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# Foundations of a learning system for food system transformation under uncertainty

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## Abstract

Despite a broad consensus on the necessity of fundamental change, endeavors to transform food systems appear to have reached an impasse. Greater engagement with the uncertainty of food systems could open up new ways of triggering transformation directed towards achieving more sustainable and inclusive outcomes. As a way of reorienting current food system change efforts to better embrace uncertainty, we propose a framework for a transformative learning system that serves two aims. First, the framework highlights the importance of locally led action, experimentation, and learning, providing a way of focusing on the core capacities and skills needed to act in the face of uncertainty. Second, it outlines the different types of learning functions that need to operate at different scales of food systems to trigger disruptive, coordinated, and more democratic change processes. The operationalization of this framework necessitates shifts in roles and ways of working across the landscape of food system interventions. The discussion will address the who and how of this potential change, as well as its subsequent impact on the operational modalities of individuals, the process of change itself, and the structures and institutions involved in the process. We argue that embracing uncertainty and the focus on learning has the potential to facilitate a more agile and locally relevant change process. This would allow actors to learn from decentrally pursued food systems reforms, leading to the emergence of diverse pathways that complement on-going efforts and potentially accelerate transformation efforts.

**Keywords** Complex systems · Sustainability · Equity · Localization · Tropentag 2023

## 1 Introduction

There is a growing recognition of the need for transformations in global food systems (Fanzo et al., 2020; IPES-Food and ETC Group, 2021). Currently, these systems are failing to achieve the desired societal outcomes (Rockström et al., 2023; Ruggeri Laderchi et al., 2024) and are causing significant negative impacts on people, climate, and the environment (Béné, 2022; Fanzo et al., 2021; Thornton, 2023). The lack of capacity to respond effectively to uncertainties, such as disruptions and unexpected external challenges, further exacerbates these effects. While the challenges faced by food systems manifest differently across different regions, the challenges are universal and the urgency to address them is growing (Webb et al., 2020). Despite the global consensus on the need for change, recent years have seen insufficient progress in overhauling food systems, resulting in slowed progress or even backsliding in meeting food and nutrition

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security goals or tackling environmental externalities (FAO et al., 2023). This situation prompts a critical question: why has there been so little progress despite widespread agreement on the need for transformation?

The theories of systems transformation have been critiqued for several reasons. First, these theories have been criticized for their inability to provide adequate guidance on the implementation of food systems transformation, as well as for their lack of consensus on the types of pathways to catalyze such transformation (Feola, 2015; Hubeau et al., 2017; Leach et al., 2020; Scoones et al., 2020). Second, the intricate connections and feedback loops between local action and broader national, regional, and global settings are often overlooked (Douthwaite & Hoffecker, 2017; Mayne et al., 2017; Woltering and Boa-Alvarado 2021; Mausch et al., 2020; Conti et al., 2024; Hebinck et al., 2021; Fanzo et al., 2024). This detaches local action from the global transformation agenda, for which they could otherwise contribute valuable insights. A major challenge is the overwhelming scale of the task implied by transformation (Stirling, 2014), which can make practical action seem daunting at the local level. As a result, local initiatives may prioritize smaller, more manageable, and isolatable problems within their sphere of control. Similarly promising efforts at the local level can often appear insignificant and invisible in the broader context of food systems, which are inherently susceptible to systemic dynamics arising from uncertainty, prevailing patterns of power, and the dynamics of incumbency (Conti et al., 2021; Thompson & Scoones, 2009). Yet, wicked problems, such as those confronting food systems, that require transformative change, do not lend themselves to linear and technologically focused problem-solving methods (Newman & Head, 2017; Wanzenböck et al., 2020).

In this paper, we argue that to effect the needed change in our food systems, actors involved in transformation should adopt a more adaptive approach that embraces uncertainty in how change is governed and supported from the global to the local level. To help achieve this, we propose a framework for a transformative learning system as a way of re-orienting development practice toward a more locally centered and experimental modality where local learning is explicitly connected into broader learning and adaptation processes. The rationale for proposing such a framework and approach is rooted in a renewed interest in development thinking on uncertainty and system complexity. We outline the conceptual foundations and the debates about how this may substantially reframe current development efforts to affect the food systems change that is needed. For example, Scoones (2024, p. 6) argues that "taking uncertainty seriously means rethinking our world quite fundamentally – from top to bottom, from politics and policy to individual practice".

More specifically, we argue that a more pragmatic approach to navigating uncertainty is to embrace ‘muddling through’<sup>1</sup> as opposed to the prevailing assumption that we can engineer pathways to a better future. This shift in focus entails that localized action assumes a central role in efforts for food systems transformation (Sengers et al., 2019), while ensuring that changes at the higher levels of the food system are effectively implemented. A focus on localized action has the potential to provide valuable insights that may have been previously overlooked (Moallemi et al., 2019, 2020) or intentionally sidelined due to vested interests or power asymmetries. The transformative learning system framework that we propose offers a way of conceptualizing how different capacities for learning and adaptation can be utilized and developed in an integrated way. We suggest that the intersection of locally-led action and a learning system has the potential to trigger broader scale system transformation. This intersection is where new insights, forms of knowledge, and system dynamics will emerge.

This paper has two main goals: first, to highlight the need for a shift in thinking and practice to embrace uncertainty in food systems; and second, to propose a framework for a new transformative learning system to support this shift. It has been recognised that change is unpredictable and that interactions across scales enable or inhibit change which thereby requires flexible thinking and methods from systems science (Thompson & Scoones, 2009). The proposed framework builds on existing concepts and tools but does not aim to provide a detailed guide or exhaustively explore the full range of tools and learning functions, as these must be adapted to specific contexts and addressed on a case-by-case basis. Instead, the emphasis is placed on the manner in which diverse actors within food systems—such as development agencies, local communities, or individuals—can engage and enhance each other’s actions to drive more effective transformation. We acknowledge that supporting people and organizations to ‘muddle through’ by strengthening learning and evaluation capacities is in itself not a new idea. This approach is fundamental to the established field of complex systems practice (e.g. Wanzenböck et al., 2020; EEA, 2024; Hertz et al., 2021; Singh et al., 2023; Moallemi et al., 2024a, b; Patton, 2023; Ofir and Rugg, 2021). Furthermore, we acknowledge that strengthening learning and evaluation capabilities in isolation is insufficient to transform food systems. Instead, the objective of this paper is to highlight an alternative and complementary approach that actors ranging from the local to system scale can adopt to meaningfully engage in the food systems transformation agenda.

<sup>1</sup> The term ‘muddling through’ draws from Lindblom (1959) and Hirschman and Lindblom (1971), who understand muddling through as incremental learning from changes in uncertain environments. Here, we think about muddling through as responding to and adapting to uncertainties in the implementation of interventions.

To provide the conceptual underpinning of the proposed transformative learning system framework, we begin by giving an overview of foundational concepts addressing uncertainty and complexity and how they relate to food systems transformation. Our discussion outlines the implications of a more uncertainty-aware approach and how roles within the transformation process will need to change, as well as where entry points for this shift are already emerging. Taking current development practice as a starting point, we focus on four enabling entry points to support the approach: (i) A shift in mindsets; (ii) New project designs and theories of change; (iii) Evaluation methods; and (iv) Funding options for supporting new roles and learning functions. We conclude with a reflection on how the proposed transformative learning system relates to the broader changes that are necessary to support food systems transformation.

## 2 Uncertainty, complexity and transformative change

### 2.1 Renewed interest in uncertainty and complexity

The topic of uncertainty is receiving renewed attention in research tackling, among other problems, global food systems challenges (e.g. DeMartino et al., 2024; Scoones, 2024; Scoones & Stirling, 2020). Unlike risk, where different known outcomes have known probabilities of occurrence, uncertainty could manifest in different ways, falling sometimes under the categories of Knightian, deep, or severe uncertainty which cannot be characterised probabilistically and may not be assigned a likelihood of occurrence (Ben-Haim, 2006; Knight, 1921; Lempert et al., 2003). In systems science, uncertainty is an inherent property of a complex system (see for example Checkland, 1999; Checkland & Poulter, 2010). In this context, complexity refers to systems that consist of an ensemble of numerous elements that interact in a disordered manner, making it difficult to determine and predict cause-and-effect relationships. Emergent properties are a result of the totality of the interactions of components parts. Scoones (2024) argues that examples such as climate change, the Covid-19 pandemic and the global financial crisis as well as a range of persistent development challenges, including sustainability and equity challenges of current food systems, display the property of deep uncertainty and are rarely amenable to simple solutions.

Scoones and Stirling (2020) have noted that the recognition of the significance of uncertainty is not a novel concept. Since the 1960s, development economists have advocated for embracing uncertainty and, more broadly, system complexity (DeMartino et al., 2024; Hirschman & Lindblom, 1971). However, DeMartino et al. (2024) argue that ideas

around uncertainty have been marginalized in development economics. Consequently, they advocate for revitalizing heterodox approaches that explicitly account for uncertainty. This paper builds from DeMartino et al. (2024) to argue that, like many societal challenges, the transformation of food systems needs to be understood as a complex systems problem and embrace uncertainty.

Uncertainty in food systems means that the future evolution, including the nature of shocks, drivers, and outcomes, is unknown or unknowable. In an increasingly turbulent global context, it is argued that we should replace the current control oriented, risk-based calculative approach, where we assume we know about and can manage the future, with a more flexible, practices-based approach that is responsive to uncertain conditions (Scoones, 2024; Stirling, 2010). Scoones (2024) goes on to propose that if uncertainty is to be navigated effectively, new approaches are needed that are more open, inclusive and collective, some reclaimed and adopted from previous times and different cultures. This echoes earlier calls to give greater attention to complexity and uncertainty in international development practice, prompted by a growing recognition that development projects are always embedded in and influenced by the unpredictable dynamics of the broader systems in which they are embedded (Ramalingam et al., 2008; Jones et al., 2015; Glover et al. 2021; Conti, et al., 2024).

### 2.2 Food systems transformation as an arena of uncertainty and complexity

Calls to recognize and engage with uncertainty and complexity in global development are mirrored in current discourse on food systems transformation (Conti et al., 2024; Foran et al., 2014; Hall and Clark, 2010; Kampelmann et al., 2018; Moallemi et al., 2024a, b). A complex systems approach enables an understanding of the interconnected web of actors, drivers, and interactions at different physical and temporal scales in the production, processing, distribution, consumption, and disposal of foods, generating non-linear and uncertain (and hence unpredictable) pathways of food systems transformations (IPES-Food, 2015). Such an approach requires an awareness that solving systemic problems, such as food insecurity, cannot be achieved by simply analyzing the component parts of the systems (Hambloch et al., 2023). Nonlinear cause-effects are inherent properties of the system itself (Conti et al., 2021; Hambloch et al., 2023).

When attempting to improve food systems outcomes, the complexity and uncertainty of food systems can manifest in various and often contradictory ways. Clear interactions exist between different global targets, such as the SDGs, including synergies, trade-offs, and feedback loops (Herrero et al., 2021). For example, achieving success in one area,

such as increasing food availability through improved farm productivity, may unintentionally result in the exclusion of smallholder producers due to falling food prices, incomes, and profitability (Mausch et al., 2020). Similarly, relying solely on smallholder farmers to address food production and income shortfalls is unlikely to be effective unless systemic issues are also addressed (Gassner et al., 2019). Many people in the Global South, particularly those in fragile environments, frequently confront uncertainties as a fundamental aspect of their daily lives, and have strategies to address those uncertainties (see e.g. DeMartino et al. 2024). For example, pastoralists in Kenya adopt diverse practices in response to droughts, including sharing livestock, dividing herds, and negotiating land access (Mohamed & Scoones, 2023). Uncertainty is thus part of daily lives and factoring in uncertainty is core part of these farmers' decision-making process (Bacon et al., 2017; Molla et al., 2020).

The complexity and uncertainty of food systems are often exacerbated by power dynamics and the political influence of dominant actors. Clapp (2021) and Bene (2022) argue that political economy factors may well derail the great food systems transformation agenda. Power and politics are key sources of inertia and path dependency in food systems development and a key lock-in preventing the transformation of these systems to more environmentally sustainable and inclusive pathways (Conti et al., 2021). This can lead to unintended consequences, such as perpetuating poverty and malnutrition, despite well-intentioned development efforts (Leach et al., 2020, Bene, 2022). For instance, efforts to enhance diets and address nutritional security may face obstacles due to the interests and incentives of influential actors in food value chains who are seeking new sources of revenue rather than nutritional outcomes (Ansari et al., 2018; Hambloch et al., 2023). In addition, it is important to note that powerful actors and their interests can greatly influence the way problems and solutions are presented. Furthermore, local priorities may not always align with international priorities and more negotiation room needs to be incorporated. Harris (2023) illustrates this in relation to the nutrition agenda in Zambia, outlining how the political economy plays out in this debate. In situations where the outcomes and pathways for transforming food systems are highly uncertain, incumbent power and politics may restrict the range of possible pathways and in doing so reduce the preparedness for shocks (Scoones, 2024; Scoones & Stirling, 2020; Stirling, 2008).

The implications for transformation and development practice that seek to contribute to this, are that the approaches to and destinations of change pathways “remain deeply uncertain” (Scoones & Stirling, 2020). Yet, uncertainty is not (only) something to fear; it can be a source of opportunities (Scoones, 2024). When false narratives on

control of complex problems are overcome, new opportunities to collectively imagine different futures can emerge. These opportunities emerge from a more diverse array of knowledge sources and have the potential to catalyze innovation, disrupt established pathways, and foster unconventional partnerships (Scoones, 2024; Thompson et al., 2007). However, the current trend of expanding the range of indicators used in development practice is counter to this thinking, and suggests an attempt to convert uncertainties into quantifiable risks, disregarding the actual experiences of uncertainty and the current mechanisms that deal with its consequences (DeMartino et al., 2024; Scoones, 1994). For instance, early warning systems for famines in the drylands of Eastern Africa are intrinsically fraught with uncertainties related to weather forecasting and conflicts, which increases the likelihood of underestimating the impacts on food insecurity (Krishnamurthy et al., 2020).

Since the emerging effects of system uncertainties are experienced in highly context specific ways, food systems transformation will necessarily need to be a locally rooted process (Sayer et al., 2008). This will require local communities acquiring tacit knowledge which in itself is a type of knowledge that is not gained in a plannable approach but reveals itself through practice and the acquisition is therefore itself deeply uncertain in nature (Scoones, 2024). For some time, it has been argued that dealing with uncertainty requires experimentation, learning and adaptation in a particular setting to create new capacity and knowledge to act (Watts et al., 2003; Ramalingam et al., 2008; Bossyns and Verle, 2016; Cronkleton et al., 2022, Oliver et al., 2021). This requires a fundamentally different approach where locally-centered action and learning take center stage and where supporting the capacity to act locally cognisant of broader system dynamics is a core strategy.

### 3 A locally centered, coordinated learning system for transformation

#### 3.1 Learning centered on locally led action

In this paper, we argue for a learning focused approach that embraces uncertainties in food systems transformation (similar to EEA, 2024; Oliver et al., 2021). To operationalize this novel approach to development practice and policy, it is imperative to (re)assemble new and existing tools, frameworks, and practices around this new task. To guide investment and intervention here we suggest a framework that builds on ideas of Oliver et al. (2021) as a way of engaging with the need to facilitate local actions and learning, and connect action and learning across scales within systems during the transformation process. We believe that

the intersection of locally-led action and a learning system has the power to trigger broader scale system transformation that complement and accelerate on-going change processes.

The purpose of the framework is twofold. Firstly, it conceptualizes the organization of an integrated set of learning functions that are centred on locally-led action. At the same time it recognises that learning and adaptation also need to take place at higher systems scales to truly engage with the uncertainties of the food systems transformation process. Secondly, and perhaps more importantly, it serves as a framework for guiding investment in food systems transformation toward the capabilities, institutional arrangements and sources of change needed to enable these learning functions (see Oliver et al., 2021; EEA, 2024). Accordingly, this framework is principally oriented towards rethinking development practice by practitioners and funders in the Global North. Nevertheless, it is also relevant for development actors in the Global South. We refer to this as a transformative learning system because it is transformative in two senses. Firstly, it supports local action and learning to disrupt and direct efforts in the wider food systems to support local experimentation while it also helps to scale promising transformation practices and processes where desirable outcomes are negotiated between bottom up and top down processes. In this way, the learning dynamic between local and system scales is enabled through virtuous learning cycles while remaining embedded in wider system level changes. Secondly, it is transformative in the sense that it disrupts and transforms the way individuals and communities engage with uncertainty by providing a different way to imagine and organize the learning arrangement required in specific local circumstances.

### 3.2 Capacities and functions of the learning system

The proposed framework builds on the recognition that additional capacities and skills will be critical for change in complex systems and in the food systems transformation process specifically (EEA, 2024; Oliver et al., 2021). Before describing the key learning functions in the proposed framework it is useful to describe the broad types of capacity that these learning functions will need to support. Below we describe three critical capabilities for food systems transformation based on an elaboration of the work of Oliver et al. (2021) and EEA (2024).

**Capacity for local action within systems** The food systems transformation agenda suggests that communities at local scales will need to navigate the uncertainties in both their responses to a changing global context and in their attempts to identify new pathways to sustainable and inclusive futures. In order to achieve this, individuals, projects, and

organizations involved in the transformation process will need the capacity to make sense of and refine their own experimentation and adaptations through learning, evaluation, planning, and replanning processes. Consequently, the need to support people, communities, organizations in navigating these uncertainties and leading local initiatives to address and learn from emergent issues becomes paramount. These groups are not only confronted with the uncertainties surrounding a changing global context, but also uniquely positioned to drive change within the transformation process, experiment with new approaches, and assess their effectiveness. The necessity of providing support lies not merely in the provision of resources, but in the facilitation of learning processes that enable strategic and tactical adaptation, thus ensuring the effective navigation of emerging uncertainties.

**Capacity for coordinated action and collaborative sense-making across actions** A focus on systems transformation that emerges from local disruption and inspiration gives rise to a need for a greater degree of coordination across local initiatives. This involves synergizing efforts, avoiding duplication, and building coalitions of interest. It also entails supporting broader learning efforts to strengthen the collective ‘muddling through’ processes that uncertainty demands. In order to facilitate this form of collaboration across local efforts, there is a need for the incorporation of localized reflections in order to gain sight of negative consequences and trade-offs that may be affecting people in other geographies. The strengthening of the learning and evaluation capabilities of people and organizations will contribute to better coordination across geographies. However, this process also requires a broader range of methods in order to consider other forms of knowledge and insights, allowing tacit knowledge to emerge.

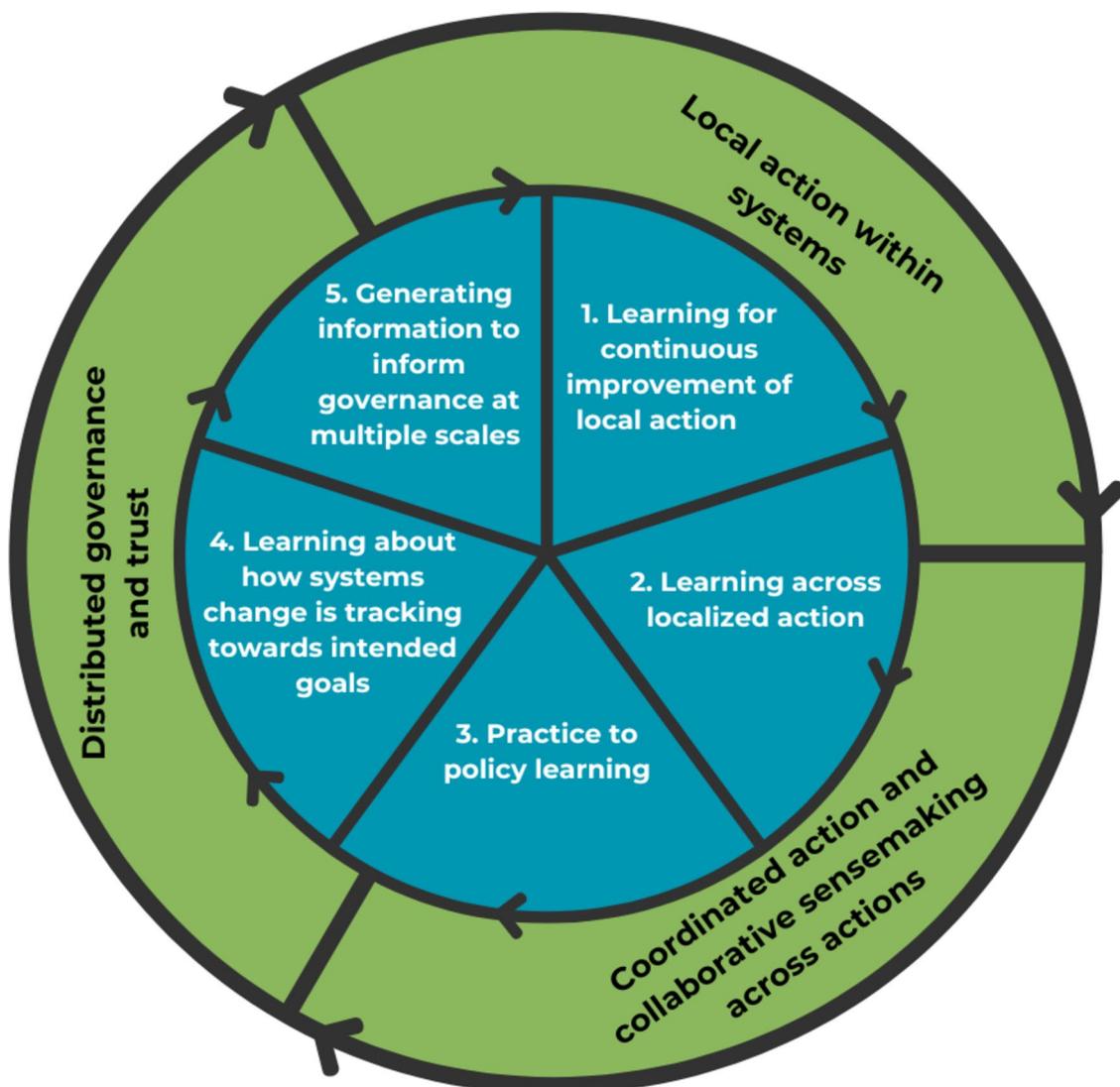
**Capacity for distributed governance and trust** New governance arrangements are necessary for the integration of local knowledge and learnings across scales, ultimately leading to larger systems transformation. These governance arrangements must be based on full local leadership and agency, facilitating engagement in transformation within the lived realities of people while being embedded across scales. Specifically, governance arrangements that form the basis for legitimacy and resulting forms of leadership are required to set a broader and more democratic global agenda. In essence, local ownership of transformation involves not only the ownership of local agendas, actions, and outcomes, but also the assurance of a role in influencing national and global agendas that, by their very nature, establish the framework conditions for local action through regulatory frameworks, incentives, and market mechanisms. The glue that holds

these arrangements together is the establishment of trust, which is founded on the transparency of the arrangements to collect information on transformation outcomes and lessons rooted in the values of people and organizations.

In order to transform food systems, it is essential that these capacities be purposefully directed. This will enable individuals within the system and the system itself to learn about systems transformation during the change process. The combination of these capacities (see above) and learning functions (see below) will serve as the foundation for the proposed locally centered and coordinated transformative learning system. Figure 1 summarizes how these learning functions and capacities work together to enable transformation.

We propose five key learning functions within the proposed framework to harness the capacities to embrace uncertainty for transformative change:

1. **Learning for continuous improvement of local action:** This learning function focuses on framing problems at a local level and strengthening the learning and evaluation capacity of individuals and organizations to understand and manage their own transformation journey within the system. It provides the means to experiment with action and impact logics against aspirations to change parts of food systems performance, and to develop lessons about what works and where broader system blockages or lock-ins occur.



**Fig. 1** Proposed capacities (in green) and functions (in blue) needed to embrace uncertainty within a transformative learning system

2. **Peer-to-peer learning across localized action:** This learning function focuses on continuous, incremental, and adaptive peer-to-peer learning. It provides the means to generate lessons from transformation experiences in different contexts of uncertainty and across scales (people, organization, geographies).
3. **Practice-to-policy learning:** This learning function focuses on locally embedded practice-to-policy learning. It emphasizes the application of knowledge from local practices to the development of policy and decision-making processes within governments, development agencies, and funding entities. It facilitates the dissemination of insights and lessons learned, with the objective of informing and guiding further policy and institutional reforms to achieve food systems performance goals.
4. **Learning about how systems change is tracking towards intended goals:** This learning function focuses on the collaborative development of mechanisms for tracking progress and directionality across different contexts, leveraging multiple forms of data and means of collecting them to extend performance insights.
5. **Generating information to inform governance at multiple scales:** This learning function focuses on generating information on governance, outcomes, and impacts. It provides the means for the transparent dissemination of information to different stakeholders regarding the progress of ongoing transformation processes aimed at achieving food systems performance goals. This approach highlights trade-offs and perverse consequences, especially for marginalized groups. Furthermore, it provides politically influential metrics that have the capacity to catalyze sustained investment.

In order for learning to be meaningful and generate actionable insights, the development systems within which the transformation should occur will need to change. Individuals within this system must have agency in order to truly effect change. People have long been dealing with uncertainties at the local level and have deep insights into how they unfold. This fundamentally reframes the role of interventions to one of supporting autonomous experimentation. This approach involves a locally-led strategic experimentation process that aims to transform systems while acknowledging uncertainty and incorporating learning loops into action. At the same time, it is important to emphasize that these localized experiments must be interconnected and interact in a meaningful way. The insights gathered from these experiments enhance other local experiments and the envisioned change accelerates through to the wider food systems levels. It should be noted that we do not argue that other types of intervention are redundant. Far from it, we posit that locally initiated

actions, when integrated with systemic interventions, can enhance their efficacy, rendering them more agile and purpose-driven in the face of uncertainty.

### 3.3 A coordinated system of locally led experimentation

New approaches and lines of support should be aligned with the diverse visions and needs of the people projects engage with when attempting to implement a system of people-focused, local innovation and leadership during food systems transformations (Mausch et al., 2021a; Mausch et al., 2025). It is important to consider how current and future interventions could support multiple and diverse locally-led pathways (Mausch et al., 2021b). This shift in focus raises different questions that are at the heart of learning needs. The proposed process would facilitate the generating of insights and directions regarding the current pathways and their inherent diversity, with the participants' vision serving as the fundamental guiding principle. This approach would enable a transformative reshaping of operational modalities and the focus of support mechanisms, thereby democratizing the innovation process.

When local conditions are diverse and individual visions for the future are heterogeneous, a localized<sup>2</sup> and decolonized<sup>3</sup> approach to interventions becomes critically important. Embracing uncertainty essentially means that these approaches transcend their current perception as rights-based. Instead, they emerge as pivotal catalysts for transformation in uncertain environments. This paradigm shift challenges top-down approaches, solutions and pathways by emphasizing the agency of people within the process. It also

<sup>2</sup> Localization of development has recently regained significant traction and appears to be mainstream now among development agencies (Bilsky et al., 2021; North and Longhurst, 2013; Reddy, 2016). Localization of development refers to the shift towards increased access for local actors to funding streams, decision-making spaces, capacity development, local leadership, and policy influence (Robillard et al., 2021). Fundamentally, it recognizes that local actors are often better positioned to contextualize uncertainty and respond to it. Localization became formally part of mainstream humanitarian development after the 2016 World Humanitarian Summit. For the currently wide endorsement, see for example the widely signed and endorsed Charter for Change (Charter for Change, 2024).

<sup>3</sup> “Decolonizing development means disrupting the deeply rooted hierarchies, asymmetric power structures, the universalization of Western knowledge, the privileging of whiteness, and the taken-for-granted Othering of the majority world.” (Sultana 2019, p. 34). This involves addressing power inequalities in development finance and implementation, respecting, and including diverse forms of knowledge, and promoting a diversity of transformation pathways in food systems (Nelson and Edwards, 2020). Despite also being a political project, decolonizing development implies the redefinition of goals where personal life goals become the focus and multiple pathways are therefore supported independently from outside agendas or priorities (Domptail et al., 2023; Herring et al., 2020).

challenges dominant solution-oriented development narratives that rarely reflect the lived reality of complexity and uncertainty of food systems (Sanga and Schülter, 2025). To promote diversity and alternative pathways, it is necessary to prioritize inclusivity, cultural sensitivity, strengthening capabilities enhancement, adaptivity, and evidence-based approaches (Cuppen, 2012; Stirling, 2009; Tschersich & Kok, 2022).

We argue that uncertainty and the resulting need to connect locally led processes of experimentation with a broader agenda of food systems transformation and the development system this is currently embedded in requires a fundamental shift in roles across people and structures within the system (see Fig. 2). Ideas and actions will need to be shaped and led locally by those people and communities that are affected. Simultaneously, organizations implementing projects and broader structures and institutional arrangements (system) within the sector must directly support these local processes, as well as connect localized actions towards learning across time and scale across all dimensions.

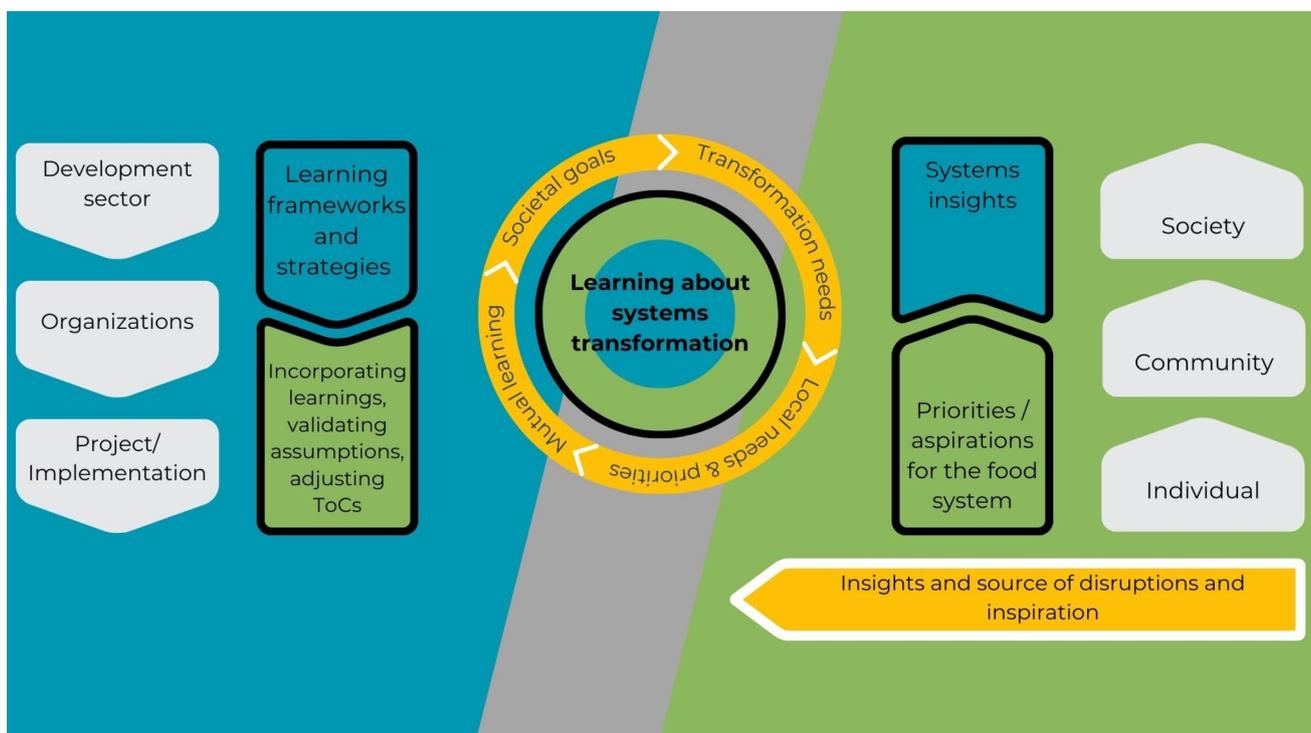
This process would open additional and complementary pathways towards the needed food systems transformation. The emphasis should be on an expanded system to guide investments and actions that will facilitate local action learnings. During the transformation process, this system further connects these learnings across scales within the development system. This new system builds on autonomous action

and learning will offer new approaches for transformation and has the ability to embrace uncertainty.

## 4 Steps towards putting a transformative learning system into practice

### 4.1 Entry points from current practice to trigger change

The arguments proposed by Scoones (2024) stress the importance of locally-led action as a strategy for addressing food systems transformation. This mirrors a growing trend in development thinking (Booth & Unsworth, 2014; OECD, 2024). Many international development agencies have instituted guidelines that stress the importance of local leadership (Charter for Change, 2024). This shift in focus signifies a reorientation of development practice and policy towards local leadership and action. It is also a strategy that has the potential to address the context specificity of uncertainty and leverage the accumulated knowledge and practices within these contexts. Consequently, this reorientation paves the way for the transformative learning system to be rolled out and for the emergence of the complementary pathways we believe can contribute to the realization of the necessary transformation.



**Fig. 2** Shifting roles for connecting localized experimentation and action to system scale learning and transformational change

Furthermore, many individual tools needed are already in use today in food or other related sectors (e.g. multi-stakeholder platforms, theories of change, MEL systems) and will remain relevant for the new learning system. These instruments must be deployed in different modes and for a set of adjusted goals. Table 1 summarizes the new roles emerging from the previous section and provides some examples of existing tools that can be deployed in different ways to address these new roles.

In practice, however, there is currently a lack of integration among tools. The transformative learning system suggested here argues for a more deliberate approach which explicitly incorporates uncertainty and embeds relevant tools. This implies short-term adjustments with longer-term changes in sight to be the starting point for connecting and implementing the learning elements across locations and levels.

### 4.2 Shifting mindsets

The foundation of the new learning system is a shift in mindsets and ways of thinking. According to Centola et al. (2018), a relatively small minority of about 25% of a group can effectively catalyze a shift in social conventions, thereby reaching a tipping point. This can be initiated by posing different questions, adding new dimensions to the discussion, and implementing novel practices. Subsequently, building strategic alliances within and across all levels can start momentum. Similarly, at the organizational level, food

systems actors should form strategic alliances with groups that are challenging current system practices, such as social movements, labor unions, and farmers’ organizations, to enable transformative change from the grassroots level, rather than trying to engineer it from the top-down (Behar, 2022). This is where mutual learning occurs, and local and global agendas intersect to facilitate transformative change.

For example, the Stakeholder Approach to Risk-informed and Evidence-based Decision-making (SHARED) process (see Neely et al., 2021) brings multiple forms of evidence and diverse voices into development planning and design. The application of this process already led to the intentional integration of learning loops (act—reflect—replan) into the Turkana (Kenya) county development plan (Neely et al., 2021). Within a process such as the one in Turkana, the JUSTRA matrix can support reflection on power imbalances and help to identify approaches to overcome these (Conti et al., 2025).

The beginning of the change process is simple, yet challenging. Adopting a learning perspective and reflecting on current projects from the vantage point of systems transformation is crucial. This involves adopting an adaptive and reflexive approach that allows for a different set of questions to be asked. Adding new and different types of metrics into monitoring indicators that prioritize the process of change, meticulously examining the assumptions underlying theories of change, or engaging in alternative dialogues with people engaged in or affected by the project. Embracing the uncertainty that is already part of daily operations and using

**Table 1** Practical steps towards the transformative learning system: changing roles and corresponding tools for people and system

Function	People		System	
	New role	Existing tools	New role	Existing tools
<i>Learning for continuous improvement of local action</i>	Primary source of knowledge, problem framing, solution identification, project leadership	Design-thinking toolbox (Korner, 2021), Community engagement workshops, leadership training	Capacity development for systemic thinking, accepting higher risk for innovation	Experimental approaches (Sengers et al., 2019), grant schemes, challenge programs, system dynamics modeling (Moallemi et al., 2021)
<i>Learning across localized action</i>	Facilitate emancipatory learning, challenge status quo	Peer-to-peer support networks, communities of practice (Strasser et al., 2022)	Utilize existing capabilities, learning-oriented approach, sustainable financing	Complex Theories of Change (Marciniak et al., 2024), experimental systemic interventions, adaptive project management
<i>Practice to policy learning</i>	Generate and disseminate disruptive lessons and information	Stock-taking exercises	Bridge practical experiences and policy-making	Communities of practice, donor coordination, policy think tanks, research networks, Theory based evaluation (Rogers, 2007)
<i>Learning about how systems change is tracking towards intended goals:</i>	Provide localized insights, manage trade-offs	Mapping exercises, local case studies Modeling/integrated assessment (Moallemi et al., 2024a)	Reflexive approach, focus on process and complexity, develop complex metrics	Analysis and learning facilitation capabilities Lazurko et al., 2025), new process indicators, data collection protocols for national statistics and citizen science (Fritz et al., 2019), Modeling/integrated assessment
<i>Generating information to inform governance at multiple scales</i>	Integrate diverse knowledge sources	Collaborative research platforms (Norström et al., 2020), knowledge sharing forums	Ensure adherence to principles in outcome assessments	Principle-based assessment guidelines, systemic evaluation frameworks

it as a catalyst for reflection can offer new perspectives and insights. These initial steps can be incorporated into existing project approaches with minimal or no additional cost, while generating valuable insights that are instrumental in facilitating systems transformation processes.

### 4.3 New project designs and theories of change

However, the project environment itself requires a different setup. Beyond the shift in mindsets and the corresponding incorporation of new perspectives, adjustments within the current project environment are needed to effect a change of the sector. For the learning system to start functioning, the focus must be on the new sources of disruption to the current system and new avenues for generating insights into the system responses. This will require new types of project governance, as well as engagement processes that will take different forms. Most radically, it would take the opposite form of today's standard operations and start from the local population that engages an agency to support their muddling process, rather than agencies implementing solutions in a location (Sanga and Schülter, 2025).

This new arrangement will result in a shift of the roles that project participants and local organizations play in the process. Projects will be designed and led locally and institutions will assume a supporting role providing feedback into the process and offering learning frameworks and strategies. The tools currently in use are already able to accommodate these changes and remain relevant, although they will need to be deployed in different and more integrated ways and forms. One example is Theories of Change (ToCs). In practice, these would be slightly more complex with locally led projects and corresponding ToCs being embedded in a higher-level learning structure that is able to facilitate learning and progress assessment. For the system-level learnings, ToCs will also need to be broadened to incorporate more elements that reflect the complexity of food systems dynamics, which are beyond the control of localized actions, yet are highly relevant as they influence the local environment. Therefore, it is crucial to make explicit assumptions regarding these interactions and subsequently prioritize the assessment of their validity.

Projects will need to be learning oriented. They need to acknowledge the scarcity of system capacity, be trust-based, build on local innovation and knowledge (Liverpool-Tasie et al., 2020), and embrace adaptive, responsive management approaches and reflexive learning. Over time, this learning-oriented approach will foster a deeper understanding of system responses to local changes and facilitate the transformation process through adjusted sets of local actions that trigger system changes in the desired direction. This broader learning process should be cascaded, reflecting, and linking

local learning. A multi-way coordination and communication process, designed to facilitate diverse intersecting learnings, will support these shifts and insights, and trigger a new set of changes within the evolving local components of the system. It is critical to acknowledge and embrace uncertainty as an inherent feature of this process. Rather than seeking to eliminate or control uncertainty, it is crucial to recognize it as a key element that facilitates the learning journey and facilitates the understanding of system change (Thompson & Scoones, 2009).

### 4.4 Evaluation approaches

In order to effectively harness the potential of localized insights, it is necessary to employ evaluation methods that can handle complexity. The necessary tools already exist (see for example Westhorp, 2012 or Molas-Gallart et al., 2021). However, reframing these tools to align with more decentralized and locally-led initiatives, ensures the participation at all levels and facilitates interpretations from diverse perspectives. A shift in focus to more argumentative and formative types of evaluation, with a stronger orientation towards processes rather than outcomes, is likely to be necessary. Reflexive learning by participants rather than external assessment and control will help to overcome biases and shed light on previous blind spots.

Transformative change in food systems takes time, likely extending beyond the duration of standard project timelines. Consequently, the necessity arises for newly established process, impact, and outcome indicators to be embedded at the institutional level rather than at the project level, particularly for medium- to long-term timeframes. One example of this can be found in UNDP's portfolio approach (UNDP, 2023) which aims to improve understanding of how transformation takes place. Furthermore, their Causality Assessment for Landscape Interventions (CALI) approach (UNDP, 2022) as one example of a participatory and complexity aware program roll out highlighted the benefits to the participating communities. Not only did their agency increase but additional perspectives offered improved the program itself (Bina, 2025). UNDP also offers guidance on the use and application of tools (Haldrup, 2022), including ToCs and MEL systems, which need to put more emphasis on explicitly exploring and learning about causal processes and mechanisms rather than narrowly focusing on outcome and impact components.

### 4.5 Funding for new roles and functions

While there is scope to start the process within current mechanisms, new or adapted financing mechanisms and approaches have the power to accelerate the process and

effect deeper changes. In a facilitative role, financing mechanisms and conditions should avoid glossing over inherent uncertainties. The new functions of the transformative learning system will need to accommodate two basic elements: 1. Institutional funding to allow learning functions to perform beyond projects, 2. Funding for autonomous localized action in the absence of predefined outputs and outcomes—this can be done directly or indirectly through other institutional arrangements.

Opening up spaces for experimentation and localized muddling with a larger vision for Food systems transformation has the potential to accelerate the changes we urgently need. The Think Tank Initiative, for example, highlighted that core funding, committed for 10 years, enabled organizations to learn and implement strategic shifts (Christoplos et al., 2019). Another strong example is the UN Forest and Farm Facility,<sup>4</sup> a multi-donor fund and partnership that provides direct support to forest and farm producer organizations. This initiative has channeled more than 60 million USD to fund activities and priorities which are annually determined—and adapted—by producers themselves. While donors have routinely pushed for clearer, more measurable targets, the program retains a flexible window to fund participatory and adaptive learning systems and ensures programmatic guidance by a Global Steering Committee composed of local farmers and producers (FAO, 2025). Along with closer vertical and horizontal coordination, and a focus on the comparative advantages of both donor agencies and grantee organizations at all levels, a learning system could quickly gain traction and effect change.

## 5 Conclusions

In order to effectively transform food systems, it is essential to navigate ever-increasing uncertainties. The implementation of the proposed transformative learning system needs to be an experimental and empirical process, unfolding in the context of perpetual uncertainty. Indeed, uncertainty can be seen as a positive feature of systems, and by embracing it, we can "transform[ing] our perspectives on uncertainty from ones of despair and fear to those of hope and opportunity" (Scoones, 2024, p2). The localized entry point is well-positioned to facilitate this transformation, as solutions and options become more tangible and actionable. This process requires significant changes at all levels

<sup>4</sup> "The FFF is a partnership launched in September 2012 between FAO, IIED and IUCN, and AgriCord. Its Steering Committee is formed by members affiliated with forest producer, community forestry, indigenous peoples' organizations, international research community, business development service provider organization, private sector, government, and donors." (FAO, 2025, About).

and among all stakeholders. The magnitude of the required change may appear daunting, potentially leading to a reversion to addressing problems in isolation within the process. However, the shift to a learning system for transformative change could begin gradually and in a decentralized manner. Furthermore, this shift would not replace on-going efforts; rather, it offers additional perspectives and insights that have the potential to accelerate the transformation.

The new actions that emerge from new roles will differ from those previously employed. Changes in funding mechanisms, investments in R&D, infrastructure, and mindsets will be required as the process unfolds. More importantly, the argument here is that without an integrated set of learning and evaluation capacities that are locally rooted and reach across scales, choices, and priorities in different areas of investment and public debate, these choices will be blind to and unprepared for the uncertainty characteristic of reality as food systems undergo transformation.

This shift is redefining our notions of success and failure and broadening the range of actors driving change and the skills they need to effectively navigate uncertainty. Using the emerging mechanisms of localization and decolonization as a starting point, we proposed a new learning system that can facilitate a democratic approach to transformation and limit the risks of derailment by vested interests. Our proposed functions within this learning system include learning for continuous improvement at a local scale, with horizontal connections through peer-to-peer learning and vertical distribution of information through practice to policy learning. Furthermore we propose that the learning system should facilitate the tracking of directional change at a systems level, and should generate information for governance at multiple levels. We believe that these functions would build further capacity for localised action, would coordinate action and sensemaking across scales, and would build distributed trust and governance into transforming food systems.

We believe that any intervention, regardless of its size, can contribute to learning and system transformation during implementation. Each initiative should function as a systems probe that facilitates local progress and, more importantly, improves our understanding of the system itself, its reactions to the probe, and the underlying dynamisms. The focus should not be on the extent to which the system has changed, but rather on the manner in which it has been modified or remained locked-in. Through this process, we can learn how the entire system reacts to certain shifts and how these changes translate to different outcomes.

Small tweaks and shifts in focus may be insignificant in isolation, but when embedded in a larger learning system that spans all levels, they could become transformative. The argument presented is that we should not strive for perfection

in innovation, but rather for perfection in learning. Food systems actors should embrace muddling as a new and valid approach that serves a learning purpose—purposeful muddling. For those providing funds for transformation initiatives, a shift in approaches and mechanisms is necessary. This involves embracing a higher degree of uncertainty in outcomes and an increased focus on the process. Achieving this objective and demonstrating its practical implementation will establish a new standard far beyond the food systems arena, potentially impacting other complex systems grappling with similar needs for transformative approaches and seemingly intractable challenges.

## Declarations

**Conflict of interest** The authors declared that they have no conflict of interest.

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edge sources and methods often from Decision-Making Under Deep Uncertainty, Multi-Sector Dynamics, System Dynamics, and Integrated Assessment Modelling.