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Further concepts and approaches for enhancing food system resilience

The cornerstones to enhance food system resilience can be considered as three fundamental concepts, the '3Rs'[1]: robustness, based on the capacity of the food system actors to adapt their activities to resist disruptions to desired food system outcomes; recovery, based on the ability of food system actors to adapt their activities so as to be able to return to pre-existing food system outcomes following disruption; and reorientation, based on the ability of food system actors to adapt their activities based on accepting alternative food system outcomes as a strategy before or after disruption. The 3Rs are not mutually exclusive or hierarchical. Each is dynamic, complex and subject to unpredictable uncertainties, requiring innovations in institutions, governance mechanisms and other systems of accountability, as well as changes in culture, individual behaviour and technology. An appropriate balance is needed across the 3Rs, rather than advocating for singular solutions. While resilience strategies based on robustness and recovery may be more appropriate in the short term but not sustainable, reorientation is arguably a longer-term approach, suggesting practitioners need to situate shorter-term 'status quo' efforts within a longer-term, reorientated vision.

The approach taken will depend on the answers to a set of framing questions that have shaped resilience practice over the past two decades[2,3]: resilience of what, to what, from whose perspective and over what time frame? Yet, these four questions lead to the need for a fifth one: resilience for what purpose? In relation to stakeholder interests, this fifth question emphasizes the normative nature of resilient food systems and makes it explicit that different stakeholders have different objectives, motives and worldviews. This is particularly important for considering the preferred mix of food system outcomes coupled with acceptable trade-offs between outcomes that will align with reorientation. These five questions need to be answered collaboratively and iteratively among food system stakeholders to arrive at a shared understanding and agreed framing. However, links between the 3R concepts and practice are not sufficiently well developed and strategies are needed to improve these links. Key components to consider in light of these resilience concepts include agency (of actors in responding to shocks), buffering (resources to fall back on in times of stress), connectivity (and communication between actors and market segments) and diversity (across scales and places in the interacting systems)[4]. Building resilience in practice has hence been associated with the capacity and agency of food system actors to develop connections across multiple levels on spatial, temporal and jurisdictional scales, and to respond to disruptions. It is also necessary to acknowledge the wider context with which specific food systems operate, for example, historical and cultural determinants, the integration of farming with other economic domains (for example, tourism[5]), local geographies and natural resources, as well as relevant policies and regulations at local, national and international levels. This allows for strengthening food sovereignty at bioregional levels[6].

General approaches for implementing resilience-enhancing strategies include improving the flow of information between food system actors built on diverse stakeholder engagement in the identification of opportunities and formulation of interventions; supporting greater capacity and agency among actors and institutions; and building interconnections and buffers (that is, redundancy) in food systems. As an example, many such actions took place in Chile due to intense social unrest, which led to increased recovery potential in response to the COVID-19 pandemic[7]. Further approaches include a greater diversity of supply chains[8], increasing individual preparedness by storing food for use in times of food system disruption[9] (although this would potentially accentuate inequity), and using digital technological investment and development to help build stronger links between food system nodes[10]. Adapting consumption patterns towards healthier diets from sustainable food systems also provides a powerful approach to enhancing the resilience of food system outcomes related to health and environment; this is because food systems based on such diets are often less demanding on complex supply chains, which can be more vulnerable to shocks and stresses. As such, diets can also draw less on the natural resource base, a reorientation that also contributes to environmental sustainability. Acting indirectly on consumers' preferences and consumption habits is of key importance to such a dietary transition[11].

Research on transforming food system outcomes has underlined that a coherent mix of policies is required to support changes towards sustainable farming and promote innovation in food processing, distribution and material recycling, as well as assist consumers and citizens in practicing healthier diets from more sustainable food systems[12]. This requires designing and implementing coordinated interventions that combine policy and regulatory reforms to target specific food system activities for desired outcomes, and reassessing policies over time[13].

In order to realize synergies across multiple, coordinated interventions, while avoiding unintended trade-offs, resilience is best nurtured through policy options developed from a systemic framework. To this end, new models for data sharing are needed that protect private interests and contribute to the public good. Such a breakthrough depends on trust and respect across multiple stakeholders and more effective collaboration between the private and public sectors[14]. This, in turn, will require negotiation and be based on communication, transparency, mutual accountability, mediation and deliberation[15].

Given that socioeconomic and environmental drivers are expected to remain volatile, flexible pathways to enhance food system resilience will be important and will have to accept uncertainties over time. Designing these will require engagement across stakeholders built on strategic investment of effort, and attention, time and money to build the 'social capital' (including rapport, trust) needed to identify, prioritize and create measures to enhance resilience before the next shock(s). In the longer term, improved food governance that fosters integration with

economic domains across multiple levels on spatial and temporal scales, and coherence of policy and regulations across the system, can support a reorientation aim.

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