

Democratic directionality for transformative food systems research

Effective interfaces of knowledge and policy are critical for food system transformation. Here, an expert group assembled to explore research needs towards a safe and just food system put forward principles to guide relations between society, science, knowledge, policy and politics.

Jessica Duncan, Fabrice DeClerck, András Báldi, Sébastien Treyer, Jessica Aschemann-Witzel, Kerstin Cuhls, Lilia Ahrné, Stefano Bisoffi, Stefano Grandi, Liutauras Guobys, Johanna Kohl, Henning Otte Hansen, Richard L. Hudson, Hans-Jörg Lutzeyer, Vivi Hunnicke Nielsen, Begoña Ruiz, Elke Saggau, Egidio Valceschini, Grzegorz Siebielec and Gianluca Brunori

Transformations towards sustainable food systems are required as part of the pressing challenge to keep humanity within a safe and just operating space¹. Research and innovation policies are key to such transformations insofar as effectiveness and the legitimacy of policies are linked to the quality of the knowledge they use. Research and innovation have the power to drive knowledge production and its application to well-defined pathways with the narratives, priorities, rules, organizational patterns and financial resources that related policies provide. Towards this end, we argue that one key modality of engagement remains the science–policy interface. However, recent calls for new science–policy interfaces for food systems, as well as the integration of ‘stakeholders’ across the policy cycle, have raised important questions and concerns about the role of science and scientists, while illuminating some of the politics and power involved^{2,3}.

To respond to the challenges ahead, there is need for deeper reflection not only on the challenges that transformations demand but also on principles to guide relations between society, science, knowledge, policy and politics. On the basis of our experiences as experts in a science–policy process that feeds research and advice related to agriculture, food, biodiversity and the wider bioeconomy to the European Commission, we reflect here on the processes of translating research to policy. In so doing, we aim to move the conversation away from specific mechanisms and technocratic solutions⁴, by calling for a new democratic directionality; laying out a set of related principles, applicable across different scales and contexts; and, placing knowledge–policy–action interfaces at the heart of food system transformations.

The 5th SCAR Foresight Exercise Expert Group

In 2019, we started the 5th Foresight exercise of the European Commission’s Standing Committee on Agricultural Research (SCAR), a ‘think tank’ composed by European Union (EU) member states and associated countries that provides advice on EU research policies and promotes coordination between the research and innovation policies of member states. We were tasked with exploring research needs related to triggering and enabling transitions towards “a safe and just food system”¹, with the aim of providing a frame of reference for national research strategies, EU-level priorities and joint programming initiatives.

The United Nations Agenda 2030, with the Sustainable Development Goals (SDGs), and the Paris Agreement provided the normative framework for our work. Our qualitative foresight exercise started with a discussion of the targets and objectives of these important commitments, with a view towards making them more operational to agriculture and food at the European level. These served as a starting point for stakeholder discussions, as described below. Our final report¹ was published in December 2020.

Beyond the COVID-19 crisis, the political context within which we operated proved to be highly dynamic, with the European Parliament voting to support a European Green Deal and Europe’s Farm to Fork (F2F) and Biodiversity strategies; and negotiations on the reform of the Common Agricultural Policy with European Parliament discussion for matters such as the ‘green financial taxonomy’, the threshold indicators for banning pesticides harmful to pollinators, and the classification of forestry products for energy production as ‘renewable

energies’⁵. In this way, our process reflects the evolving dynamics of transformative research and innovation policy, providing insights into the roles of scientific knowledge production in the process of transformation⁶.

Food systems research and innovation for transformative policy and action

Transformation, as the term is used here, implies a change of mental modes, social practices and even the development of new values⁶. It is characterized by the destabilization of existing behaviours, social practices, infrastructures, technological systems, and business and administration models, while rebuilding new ones. Transformative change implies dismissing obsolete knowledge and ceasing obsolete action while developing new paradigms, assumptions, models, methods and practices. It also links knowledge and action, rejecting a separation between knowledge generation and its application⁷. Commitment to transformational change requires researchers to ‘engage seriously with the critical question of how to contribute to making transformative change happen’⁸. In turn, transformative policies demand new relational patterns between society, science, action and policy (including policy levels and sectors), based on shared goals, mutual learning, co-construction and openness. In short, transformations demand knowledge–policy–action interfaces operating at multiple scales⁹.

As food is deeply embedded in culture and daily routines, even when there is political will, transformation of food systems is likely to be resisted and thus slow, contested and delayed. Different problem framing based on alternative paradigms and mechanisms of change, the severity of the outcomes, the distribution of their costs

and benefits, trade-offs, entrenched political economies, and fear of perverse system dynamics can generate legitimate (but also illegitimate) resistance to change, even more so when knowledge is uncertain, good examples are lacking and multiple interests are at stake.

Widespread adoption of transformative narratives can challenge business-as-usual narratives¹. For several decades, food system challenges have been framed by a 'feed the world' narrative, centred on the long-term gap between supply and demand — the response to which would be productivity growth. Alternative narratives have been advanced in important institutional settings, from the High Level Panel of Experts (HLPE) of the Committee on World Food Security (CFS), the European Commission's F2F Strategy, the Global Panel on Agriculture and Food Systems for Nutrition, and by the EAT–Lancet Commission^{2,9}. They give priority to quality over quantity, acknowledge the role of economic, physical and legal access to food as determinant of food insecurity, consider the importance of nutrition patterns, and place attention on the link between food system activities and the pressure on natural resources. They recognize that climate, environment, livelihood and nutritional security can no longer be pitted against food security. However, existing science policy interfaces either struggle to integrate food (for example, the Intergovernmental Panel on Climate Change and the Intergovernmental Science–Policy Platform on Biodiversity and Ecosystem Services), struggle with legitimacy (the United Nations Food Systems Summit) or lack authority to effect change (CFS and its HLPE). To address systemic food system challenges, multiple science–policy interfaces (rather than a single), coupled with political capacity and will, are needed to ensure legitimacy and address the urgency that food system change requires^{2,9}.

Building and affirming transformative narratives demands strong commitment, time and meaningful deliberation between a wide range of actors¹. In the SCAR foresight exercise, the main interlocutors were research officers of member states, representatives of businesses and civil society, and researchers — all have a stake in research and innovation policies. Our experience has reinforced how conversations with stakeholders can be very influential for developing a new research agenda. In our process, three interconnected pathways were identified in a 'safe and just operating space' narrative: sustainable diets, full circularity of food systems and diversity for resilience. Stakeholders were then encouraged to

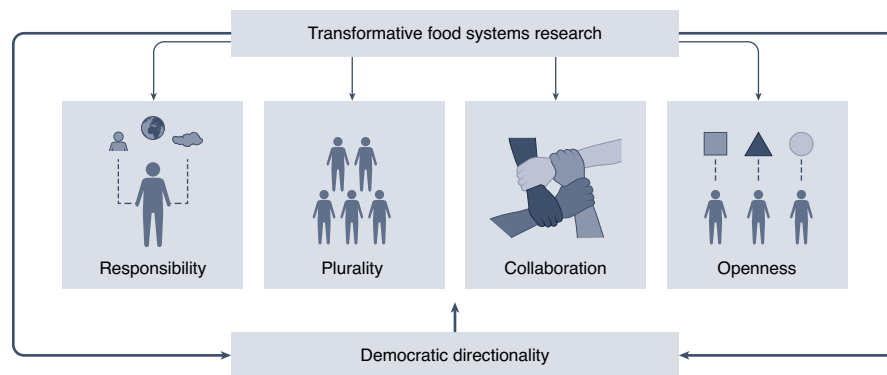


Fig. 1 | Interconnected principles for research for transformative food system policy. Transformations across food systems demand comprehensive democratic directionality, supported by research that is responsible, pluralistic, collaborative and open.

develop research questions and identify innovative solutions consistent with them.

Through this process, we found that reaching consensus on the principles of a safe and just operating space was a relatively easy task. Focusing on possible futures helps participants to detach from existing thinking routines, fosters imagination, brings in cross-fertilization of ideas and invites them to identify obstacles to change. We found that this also supports a move away from techno-centric research priorities, towards a greater awareness of the role of social processes on demand-driven pathways for change. Encouraging participants to make their values and interests explicit further encourages communication between disciplines and with society, moving away from the constraints that sectors and disciplines often impose. We observed that generic objectives such as 'reducing the level of chemical inputs in agriculture' were not sufficient to give research policies a clear future direction. On the contrary, giving more precise targets left less space for interpretation of the goals, while also acting as a catalyst for collective commitments. In turn, we put forward a set of quantitative targets linked to our normative framework, broken down at the European level. We invited stakeholders to discuss how research and innovation could be mobilized to achieve them. This process illustrated the importance of stakeholders coming together to define and link to diverse context-specific transformation pathways towards safe and just food systems. It also reinforced the key contribution of science in providing guardrails for these diverse pathways.

After we reached consensus on the goals and targets, we faced a wide range of divergent interpretations on the implications. In practice, there is often a confounding idea that alignment on goals implies a uniform trajectory, which is not

the case. Policy frameworks, and indeed the political economy of food, consistently fail to recognize multiple pathways within the safe and just operating space^{1,10}. By establishing multi-stakeholder conversations, and by iteratively translating knowledge, experiences and values between actors, we argue that a higher-level research–policy–action synthesis, based on shared benefits and compensations of costs, can be achieved and that these are compatible with shared goals (that is, the SDGs), while allowing for a diversity of approaches.

Principles for research for transformative food system policy

Research for transformation assumes that science and innovation can be oriented towards achieving shared goals. There are also risks when research is subordinated to policy and mainly serves direction-oriented policy goals. We argue that directionality should emerge from deliberation and debate, with procedures that ensure space for dissenting positions, and that a diversity of directions is coherent with negotiated, and largely shared, goals.

Towards this end, and based on our experiences, we put forward four principles for transformative research and innovation for food system policy (Fig. 1). These principles are aligned with more specific efforts to articulate a research and action agenda centred on a collective task of revitalizing biodiversity and ecosystem services to transform towards healthy, circular, safe and just food systems^{7,11}. The principles rely on a comprehensive democratic directionality framework to identify shared goals and also to avoid pathways of unsustainable directionality¹².

The first principle is responsibility¹³. Research for transformation presupposes an ethical commitment of researchers⁶ and funders to shared goals, and to the intended

and unintended consequences of research application. Responsibility links knowledge, or lack of it, to its consequences. It involves making visible assumptions behind research questions; ensuring deep understanding of the context(s) where research is undertaken and innovations are implemented; capacity to anticipate unintended consequences across goals and objectives; and willingness to change direction in light of new information about (unwanted) impacts. Responsibility also means recognizing limits of claims to (scientific) objectivity and neutrality.

Will responsibility limit the independence of researchers? What about curiosity-driven research? This may be an open issue, as the freedom of individuals can be limited by overarching social norms. Scientists have a responsibility to clarify the possible impacts of plausible food system transformation pathways ('identifying the guardrails'), while also being as concrete as they can about trade-offs and systemic risks. Moreover, scientists are needed to contribute to the co-development of new framings for transformative policy. Thus, we argue that scientists have the responsibility to support the evidence base for evaluating transformative pathways and their impacts. The responsibility of stakeholders is to define plausible narratives of change, which is all too often taken on by the research community without adequate consultation or engagement. We contend that across science-policy-action interfaces, researchers are well positioned — due in part to methodologies, theories and credibility — to facilitate open, transparent and democratic processes of agenda setting, in which affected stakeholders have a voice, and independence and freedom of expression are ensured. We also note this work requires training, support, sensitivity, reflexivity and the capacity to seek out understanding.

This brings us to the second principle: plurality. Plurality recognizes that food system transformations include multiple and often competing visions and accepts the viability of a plurality of these visions. Pluralization comes with the recognition that there are no one-size fits all solutions, neither in the way future priorities are identified, nor in the composition of stakeholders, and that transformations will take on distinct characteristics depending on the time, local environment, territory and other contexts. Exposure to diversity can be a powerful driver of change, but directionality in plurality is needed. To achieve plurality, there is an urgent need to address uneven relations of power, by identifying and giving voice to people marginalized by food systems, and making

space for disagreement and controversy¹². This diversity is hard to achieve and can slow, or even stall, processes, but it has value when it is aligned to overarching objectives. However, in line with our directionality framework, science-policy-action interfaces have a responsibility to provide clear assessments of the different positions (including those of the most-affected stakeholders), and their potential impacts.

The third principle is collaboration — a key component to ensuring effective democratic directionality for food system transformations and the application of principles of responsibility and plurality. Such collaboration, in turn, requires institutional support⁷. Transdisciplinary research designs need the allocation of adequate time and resources for interaction, communication and knowledge management, also to ensure the application of principles of responsibility and plurality. Overcoming obstacles that stem from different visions, languages and working styles requires specific strategies, tools and skills that should be fostered, funded, recognized and rewarded.

Fourth, transformation requires openness¹⁴. Openness implies freedom of access to research outputs, data and tools that can multiply collaborative opportunities between researchers and citizens. It distributes resources, contributing to a level playing field. It also means comprehensibility and translation efforts. Researchers should be able to use language that, without simplifying the complexity, allows scientists from other disciplines and practitioners to engage and understand. Communication to a broader public should be a routine component of the research process, based on awareness of the impact of communication on public opinion. For example, our foresight report was brought together by a journalist, skilled in writing for research impact. Openness should also prevent powerful economic interests from skewing priorities in research funding programmes towards the goals of incumbents and away from new entrants, thereby limiting transformational potential.

Towards a democratic directionality for food systems

The ongoing task of transforming food systems will take many forms and will face several hurdles. The four principles for research and innovation for transformative food system policy and action outlined above are not meant to be prescriptive. They are put forward with a view towards sharing our learning and to contribute to ongoing discussions around the science-policy interfaces for food systems. They are


intended as an initial resource that offers a renewed vision of 'the what' and 'the how' of future just and sustainable transdisciplinary research and action.

Research is only one of the components of transformative change. Transformations will depend on the commitment of social and political systems, as well as on external conditions. For this, science-policy-action interfaces are needed, wherein knowledges, values and interests interact to assess areas of certainty and of uncertainty, of consent and dissent, and to develop knowledge around policy options and their implications². Investments in strategic research agendas, strategic management, organized links between research policy and other policy areas, coordination of research efforts, and governance tools that multiply the impact of research are also needed¹⁵.

The experiences of our foresight exercise have reinforced the importance and the peculiarity of policy-related research and innovation with a long-term view. This is aligned with the problem-solving approach embodied in the mission-oriented research and innovation policies advanced by the European Commission.

We found that a deep understanding of policy regimes is a precondition to support policy implementation strategies that can address opponents and inertia. Working in transdisciplinary teams that include policymakers can facilitate this. In our own work¹, we have articulated our vision for how research and innovation can support and affect policy at different stages of the policy cycle, recognizing that knowledge serves different purposes at different levels and times. For example, new scientific paradigms can help to redefine policy problems and policy goals: framing obesity or new diets as outcomes of the 'food environment' instead of individual responsibility can bring forward radically different policy solutions. Updated evidence on the links between trade and environmental outcomes can support new approaches to trade policy. Refined methods of analysis can contribute to monitoring and evaluation, which in turn can feed research.

Finally, we recognize that there are fields where science, policy and politics are inseparable and have indeed always depended on each other. For science, a transition from linear processes of knowledge to action would benefit from greater integration and iteration: knowledge and action. We further recognize that food system transformations require more joined-up, inclusive, just and radical approaches. Reflecting on our foresight process, and the resulting principles for research and innovation for transformative

food system policy, what we find most promising is the potential for research to increase our capacity to deal with complex problems to ensure just and sustainable food systems for all. 

Jessica Duncan ¹✉, Fabrice DeClerck^{2,3}, András Báldi⁴, Sébastien Treyer⁵, Jessica Aschemann-Witzel ⁶, Kerstin Cuhls^{7,8}, Lilia Ahrné ⁹, Stefano Bisoffi ¹⁰, Stefano Grandi ^{11,12}, Liutauras Guobys¹³, Johanna Kohl¹⁴, Henning Otte Hansen¹⁵, Richard L. Hudson¹⁶, Hans-Jörg Lutzeyer¹³, Vivi Hunnicke Nielsen^{12,17}, Begoña Ruiz ¹⁸, Elke Saggau¹², Egidio Valceschini¹², Grzegorz Siebielec¹⁹ and Gianluca Brunori ²⁰

¹Rural Sociology Group, Wageningen University, Wageningen, the Netherlands. ²Alliance of Bioversity & CIAT, Montpellier, France. ³EAT, Oslo, Norway. ⁴Centre for Ecological Research, Institute of Ecology and Botany, Vácrátót, Hungary. ⁵IDDRI, Paris, France. ⁶Department of Management, MAPP Center, Aarhus University, Aarhus, Denmark. ⁷Fraunhofer Institute for Systems and Innovation Research, Karlsruhe, Germany. ⁸University of Heidelberg, Heidelberg, Germany. ⁹Department of Food Science, University of Copenhagen, Copenhagen, Denmark. ¹⁰Independent Expert, Rome, Italy. ¹¹Ministry of Agricultural, Food and Forestry Policies, Rome, Italy. ¹²SCAR Foresight Working Group, Brussels, Belgium.

¹³EU Commission, Brussels, Belgium. ¹⁴Natural Resources Institute, Helsinki, Finland. ¹⁵Department of Food and Resource Economics, University of Copenhagen, Copenhagen, Denmark. ¹⁶Science Business, Brussels, Belgium. ¹⁷Danish Centre for Food and Agriculture, Aarhus University, Foulum, Denmark. ¹⁸AINIA, Paterna, Spain. ¹⁹Department of Soil Science Erosion and Land Protection, Institute of Soil Science and Plant Cultivation State Research Institute, Pulawy, Poland. ²⁰Department of Agriculture, Food and Environment, University of Pisa, Pisa, Italy.

✉e-mail: jessica.duncan@wur.nl

Published online: 14 March 2022
<https://doi.org/10.1038/s43016-022-00479-x>

References

1. Report of the 5th SCAR Foresight Exercise Expert Group: Natural Resources and Food Systems: Transitions Towards a 'Safe and Just' Operating Space (European Commission, 2020).
2. Turnhout, E. et al. *Science* **373**, 1093–1095 (2021).
3. Singh, B. K. et al. *Nat. Food* **2**, 838–842 (2021).
4. Sterman, J. D. *Science* **322**, 532–533 (2008).
5. Schot, J. & Steinmueller, W. E. *Res. Policy* **47**, 1554–1567 (2018).
6. McAlpine, C. A. et al. *Ecol. Soc.* **20**, art56 (2015).
7. Caniglia, G. et al. *Nat. Sustain.* **4**, 93–100 (2021).
8. Pereira, L. et al. *Sustain. Sci.* **15**, 161–178 (2020).
9. Hainzelin, E. et al. (eds) *Food Systems Summit Brief Prepared by Research Partners of the Scientific Group for the Food Systems Summit* (IFPRI, CIRAD, UNFSS, 2021).
10. Gasselin P. et al. *Coexistence et Confrontation des Modèles Agricoles et Alimentaires: Un Nouveau Paradigme du Développement Territorial?* (Éditions Quae, 2021).
11. Wyborn, C. et al. *Conserv. Biol.* **35**, 1086–1097 (2021).
12. Duncan, J. & Claeys, P. *Food Secur.* **10**, 1411–1424 (2018).

13. Owen, R., Macnaghten, P. & Stilgoe, J. *Sci. Public Policy* **39**, 751–760 (2012).
14. Fecher, B. & Friesike, S. in *Opening Science* (eds Bartling, S. & Friesike, S.) 17–47 (Springer International Publishing, 2014).
15. Schot, J. & Kanger, L. *Res. Policy* **47**, 1045–1059 (2018).

Acknowledgements

We acknowledge the work and report prepared by the SCAR Expert Group (EG) on the 5th Foresight exercise 'Natural resources and food systems: Transitions towards a 'safe and just' operating space' (https://ec.europa.eu/info/publications/resilience-and-transformation_en). The EG is an independent panel constituted by the European Commission and the Standing Committee for Agricultural Research. The views expressed in its report represent those of the EG members, and not the European Commission. The EG does not promote any political agenda or researcher self-interest. This manuscript is an independent exercise of the group, which builds on the experiences working as an expert group.

Author contributions

J.D. and G.B. led the idea generation, writing and editing process, with active support from F.D., A.B. and S.T. All other authors played a crucial role in idea generation and contributed to writing and editing.

Competing interests

Authors were associated with the EU SCAR 5th Foresight Team. The team acts independently and in the public interest.

Additional information

Peer review information *Nature Food* thanks Patrick Caron and Amanda Harding for their contribution to the peer review of this work.