes….all up to 350 words; the only change needed to your original is to bold the overview title]

Table 1. Current Science-Policy Interfaces (SPIs) in food systems. ***[ok? display item titles must have a short bolded overview title, followed by unbolded explanatory notes….all up to 350 words; the only change needed here is to include a short amount of explanatory, unbolded text]***

Name/	**Focal/ food relevant Thematic Domains**	**Mandate**	**Modality**	**Outputs**	**Funding Sources**
Intergovernmental Panel on Climate Change (IPCC)	Climate Change/ Climate & Food Systems	Inter-governmental	Board and Plenary; Nominated Scientific Expertise	Multi-Volume Assessments, summaries for policymakers (SPMs) based on peer-reviewed literature, data, and model archive. Regular cycle (5 years) with special reports interspersed.	WMO/UNEP Secretariat funding from multiple donor countries
International Resources Panel (IRP)	Natural Resource/ Natural resource use for food	Inter-governmental	Scientific Experts; research and reviews	Research, Syntheses, Assessments, SPMs; Multiple outputs per year	UNEP Secretariat, funding from multiple donor countries
Inter-governmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)	Biodiversity and ecosystem functions/ Biodiversity & Food Systems	Inter-governmental & Communities	Multi-stakeholder Plenary; Nominated Scientific Expertise & Technical Support Units	Multi-volume and focused assessments based on peer- reviewed literature and Indigenous & traditional knowledge; multi-year plan for delivery	UN Secretariat, funding from multiple donor countries, foundations
High-Level Panel of Experts on Food Security and Nutrition (HLPE) of the UN Committee on World Food Security (CFS)	Food Security	Inter-governmental & Stakeholders	Steering Committee of Nominated Experts; Teams of nominated experts; FAO	Analyses of state of food security and nutrition; scientific- based advice on policy-issues, using existing high-quality research; identifies emerging issues	FAO Secretariat, funding from multiple donor countries

Group on Earth Observations (GEO)	Environment/ Environment & Food Systems	Inter-governmental & Stakeholders	Multi-stakeholder Advisory Board; Experts and Practitioners; UNEP	Multi-Volume Assessments, SPMs based on peer-reviewed literature, data, and model archive. Regular cycle (5 years) with special reports (e.g., GEO for Business) interspersed.	UNEP Secretariat, funding from multiple donor countries
Standing Committee on Agricultural Research (SCAR)	Agriculture, bioeconomy, food systems, resilience	Established by Regulation of EU Council; inter-governmental	Plenary governing body; Steering Group; national delegates, EC experts; working groups/task forces	Periodic technical and strategy reports. Source of advice on European agricultural and bioeconomy research; catalyst for coordination of national research; Foresight meta-analyses.	EC Secretariat funding and national governance of EU
Global Forum on Agricultural Research and Innovation (GFAR)	Food systems	International, networks of partners, non-governmental	Regional platforms in Asia, Africa, Latin America, and Europe; Scientists, business, policymakers, farmers	Supports development of a strategic agenda for agri-food research and innovation; catalyzes dialogue among all relevant stakeholders; supports the strengthening of institutions and organizations to better link research	FAO secretariat, funding from FAO, IFAD, EU, other donor countries
The Economics of Ecosystems and Biodiversity (TEEB)	AgriFood Systems & Capitals	International, inter-governmental	Experts nominated; stakeholder and UNEP	Periodic Scientific reports; National Assessments	UNEP Secretariat; funding from donor countries, foundations
Global Panel on Agriculture & Food Systems for Nutrition (GLOPAN)	Food Systems, diets, nutrition	International, non-governmental	Scientific experts, research, foresight, policymaker engagement	Using existing high-quality research, data and technical studies and new modelling for policy briefs. Foresight reports, analytical tools, policy dialogue convening.	Multiple donor agencies, foundations.
European Food Safety Authority (EFSA)	Food and Feed Safety	EU; inter-governmental	Board; Nominated Scientific Expertise; EFSA	Regular Reports, Policy Briefs, Statutory Analyses	EFSA Secretariat; funding from EU budget.

International Panel of Experts on Sustainable Food Systems (IPES-Food)	Food Systems	Independent Panel of experts, non-governmental	Multi-stakeholder; co-creation of solutions based on science, experiential.	Regular assessments produced with a wide range of food system actors, democratic approach, cutting-edge science combined with experiential, Indigenous & traditional knowledge.	Multiple foundations. IPES-Food does not accept funding from governments or corporations.