Enhancing Science-Policy Interfaces for Food Systems Transformation: Needs, Options, and Opportunities

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The global food system is facing major and interconnected challenges including climate change, natural resource depletion, biodiversity loss, malnutrition, food insecurity, population growth, rapid urbanization and inequity *(1, 2)*. All of these are further exacerbated by food systems fragmentation and policy incoherence. COVID-19 has shown the pivotal importance of effective food supply chains and the need to increase their resilience to emergencies, including pandemics. To address these planet-wide challenges, a food system transformation that shifts humanity towards more sustainable and healthy diets and aims to ensure food and nutrition security for all is required (3).

The failure by many countries to achieve the Sustainable Development Goals (SDGs) highlights the inadequacy of current food systems and the need for transformation. This is especially the case for the SDGs linked to ending hunger, food security, and gender equality *(4)*. Unhealthy diets, underpinned by food system inadequacies, are now one of the leading global drivers of non-communicable diseases, overweightness and obesity. Meanwhile, half the planet cannot afford even the most basic of healthy diets *(5)*. At the same time, current food systems contribute approximately 34% of global greenhouse gas emissions *(6)*. Urgent steps are needed to transform food systems and ensure that they deliver healthy and sustainable diets for all.

Progress towards more sustainable, equitable, and fair food systems is hampered by several factors including key knowledge gaps on the systemic interplay between a range of food system activities, an under-representation of critical sustainability issues, and disjointed policy making *(7)*. For instance, there is little information available on the effects of trade regulation on the environment, dietary patterns, smallholder productivity, and gender equity. Due to these knowledge uncertainties, that are coupled with divergences in terms of interests and values, policy makers operating at different scales (from global to

local) are constrained in developing effective integrated food policies to support food system transformation.

Food system transformation, therefore, requires a major investment in both a better, and a more relevant, knowledge system and more efficient science-policy interfaces (or SPIs), which should deliver on at least the following priorities: (1) the integration of research and data across food systems to support multi-sectoral and cross-scalar policies that integrate food and nutrition security, public health, environmental sustainability, and societal wellbeing; and (2) a robust, transparent and independent synthesis and assessment of knowledge to ensure the legitimacy of scientific advice through independent, transparent, credible and authoritative consensus on scientific evidence, including controversies and gaps in knowledge *(8)*.

In this article, we explore the needs and potential options for enhancing SPIs to support food systems transformation in the coming decade(s). Specifically, the article (i) assesses past and current SPI mechanisms and modalities, (ii) identifies domains of activity that could be strengthened, and (iii) explores the transformative potential of both producers and users of knowledge. Furthermore, we also assess optionss to articulate policy-actionable knowledge that builds on cutting-edge science, values experiential, indigenous and traditional knowledge and works to connect relevant expertise across sectors, scales, and geographies.

ASSESSING CURRENT SPIs

Existing food related SPIs play different functions and roles in the food system landscape (Table 1). These include assessing the latest scientific literature, promoting a better understanding of current and future food system conditions, catalyzing dialogue among stakeholders and setting research and innovation priorities *(9)*. In all, there is little overlap amongst the different SPIs in terms of topical/sectoral focus, membership, modalities of governance, and relationships with UN, EU or other

agencies offering secretariat support and funding. All SPIs offer valuable contributions (e.g., reports, discussion fora, evidence for prioritization, scenario-building and policy advice) but the current landscape lacks global and national coordination that could improve efficiency and bridge knowledge gaps about emerging issues, such as local variability in food system drivers and outcomes, the social justice dimension of value chains (e.g. fair wages, health and safety matters), multiple food system concerns (e.g., integrating climate models into local food systems and a better understanding of the drivers of household food choice) and the translation of knowledge into actionable guidance for public and private sector actors *(7, 8, 9)*.

In other words, there is lack of interoperability between many existing knowledge and data systems, unequal transparency on sources, methods and interpretations, limited translation of scientific outputs into policy options, and inadequate alignment in terms of engagement with local knowledge and concerns. Despite a range of well-considered outputs, the current SPI landscape is highly fragmented, insufficiently funded, poorly integrated and overly siloed. Given the complexity, scale, and urgency of food systems transformation, better integrated and funded SPIs are needed to fulfil at least four key functions (Figure 1). In particular, SPIs should:

- generate, collect, and integrate many forms of knowledge that adhere to the FAIR (findability, accessibility, interoperability, and reusability) data principles *(10);*
- support forward-looking efforts focused on forecasting, modelling, and scenario-building needed to create multi-stakeholder dialogues on co-benefits and likely trade-offs, risks, and opportunities, as well as costs and benefits associated with pursuing specific scenarios;
- facilitate the use of transferable lessons from multi-stakeholder dialogues at multiple levels of engagement in food systems across sectors in the value chain; and
- catalyze global and local institutional capacity building to ensure that the generation of knowledge supports informed policy decisions, better practices, and progress-tracking.

EXPLORING POSSIBLE PATHWAYS

Three broad potential options are proposed below to frame discussions around developing and enhancing SPIs that have the capacity to support food systems transformation.

1. Increased partnership between existing SPIs

Today, there are numerous food systems-related panels and initiatives, such as the *High Level Panel of Experts on Food Security and Nutrition* (HLPE), which was established in 2010 as part of the UN's Committee on Food Security (CFS), the *Global Panel on Agriculture and Food Systems for Nutrition* (GLOPAN), which began in 2013, 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) among many others. Many of these bodies have incorporated explicit food systems foci, as evidenced, for example, by HLPE's food systems and nutrition report and the Intergovernmental Panel on Climate Change's (IPCC) reports on global warming and the food system. 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 to formalize institutional collaboration based on regular outputs. Thus, one option would be to enhance more formal institutional collaborations among panels and organizations, including those anchored in a formal intergovernmental 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 networks/platforms/panels/organizations could provide new knowledge and enhance representation of stakeholders from all food systems dimensions. For example, connecting existing expert panels could lead to a 'report of reports' and foster innovative (and largely

unpredictable) initiatives. However, achieving this goal would require overcoming many challenges, especially in terms of creating synergies between different bodies and disciplines, and ensuring the inclusion of civil society and private sector stakeholders. This option would also 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 collaborations with 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 selected and resourced to provide overarching coordination, facilitate data sharing, and ensure multi-lingual report writing.

2. Enhanced mandate and resources for existing SPIs

A second possible option would be to significantly enhance both the mandate of, and the resourcing for, existing SPIs to develop their capacity to meet more complex food system challenges, ensure better interconnectedness of activities, enhance data integration and accessibility, and create spaces for discussion open to all stakeholders. For instance, it may be possible to empower existing SPIs to conduct a global modelling activity that could be linked to (and informed by) national government policy considerations as well as local (including indigenous) concerns, solutions, and innovations.

The specific enhancements over current arrangements should focus on three key areas. The first is the integration of knowledge frameworks, priorities, activities, and outputs. 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 *(11)*. A second is enhanced coordination and 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, and the World Trade Organization's (WTO) Committee on Trade and Development. A third area for improvement is to develop better integrated networks of institutions (globally, regionally and nationally) to ensure that the 'voice' of under-represented food system actors is heard and to catalyze focused dialogues on food systems problems and solutions across different geographies. An advantage of this option is that the use of existing bodies may facilitate rapid structural adaptation, which may not need legislative amendment. This option, however, would also require a willingness to broaden mandates and responsibilities, expand membership and resources, and compromise on institutional or political remits to deliver on shared goals.

3. Establishing a new mission

In the lead up to the 2021 UN Food Systems Summit, some have suggested 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 provide periodical assessments, reports and advice on climate change and biodiversity, respectively *(11, 12)*. The United Nation's Committee on World Food Security (CFS) covers areas related to food security, and its HLPE provides assessments covering specific issues related to food systems, however, it does not have either the mandate or the means to address the full range of concerns associated with food systems transformation. Therefore, it is proposed that a new institution could advise on integrated policies (covering production, processing, transportation, waste, trade) and link regional food system transformation efforts with global initiatives, thereby offering support for improving diet/nutrition, the livelihood of smallholders, gender equity and environmental outcomes.

The urgent need for improved scientific advice, assessment, monitoring and reporting to develop action and effective policies does justify an intergovernmental or international effort be performed with a specific budget and multilaterally agreed terms of reference. Additionally, although fiscal resources post-COVID-19 may be constrained among both donor and low- and middle-income countries, there is urgency to sustainable food system transformation. Nevertheless, one of the key risks inherant in creating new institional frameworks is that such an approach is time-consuming, politically uncertain and resource intensive. In addition, such an approach has been criticized for duplication and would need to be carefully defined through a democratic governance process *(13*).

PRINCIPLES FOR EFFECTIVE SPIs AND WAY FORWARD

It is unlikely that options one or two alone can provide the needed interface between science and policy to enable food system transformation at both 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 future, but the track record to date suggests that major institutional innovations are time-consuming. Considering that the SDGs should be achieved within the space of the next 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; Table 1), promote networking by creating a joint or establishing a new coordination body (with a new mandate and small budgetary allocation) that will collect, assess, and report on available data from all SPIs, national and regional governments, NGOs and private sectors, and translate knowledge into evidence for policy action in a transparent, independent and legitimate fashion.

Eisting SPIs would form the core building blocks of any such enhanced mechanism that 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 promote multi-constituency engagement in food systems across multiple scales. These could be enhanced, better supported, and structurally linked to providers and users of information of all kinds. A trust fund dedicated to resourcing SPIs activities in support of food systems transformation may be an appropriate mechanism to further encourage such activities.

In determining appropriate option(s) to be pursued, at least four 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 system actors in the design and use of the knowledge system. In this respect, SPIs should incorporate knowledge pluralism, value different perspectives and concerns, and encourage debates around alternative solutions while paying explicit attention to the voices and needs of different genders and historically marginalized 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 knowledge and ownership *(14)* (Figure 1). Finally, transformative science is needed to support policy for food system transformation *(15)*. While existing streams of research, and other approaches to evidence building are important, they are often limited by disciplinary or contextual siloes or are funded to answer questions that are not always relevant to food system transformation. Future resource commitments must promote, facilitate, integrate, and sustain new forms of transdisciplinary science that help identify synergies as well as obstacles to change and support real

world experimentation through mechanisms (such as Living Labs) that help contextualize data and information *(16).*

In conclusion, the potential SPI options presented here provide a framework to create consensus and tackle key global challenges through independent scientific support for policy action at different scales to meet the SDGs and beyond. Establishing a more effective food system will require financial and political capital, a drastically different approach that promotes time-defined dialogues, and goes beyond cooperation among existing SPIs to include other actors – national and regional governments, the private sectors and NGOs. These dialogues should be shaped by openness, inclusivity, transparency, scientific independence, and institutional legitimacy. The upcoming UN Food Systems Summit 2021, the UN Climate Change Conference in the UK (COP26), and Nutrition for Growth in Tokyo provide the opportunity to catalyze these dialogues. 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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ACKNOWLEDGEMENT:

The authors acknowledge the work and report prepared by the European Commission High Level Expert Group on International Platform for Food Systems Science where the concept of paper was conceived along with the discussion and reports from United Nation Food System Summit. We specifically, acknowledge contribution from Tom Arnold, Karen Fabbri and Magdalena Gajdzinska for convening regular meetings and contributing strongly to our discussions.

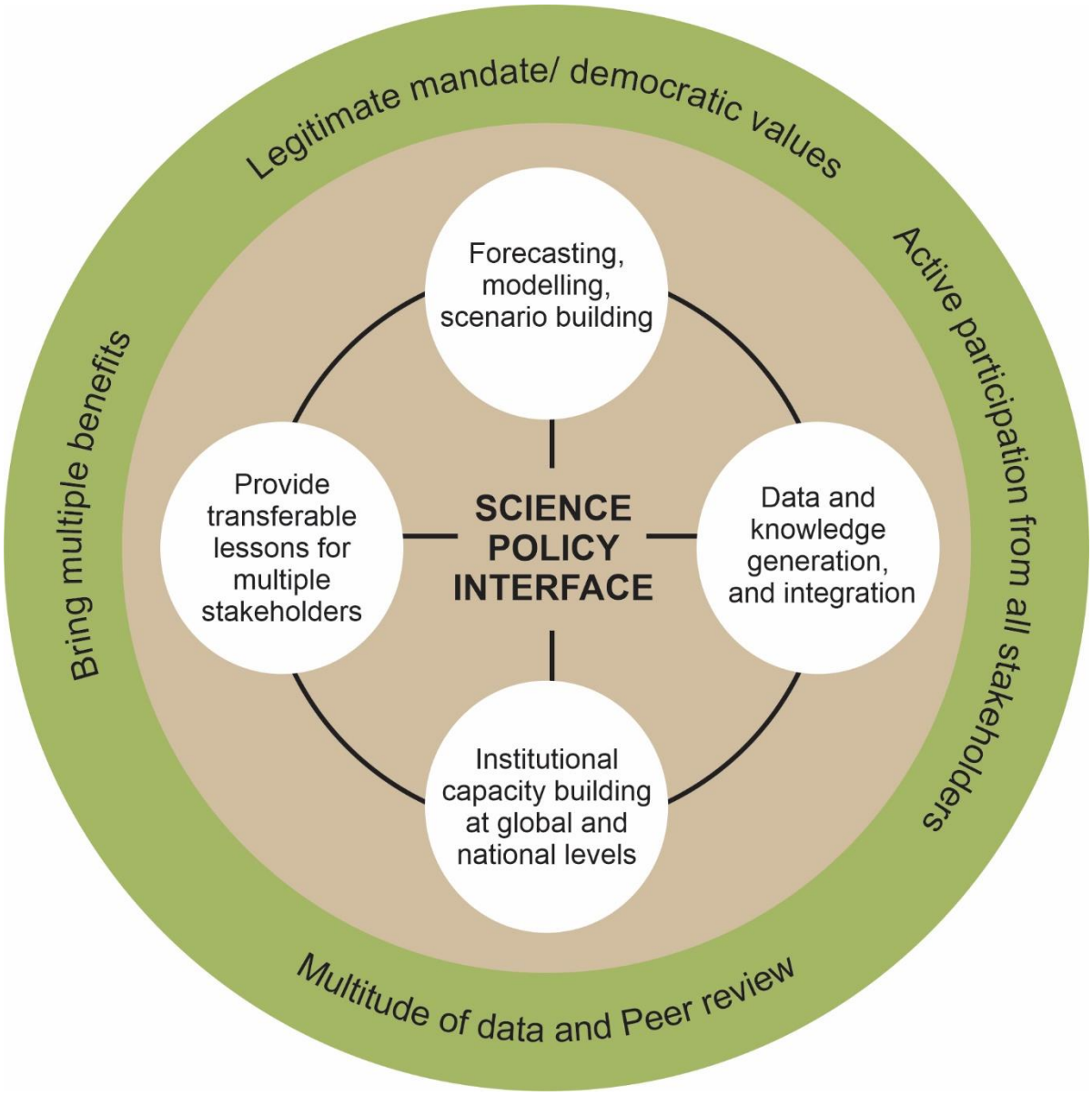

Figure 1. Critical activities and key principles (outer ring) for science-policy interfaces. Its critical activities should include generating, collecting and integrating all forms of knowledge, supporting forward looking efforts, creating multi-stakeholder dialogues, facilitating transferable lesson 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 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.

Table 1. An overview of current Science-Policy Interfaces (SPIs) in food systems.

Name	Thematic Domains	Mandate	Modality	Outputs	Funding Sources
Intergovernmental Panel on Climate Change (IPCC)	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 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 & 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 & 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; intergovernmental	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	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, National	Experts nominated; stakeholder sand 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	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; intergovernmental	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	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.