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The transformative potential of Seed Commons: Applying the social-ecological transformation framework to agri-food systems

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ABSTRACT

In this paper, we argue that small initiatives can contribute to larger transformations if they challenge and unmake incumbent unsustainable paradigms, and we demonstrate how the application of the social-ecological transformation framework helps to operationalize the analysis of paradigm shifts across different levels of transformation. Empirically, we assess the contribution of Seed Commons initiatives to agri-food systems transformations, taking the case of the organic breeding association Kultursaat e.V. At the macro level, the analysis reveals that the paradigms of 'materialistic culture and growth', 'control and autonomy of humans over nature' and 'expert knowledge and specialization' are deeply embedded in the dominant agri-food system. Kultursaat challenges them by promoting alternative narratives such as agroecology, food sovereignty, farmers' rights and resilience. At the micro and meso level, we apply a set of evaluation principles that reveal the transformative character and partial transformative impact of Seed Commons. Applying the framework to agri-food systems can bring an enhanced theoretical understanding of dynamics of change into the agri-food transformation discourse, link small-scale initiatives to wider processes of transformation, and provide a systematic research approach to enhance comparability across case studies. The framework is well suited to bring together even evolving transformation literatures.

1. Introduction

As a consequence of the significant environmental challenges associated with agri-food systems, there have been widespread calls and a growing stock of research on transformations and transitions[1] in food systems (see El Bilali, 2019a; Hebinck et al., 2021a; Melchior and Newig, 2021; Weber et al., 2020). For example, this literature has made important contributions to agro-ecological transformations (Altieri et al., 2015; Anderson et al., 2019; Gliessman, 2016; Van den Berg et al., 2022), food democracy and food justice (Baldy and Kruse, 2019; Hassanein, 2003; Whitfield et al., 2021; Zollet and Maharjan, 2021). The food transformation literature has also highlighted diverse initiatives and movements in food and farming systems, which build alternatives in societal niches and aim to destabilize dominant system structures. These include alternative food networks (Bui et al., 2016; Fourat et al., 2020), the food sovereignty movement (Edelman, 2014; Fairbairn, 2012) or the food-as-a-commons movements (see Carceller-Sauras and Theesfeld, 2021; Healy et al., 2020). Seed Commons initiatives for instance could potentially play a central role in transformations, as they counter the ongoing commodification of seeds and plant genetic resources, reclaim global seed sovereignty and enhance the re-democratization of seed systems (Carceller-Sauras and Theesfeld, 2021; Gmeiner et al., 2020;

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[1] As elaborated in Sievers-Glotzbach and Tschersich (2019), the terms transformation and transitions are often used interchangeably in the transformation literature. We consider transitions as "intentional reorganizations of individual subsystems towards specific, previously defined goals, which are often assumed to be manageable. Transformations, by contrast, are more complex and fundamental, occur over longer time-periods and are generally considered as emergent processes" (Sievers-Glotzbach and Tschersich, 2019, p. 3).

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Kloppenburg, 2014; Sievers-Glotzbach et al., 2020b). Yet there is still limited understanding on how such small initiatives on the ground could contribute to a fundamental transformation toward sustainability.

Whereas conceptions of sustainability transformations have been carefully developed and refined in the scientific discourse during the last years, there is still a lack of systematic research on assessing transformation processes in agri-food systems in particular (Hebinck et al., 2021b; Salomaa and Juhola, 2020; Weber et al., 2020). While the term transformation is often used in studies on agri-food systems, few of these apply explicit conceptualizations of transformations (Weber et al., 2020). When concrete frameworks are used, they usually refer to sustainability transitions, mainly with regard to the multi-level perspective (Bui et al., 2016; El Bilali, 2019b). However, these approaches often neglect the deeper structures of social-ecological systems and normative directionalities (Weber et al., 2020). In particular, more attention needs to be attributed to deep leverage points, hence points in the system where even small changes can have widespread effects (Abson et al., 2017; Göpel, 2016; Meadows, 1999). Paradigms have been identified as the deepest leverage points for transformation. Although paradigms and the power to transcend paradigms are discussed as powerful leverage points, they have been rarely investigated by empirical research on food systems (Dorninger et al., 2020). Moreover, research centers on individual case studies based on fragmented analytical approaches, while not sufficiently addressing interlinkages between them (El Bilali, 2019a; Weber et al., 2020). Hence, the role of agency and the potential contribution of alternative initiatives and social movements to large-scale transformations is not yet sufficiently understood (El Bilali, 2019a; van Bers et al., 2019).

In this paper, we tackle these research gaps by applying the social-ecological transformation framework[2] (*SET framework*, see Fig. 1 (Sievers-Glotzbach and Tschersich, 2019)) in an in-depth case study to the Seed Commons initiative Kultursaat e.V. Thereby, we demonstrate a systematic approach to assess the contribution of small initiatives to agri-food transformations. We argue that the agri-food transformation literature needs to more strongly consider incumbent paradigms and emerging alternative narratives as central leverage points of transformation. The application of the SET framework to the field of agri-food transformations helps to operationalize the analysis of paradigm shifts across different levels of transformation. It provides a thorough empirical analysis of how incumbent paradigms express in the global agri-food system and how Seed Commons can challenge these and promote alternative narratives in their own work.

The paper is structured as follows. We first summarize the SET framework, reflect on it in light of the recent transformation discourse and refine and operationalize its set of evaluation principles. These principles serve as a guide in assessing change processes on the ground regarding their contribution to agri-food transformations (section 2). After presenting the case study and the methods of data collection and analysis (section 3), we outline incumbent paradigms that reinforce sustainability challenges in the current global agri-food system, as well as emerging alternative narratives (section 4). Then, we apply the set of evaluation principles to assess the transformative character and impact of Kultursaat as an in-depth case study of Seed Commons. In particular, we focus on whether and how Kultursaat challenges existing unsustainable paradigms both within its own organization and in its efforts to make societal impact (sections 5 and 6). We conclude with a discussion of the results and contribution of the SET framework to the agri-food and wider social-ecological transformation discourse (section 7).

[2] The SET framework was developed on the basis of a comprehensive review and synthesis of transformation and transitions approaches with the goal of assessing how individual processes of change can contribute to wider social-ecological transformations. The conceptual framework is summarized in section 2.

2. The SET framework and its evaluation principles

To link the diversity of individual processes of change often occurring at local or regional levels with a directionality toward a wider social-ecological transformation, Sievers-Glotzbach and Tschersich (2019) proposed the social-ecological transformation framework (see Fig. 1). The framework addresses the 'process-structure divide' in the discourse around directionality in transformations (see e.g. Duncan et al., 2022): It aims to balance the tension between the need for a deliberative shift away from unsustainable trajectories and structures, and the importance for emergent and democratic processes that allow for diverse solutions in light of complex und often uncertain system dynamics. Hence, it conceptualizes social-ecological transformation as a long-term and on-going process (timeframe) in complex and dynamic social-ecological systems (breadth) toward intragenerational and intergenerational justice objectives, while allowing for a variety of pathways and approaches in an emergent process (direction of change) (Sievers-Glotzbach and Tschersich, 2019). It provides an integrated analysis of agency-structure relationships to better understand and assess change dynamics, focusing on deep leverage points such as power, paradigms and institutions (depth of change).

These criteria for conceptualizing transformation were used for a comprehensive review and synthesis of transformation and transition approaches into a coherent SET framework. The reviewed approaches included those rooted in social-ecological resilience and systems thinking (e.g. Folke et al., 2010; Olsson et al., 2014), development studies (e.g. Brown, 2016; Leach et al., 2010; O'Brien, 2012; Stirling, 2014, 2015), social and political ecology, political economy (e.g. Brand, 2016; Brand and Wissen, 2016; Görg et al., 2017) and socio-technical studies (e.g. Geels and Schot, 2010; Grin et al., 2010; Ingram, 2015). On the basis of this review, a set of preliminary evaluation principles was composed that aimed to combine the strengths of the different approaches, and helps to assess the transformative character and impact of on-going processes of change or initiatives. The SET framework hence connects structural, systemic and enabling approaches for understanding and advancing transformation – and addresses the need of „combining recognition for deep structural realities as well as vibrant social possibilities" (Scoones et al., 2020, p. 71).

The SET framework is organized across three levels: The macro level of the framework outlines the overarching normative objectives of inter- and intragenerational justice as the intended goal dimension or directionality of transformation processes toward sustainability. These goals at the macro level are translated into concrete principles to assess whether change processes at the micro level have a transformative character. The meso level assesses whether processes with a transformative character can reach beyond the niche to achieve a wider transformative impact. In the following section, we summarize the preliminary set of evaluation principles proposed in 2019 and update and operationalize them to assess the transformative character and impact of change processes in agri-food systems. By doing so, we also respond to a comment by Feola et al. (2021: 3) that the "applicability and added value of this framework remains to be proven in empirical research".

2.1. The macro level: The normative orientation of agri-food transformations

The macro level captures the normative orientation of processes of social-ecological transformation. The overall sustainability objectives of inter- and intragenerational justice demand assuring the persistence of essential ecological functions at global and regional scales as well as fostering profound changes of societal structures (Sievers-Glotzbach and Tschersich, 2019).

The SET framework outlined that in order to be transformative, change processes need to challenge three incumbent paradigms as deep leverage points for transformation, which contradict inter- and

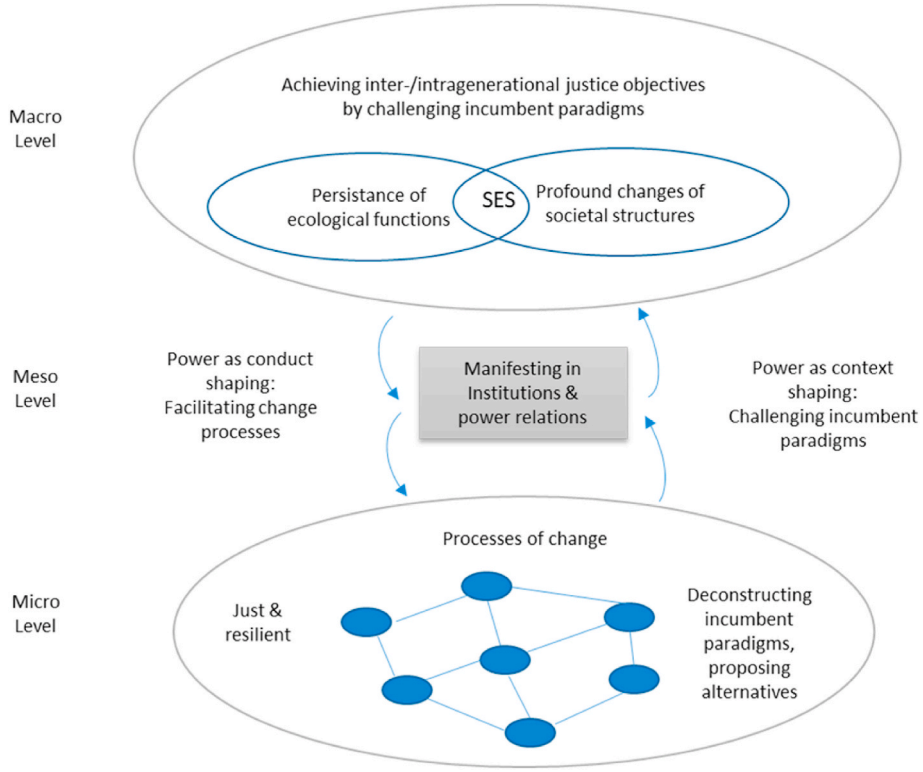

Fig. 1. The SET framework (adapted from Sievers-Glotzbach and Tschersich, 2019, Fig. 2).

intragenerational justice objectives and keep the current social-ecological system locked in unsustainable trajectories (Sievers--Glotzbach and Tschersich, 2019, see section 5): The paradigm of 'materialistic culture and growth' refers to the dominant assumption that perpetual economic growth and material wealth are needed to raise social welfare, which is a driver of massive environmental degradation, growing societal inequalities and negative impacts on wellbeing (Escobar, 2015; Göpel, 2016; Jackson et al., 2021; Kallis et al., 2012). The second paradigm of 'control and autonomy of humans over nature' captures the biospheric, spatial and temporal disconnection of humans from nature, which reduces the perception of humans of their effects on ecosystems (Abson et al., 2017; Dorninger et al., 2017; Riechers et al., 2021). Finally, the third paradigms of 'expert knowledge and specialization' emphasizes that highly specialized knowledge created in Western scientific institutions is often implicitly considered as the most relevant, and is valued over more tacit or Indigenous types of knowledge (Becker, 2010; Göpel, 2016; Norgaard, 2004). Shifts away from these incumbent paradigms toward more pluralist understandings of knowledge, toward reconnecting human-nature relationships and toward post-growth strategies (see Tschersich and Kok, 2022) are considered as powerful sustainability interventions.

To concretize this normative framing in the context of agri-food systems transformation, we here suggest certain steps to further clarify and investigate the macro level. First, the social-ecological system(s) under consideration, in our case the global agri-food system, and its sustainability challenges need to be identified. Manifold justice aspects are relevant for comprehensively defining sustainability challenges and objectives, including distributive justice, procedural justice, recognition justice (fair consideration and respect for different views or values), and restorative justice (compensation for harms done to individuals, communities and the environment) (Fraser, 2010; Jenkins et al., 2016; Kaljonen et al., 2020; Kortetmäki, 2016; Schlosberg, 2013; Tschersich and Kok, 2022). Specifically, the procedural and recognition dimension should be considered when studying social-ecological transformations, as they allow to critically review politics of framing and issue-setting (Kortetmäki, 2016).

Moreover, we suggest two steps for evaluating changes in paradigms at the macro level: (i) to sketch how the three major paradigms express in the agri-food systems as the specific social-ecological systems under consideration, and (ii) to identify which alternative paradigms are emerging from ongoing change processes. The three paradigms provide the essential linkage of the investigated agri-food (sub-)systems to overall social-ecological systems dynamics, by addressing inherent functionalities of these complex systems.

2.2. *The micro level: The transformative character of change processes*

To determine whether an initiative has a transformative character, the micro level investigates whether the respective change process challenges the incumbent paradigms outlined for the macro level. Hence, the normative framing of the change process is assessed with regard to whether it challenges or proposes alternatives to one or several incumbent paradigms. In line with Feola et al. (2021), we emphasize in this refinement of the SET framework that it considers both the deliberate deconstruction of incumbent paradigms that stabilize current unsustainable system structures ("unmaking") and the construction of alternative framings as crucial processes for promoting a SET ("making").

To contribute to the overall intra- and intergenerational justice objectives of a SET, change processes at the micro level need to reflect justice and resilience principles in their own internal organization and governance processes. Social-ecological resilience principles (Biggs et al., 2012, 2015) evaluate the ability to maintain important ecological functions and hence also the reliability of future provision of desirable ecosystem services. Thus, they capture aspects of intergenerational distributive and restorative justice. Justice principles (as operationalized by Leach et al. (2010) as "Dynamic Sustainabilities") aim to highlight diverse types of knowledge, narratives and pathways in addressing sustainability challenges. These principles provide a suiting complement to the resilience principles, as they focus on intragenerational

procedural and recognition justice, and give specific attention to aspects of power and politics.

We propose to extend and refine the illustrative set of evaluation principles outlined in (Sievers-Glotzbach and Tschersich, 2019), by considering the comprehensive set of generic resilience principles (Biggs et al., 2015) and principles of empowering designs toward sustainability (Leach et al., 2010). As both approaches have roots in social-ecological systems thinking, there are overlaps between their respective principles. We integrated these dimensions into a common set of principles to avoid repetitions[3] (see Table 1).

2.3. The meso level: The transformative impact of change processes

The meso level of the SET framework assesses whether processes of change with a transformative character can reach beyond the niche to challenge and 'unmake' (Feola et al., 2021) incumbent paradigms embedded in institutions and power relations (power as context-shaping). It regards whether initiatives are able to amplify and upscale their work, and to mobilize sufficiently to gain transformative power (Avelino and Rotmans, 2009) to alter prevalent power relations, incumbent structures and facilitate new forms of agency (Sievers--Glotzbach and Tschersich, 2019). This can include changes in governance, the diffusion or upscaling of innovations, connecting alternative solutions to strenghten one another, the way the economic system is organized, or changes in mindsets, norms and values. These processes should manifest in the making of revised and more empowering and resilient institutions, which in turn can facilitate and stabilize future change processes (power as conduct-shaping, top-down) (Sievers--Glotzbach and Tschersich, 2019). As such, the meso level aims to connect the micro and the macro level.

Concerning bottom-up processes, we originally proposed three main principles or strategies to assess and enhance the transformative impact of initiatives beyond the micro level (Sievers-Glotzbach and Tschersich, 2019). These were 'deepening and building resistance', 'horizontal and vertical networking' and 'mainstreaming of alternatives' based mainly on Transition Management approaches (Ingram, 2015; Johansen and van den Bosch, 2017, see also Naberhaus, 2011).

A recent publication by Lam et al., 2020 proposed a new typology for assessing the impact of bottom-up processes, based on a comprehensive review and synthesis of previous literature on processes of upscaling and enhancing societal impact. Since these approaches align very well, we replace the original set of principles for assessing bottom-up processes with the proposed *amplification framework* (Lam et al., 2020). First, the category of 'amplifying within' entails processes that aim to strengthen the robustness of individual initiatives to withstand external incumbent forces for instance through processes of learning and experimentation. This includes creating spaces for decision-making and securing long-term institutionalization and funding (Brown, 2016; Johansen and van den Bosch, 2017). As previously argued, a key goal is to show that viable alternatives to the status quo are indeed possible (Sievers--Glotzbach and Tschersich, 2019).

Second, 'amplifying beyond' regards processes that enhance the reach of the initiative by transferring it to a similar context or replicating it in another context. By spreading the application of alternatives to diverse contexts, it is possible to test their desirability and viability, further improve and learn from these experiences and increase their reach and impact.

Third, 'amplifying out' considers processes that aim at challenging incumbent structures and paradigms manifesting in predominant practices, rules, norms, and power relations. Hence, these aim to replace detrimental institutions and practices governing incumbent structures (scaling-up) and to influence discourses and create alternative narratives and visions (scaling deep). As emphasized by Sievers-Glotzbach and Tschersich (2019), special regard should be given by initiatives to resist co-option by the regime. An integration of individual elements of alternative practices into the incumbent system without changing its fundamental functioning principles could have counterproductive effects and strengthen the adaptive capacity of the incumbent system (see also Bui et al., 2016; Ingram, 2015; Seyfang and Haxeltine, 2012).

Additionally, we consider 'connecting vertically and horizontally'. Networking can significantly enhance the impact on all three levels of amplification, as it allows initiatives to mutually reinforce and stabilize one another, build cross-sectoral collaborations and structures, enhance their impact on policy and potentially replace incumbent system structures (see Sievers-Glotzbach and Tschersich, 2019).

The pressure created by initiatives (bottom-up) needs to translate into support structures and institutions that facilitate future change processes toward a SET. The preliminary set of principles for assessing whether current governance structures are supportive of transformative change proposed by Sievers-Glotzbach and Tschersich (2019) combined Social-ecological resilience and Dynamic Sustainabilities principles geared toward building just and resilient governance structures (see Biggs et al., 2015; Leach et al., 2010). These included 'promoting polycentric governance systems', 'diversity and redundancy', 'attending to rights, equity and power', 'encouraging learning' and 'supporting diverse population'.

We replace this preliminary set of principles with the concept of transformative governance[4], recently proposed by Visseren-Hamakers et al. (2021). It combines integrative, inclusive, adaptive and pluralist approaches to governance. This concept is well suited to operationalize the SET framework on the (top-down) meso level, as it presents a fully integrated and more coherent set of principles for transformative governance and comprehensively accounts for the resilience and justice principles originally proposed.

Integrative governance emphasizes the importance to enhance the combination, coordination and integration of various governance instruments and systems to ensure that (local) solutions have sustainable impacts across various scales, issues, places, and sectors. For agri-food systems, the importance of coherently addressing the interdependence of food, water, energy and climate systems is often emphasized (Weitz et al., 2017).

While integrative governance focuses on resilience, *inclusive governance* pays special regard to dimensions of justice, power and politics. It aims to empower those whose rights, values, interests and knowledges are currently marginalized – by strengthening diversity and equity in decision-making processes and by overcoming incumbent structures and practices, which reinforce inequalities both in processes and outcomes.

Adaptive governance accounts for uncertainty and incomplete knowledge inherent in complex systems, by supporting institutions and processes that enable learning, experimentation, reflexivity, monitoring and feedback to enhance resilience. Key supportive elements include feedback loops, networked policy actors, nested scales and polycentricity, and institutional and stakeholder diversity (Chaffin et al., 2014).

Finally, *pluralist governance* means recognizing and incorporating pluralist perspectives and different scientific and societal knowledge systems. In particular, currently underrepresented non-Western

[3] Specifically, we regard the Dynamic Sustainabilities principles "take a dynamic perspective, accept incomplete knowledge" and "be reflective" to be embraced by the resilience principles "Foster complex adaptive systems thinking and "encourage learning and experimentation", and the resilience principle "broaden participation" to be captured by the Dynamic Sustainabilities principle "include a diversity of knowledges through participatory engagement".

[4] Transformative governance is understood as "the formal and informal (public and private) rules, rulemaking systems and actor networks at all levels of human society that enable transformative change" (Visseren-Hamakers et al., 2021, p. 21).

Table 1
Evaluation principles for a SET at the macro, meso and micro level (own compilation, based on Sievers-Glotzbach and Tschersich, 2019).

MACRO LEVEL	**Achieving intra- and intergenerational justice objectives**	**Challenging incumbent paradigms in social-ecological system structures**

Normative orientation	• Specify the overall sustainability objectives for the social-ecological system(s) under consideration
	• Identify alternative paradigms emerging from the ongoing transformation processes
		• Sketch how the three major paradigms manifest in the social-ecological system(s) under consideration
		  • 'Materialistic culture and growth' paradigm
		  • 'Control and autonomy of humans over nature' paradigm
		  • 'Expert knowledge and specialization' paradigm

MESO LEVEL	**Power as conduct-shaping: facilitating change processes**	**Power as context-shaping: challenging incumbent paradigms**

Transformative impact	• Geared to transformative governance approaches (Visseren-Hamakers et al., 2021)
	  • Integrative governance
	  • Inclusive governance
	  • Adaptive governance
	  • Pluralist governance
		• Builds on the amplifying framework by Lam et al. (2021), complemented with insights from Sustainability Transitions and Development Resilience (Brown, 2016; Ingram, 2015; Johansen and van den Bosch, 2017)
		  • Connecting vertically and horizontally
		  • Amplifying within
		  • Amplifying out
		  • Amplifying beyond

MICRO LEVEL	**Just & resilient processes of change**	**Processes of change that challenge incumbent paradigms**

Transformative character	• Geared to general Social-Ecological Resilience principles (Biggs et al. 2012, 2015) and Dynamic Sustainabilities principles of appraisal for sustainability (Leach et al., 2010)
	  • Maintain diversity and redundancy
	  • Manage connectivity
	  • Manage slow variables and feedbacks
	  • Foster complex adaptive systems thinking
	  • Encourage learning and experimentation
	  • Promote polycentric governance systems
	  • Include a diversity of knowledges through participatory engagement
	  • Extend scope and enable choice
	  • Attend to rights, equity and power
		• Deconstructing one or several incumbent paradigms ('unmaking')
		• Proposing alternatives to the incumbent paradigms ('making')

worldviews, forms of knowing and understanding for instance of nature, well-being or prosperity need to be empowered (Hill et al., 2020; Lam et al., 2020). This includes rethinking current scientific systems and adopting more collaborative approaches to knowledge production.

Table 1 summarizes the refined set of evaluation principles for a SET along the three levels of investigation. They have been specified in light of current scientific research and with focus on operationalization for empirical application to specific change processes. In the following sections, we apply these principles to the example of Seed Commons.

3. Case study and methods

Seed Commons initiatives experiment with commons approaches as alternatives to the private-property based and highly concentrated seed sector and thereby challenge ongoing dynamics of commodification and enclosure of seeds and varieties. These initiatives are diverse and reach from seed sharing and conservation networks and communal seed banks to organic and participatory breeding initiatives (Sievers-Glotzbach et al., 2020b). Yet, Seed Commons initiatives share certain features, as they (1) acknowledge a collective responsibility for the protection, provision and development of seeds and crop diversity, (2) aim to protect seeds from private enclosure through both legal and biotechnological means, (3) collectively manage seeds and breeding activities in a polycentric manner through multiple, formally independent centers of decision-making and (4) share formal and practical knowledge within the initiative and beyond (Sievers-Glotzbach et al., 2020b).

As an example of a Seed Commons initiative, we reflect on the transformative potential of Kultursaat e.V., an organic vegetable breeding initiative that embraces decentral, on-farm breeding with 30 breeding locations spread across Germany, Austria, Switzerland and the Netherlands (RightSeeds 2022). Kultursaat considers seeds and varieties as cultural goods and hence refrains from claiming intellectual property rights on these varieties. Kultursaat is a particularly suitable case study, because while having typical values and characteristics of Seed Commons initiatives, it operates in the context of the formal seed system, as it develops new organic varieties for professional farmers. The association formed in 1994 with the aim of increasing the diversity of varieties through breeding and promoting open-pollinated varieties, especially for professional organic farmers and gardeners. Today, the association has registered more than 100 new and 19 conservation varieties with the German Federal Plant Variety Office.[5]

The research draws on and synthesizes empirical data and insights, as well as published research results from the five-year transdisciplinary research project 'RightSeeds', which was carried out in close collaboration with Kultursaat and several other seed (commons) initiatives in Europe and the Philippines. Throughout the project, field research in Germany and the Philippines was conducted, including participatory observation in regular meetings of the initiatives as well as various transdisciplinary workshops and discussions with the initiatives of preliminary research results.

For the micro level (section 6), we are drawing specifically on data from 19 semi-structured interviews conducted in 2018, with both breeders and coordinators of the organization Kultursaat e.V.. The interviews were complemented by the organization's online self-presentation and brochures. For data analysis, a qualitative content analysis was carried out, structured along the incumbent paradigms and alternative visions in the global food system as well as the evaluation principles of resilience and justice for the micro level. The meso level (section 7) integrates and structures previous research within the RightSeeds project (Tschersich, 2021a, 2021b). The analysis was based on four semi-structured interviews and a transdisciplinary workshop conducted with seed initiatives in Germany that focused on policy and advocacy work, combined with online communications and self-representations of various European seed initiatives.

To place Seed Commons in wider dynamics within the agri-food system, for the macro level in the following section, we carried out a literature review on the current scientific debate to outline how the three incumbent paradigms manifest in the global food system and which alternative visions and narratives challenge them.

4. Macro level: Paradigms in the global agri-food system

Seed Commons initiatives aim to unfold transformative change in global and regional food systems. Food systems have been characterized as complex and inherently normative social-ecological systems,[6] as their core goal is to maintain adequate food security for all humans (Hodbod and Eakin, 2015). In face of the massive environmental degradation and multiple injustices inherent to the incumbent global food system, the call for a fundamental paradigm shift has been raised in scientific and political debates. In this section, we will sketch how the three major incumbent paradigms express in the global agri-food system and which alternative narratives and visions have emerged (see Table 2).

4.1. Incumbent paradigms in the global agri-food system

The first incumbent **paradigm of 'materialistic culture and growth'**, which assumes that economic growth would raise social welfare, is also the major argument underlying the industrial agri-food system model and is reflected in its general focus on productivity, increasing yields, agricultural intensification and commodification of agricultural inputs and outputs (Cunningham et al., 2013; Thompson and Scoones, 2009). "Feed the world" narratives (e.g., IPES-Food, 2016: 6f.) argue that increasing food supply is needed to improve the state of food security for a growing world population. In addition, the "pro-poor agriculture growth" narrative, advocated by powerful food system actors, states that economic growth of the agricultural sector in countries of the Global South would also be an engine for growth of the rural non-farm sector and an instrument to overcome poverty (see Thompson and Scoones, 2009). Vivero-Pol (2019) identifies the "food-as-a--commodity narrative" as the dominant scientific and political paradigm linked to the development of the industrial food system. Also, recent visions and paradigms of "sustainable intensification" of agriculture (Bennett et al., 2014; IPES-Food, 2016) are based on the growth para-

Table 2
Incumbent paradigms and alternative narratives in the global food system (own compilation).

Incumbent paradigms in the global food system	Emerging alternatives opposing these paradigms
'Materialistic culture and growth' paradigm • feed-the-world narratives (see IPES-Food, 2016) • pro-poor-agriculture-growth narrative (see Thompson and Scoones, 2009) • food-as a-commodity narrative (see Jackson et al., 2021; Vivero-Pol, 2019) • sustainable-intensification narrative (see Bennett et al., 2014, p. 201; IPES-Food, 2016) 'Control and autonomy of humans over nature' paradigm • green-revolution/gene-revolution narrative (see Conway and Toenniessen, 1999; McMichael, 2000) 'Expert knowledge and specialization' paradigm • e.g. production-innovation narrative (see Thompson and Scoones, 2009)	Agroecology (Anderson et al., 2019, 2021; Gliessman, 2016) Resilient-agriculture narrative (Bennett et al., 2014; Schipanski et al., 2016) Food-as-a human-right narrative (Andersen, 2008; Claeys, 2015; Jackson et al., 2021) • right to food (Claeys, 2014; Claeys and Lambek, 2014) • farmers' rights/rights of peasants (Claeys, 2014) Food/Seed sovereignty (Kloppenburg, 2014; Patel, 2009; Wittman, 2011) Food-as-a-commons narrative (Jackson et al., 2021; Vivero-Pol, 2019) (Farmer) Participatory research and governance approaches (Thompson and Scoones, 2009)

[5] For a list of their varieties, see: Kultursaat (2022).

[6] In his food systems framework, Ericksen (2008) includes food system activities from production to consumption, outcomes in terms of contributions to food security, sustainable environmental management and social welfare, as well as the biogeophysical and socioeconomic drivers influencing food systems activities and outcomes. Food systems are closely interrelated with food, water, energy and climate systems (Weitz et al., 2017).

digm. Critics of the mentioned narratives argue that agricultural intensification and industrialization are main drivers of massive environmental degradation and disturbance of essential ecological processes at the planetary scale (Bennett et al., 2014; Tilman et al., 2002; van Bers et al., 2019). Further, these narratives disregard aspects of social inequity in the agri-food system and deepen inequitable power relations between food system actors (Bennett et al., 2014; Hebinck et al., 2021b; Jackson et al., 2021; Loos et al., 2014; Vivero-Pol, 2019).

The **paradigm of 'control and autonomy of humans over nature'** significantly shapes the industrial food model as well, as agricultural ecosystems are seen as an object, whose resource flows and environmental conditions are widely controllable by humans (Thompson and Scoones, 2009). Closely tied to this view, the **'expert knowledge and specialization' paradigm** shapes industrial food systems: The application of scientific knowledge, especially insights from molecular biology and biotechnology to agriculture, is regarded as a means to increase productivity, food quality and stability in agricultural production (Conway and Toenniessen, 1999; McMichael, 2000). The so-called "production-innovation narrative" concretizes in visions of a (modern) green revolution or gene revolution (Thompson and Scoones, 2009). Today's agri-food systems are faced with accelerating challenges through climate change, chronic stresses on agroecosystems, and the increasing complexity of global food supply chains (Kliem and Sievers-Glotzbach, 2021). Thus, the strategy of striving for optimal, controlled conditions makes agricultural systems less adaptable to diverse stresses and ignores the realities of many smallholder farmers in the Global South, often farming marginal land and being faced with uncertain political-economic conditions (Thompson and Scoones, 2009). Biotechnology-based, general solutions are also problematic from a justice perspective, as traditional and locally adapted knowledge is neglected. The narrow scope of research is connected to the consolidation in the food sector, as dominant agricultural producers have been buying out innovators (IPES-Food, 2017).

To sum up, the three incumbent paradigms in the global agri-food system reinforce each other and strengthen management approaches and technologies that lead to intensification, uniformization and industrialization of agricultural production, neglecting impacts on agrobiodiversity, provision of regulating and cultural ecosystem services, social inequity and power imbalances (Emmerson et al., 2016; FAO, 2019; Hebinck et al., 2021a; IPES-Food, 2016; Jackson et al., 2021; Tschersich and Kok, 2022).

4.2. Emerging alternative narratives and visions in the global agri-food system

Manifold alternative narratives and visions for the global agri-food system have emerged from the ongoing change processes in the last decades. In the following, we provide an overview of these partly overlapping and reinforcing narratives and sketch out in which ways they challenge one or several of the incumbent paradigms in the food system (see Table 2).

Political agroecology is discussed as an overall transformative paradigm in international policy (Anderson et al., 2019, 2021), linked to other narratives and movements such as food sovereignty, rights of peasants, just food transitions and participatory farmer research. Focusing on its ecological and practical management principles, agroecology provides a vision of farming with nature and thereby a promising approach for "re-connecting people to nature" (Abson et al., 2017; Riechers et al., 2021). This is seen as a powerful sustainability intervention to oppose the 'control and autonomy of humans over nature' paradigm. The concept of **resilient agriculture** (Bennett et al., 2014) stresses the need to build agricultural systems that are capable of adapting and transforming in face of current and forthcoming (partly unknown) disturbances. In both science and international policy building, resilience has been identified as a future priority for food governance (FAO et al., 2018; Ingram et al., 2019; Schipanski et al., 2016; Seekell et al., 2017).

The **food-as-a-human-right narrative** (Claeys, 2015; Jackson et al., 2021) and the **food-as-a-commons narrative** (Jackson et al., 2021; Vivero-Pol, 2019) challenge the 'materialistic culture and growth' paradigm. The food rights perspective encompasses democratic participation in food system choices, fair access to all resources for food production, the presence of multiple independent buyers and the absence of human exploitation and excess resource exploitation (Anderson, 2008). It forms the basis for policy framings such as **food sovereignty, seed sovereignty**, and the **rights of peasants**. The food commons narrative has been developed as a strategy of "defence against ongoing commodification (…) and [for] transformation to re-invent or design de-novo forms to use, steward and share resources important for the community outside the market and state logic" (Vivero-Pol, 2019, p. 2).

The concepts of food sovereignty, agroecology and the food-as-a-commons narrative also build a counterweight to the 'expert knowledge and specialization' paradigm – by claiming equal consideration and respect for Indigenous knowledge and non-western worldviews (e.g., Figueroa-Helland et al., 2018). Finally, **participatory research and governance approaches** potentially empower smallholder farmers to engage directly in the processes of research and development of their own agricultural systems (Thompson and Scoones, 2009).

5. Micro level: The transformative character of Seed Commons

At the micro level, we assess the transformative character of Seed Commons, taking the example of the German breeding-initiative Kultursaat. First, we investigate in how far this Seed Commons initiative deconstructs the incumbent paradigms and proposes alternative visions for the global agri-food system, as specified in Table 2. Second, we assess to what extent Kultursaat aligns its internal organization and governance processes with the social-ecological resilience and Dynamic Sustainabilities principles, as presented in Table 1.

5.1. How Seed Commons challenge the three incumbent paradigms

Kultursaat explicitly deconstructs the **'materialistic culture and growth'** paradigm: It claims that plant varieties should not be subject of privatization and control by transnational corporations, since seeds and varieties are regarded as the base of our food system and cultural heritage. Kultursaat's members most prominently refer to food sovereignty as an alternative vision to profit-maximization, commodification and enclosure supported by intellectual property rights. One farmer-breeder of Kultursaat states that "the question about commons-based seed systems is for me part of the wider context about power relations, about dependencies and autonomy" (interviewee KS4, personal communication, own translation). For Kultursaat, not claiming variety protection is a logical consequence to make seed sovereignty possible for European commercial vegetable farmers, including achieving independence from seed companies. Kultursaat places the food-as-a-commons narrative at the heart of its activities: Plant varieties are regarded as cultural goods maintained, developed and passed on from generation to generation. This implies securing free access to varieties and their genetic diversity, production of open-pollinated and hence reproducible seeds, and disclosure of information on newly developed varieties. By registering varieties to its non-profit association, Kultursaat protects them from enclosure and at the same time guarantees that breeding goals are not directed toward profit, but instead toward common welfare. Further, Kultursaat's guiding principle that breeding efforts should not be aimed at profits implies that financing of their projects stems from donations, grants, research funding and breeding contributions from multipliers and organic retailers. One farmer-breeder explains: "We place our work on the development of our new plant varieties (…), but also on the development of cultivated plants in general, in the service of the global community (…) and therefore it is only logical to finance our breeding

work through community-based funds (interviewee KS7, personal communication, own translation).

Although breeding activities generally include directed human interventions into natural selection processes, Kultursaat follows a vision of farming with nature and rejects certain forms of '**control and autonomy of humans over nature'** for ethical and agroecological reasons. A Kultursaat member summarizes this aspect as follows: "I think the essence is actually the image one has of plants, (…) and which actions follow from this image. The interventions are simply different, if I see plants as living organisms and not as economic resources" (interviewee KS13, personal communication, own translation). The initiative hence acknowledges the intrinsic value of plants and the mutual interdependence of humans and nature. Kultursaat opposes biotechnological breeding methods that would treat individual plant cells or genes as objects that could be controlled and manipulated by humans in laboratories. Beyond respecting natural crossing barriers, the vision of farming with nature becomes visible also in decentral on-farm breeding and seed production practices at diverse locations, focusing on the observation and advancement of beneficial interactions between the plants and their specific environments.

Kultursaat challenges the **'expert knowledge and specialization'** paradigm in plant breeding and seed production. All breeders are trained farmers and gardeners who combine practical on-farm experience and knowledge of vegetable cultivation with scientific knowledge of breeding and agroecology, obtained for instance through formal professional education in universities (Sievers-Glotzbach et al., 2020a). Kultursaat highly values the traditional and experiential knowledge that farmers and breeders have accumulated over centuries. Members often refer to the importance of the 'breeders' eye', hence the intuition and tacit knowledge of experienced breeders in selecting plants with suitable characteristics in the breeding process. Some of Kultursaat's breeders also experiment with spiritual and anthroposophical practices such as eurythmy and meditative practices (Sievers-Glotzbach et al., 2020a).

The number and quality of developed varieties by Kultursaat demonstrate the success of their breeding approach. Farmer-breeders from Kultursaat assess it as particularly beneficial to combine vegetable breeding and farming at their location, as gardening knowledge and knowledge of the demands along the value chain can be considered in the variety development process.

5.2. Resilience and justice principles in the organization and governance of Seed Commons

Commons-based plant breeding and seed production have been argued previously to contribute to building resilience in the agricultural sector (Kliem, 2022; Kliem and Sievers-Glotzbach, 2021). We specify this further, by applying the proposed integrated set of justice and resilience principles to Kultursaat. As described above, these are based on Biggs et al. (2015)'s social-ecological resilience principles and the pathway approach of 'Dynamic Sustainabilities' by Leach et al. (2010).

Maintain diversity and redundancy: Kultursaat places a high emphasis on fostering biological diversity. A seed multiplier and Kultursaat member stresses that the main societal value of Kultursaat is "the preservation of varietal diversity. For me, it is an invaluable and highly important cultural good, that we as humans have the possibility also in the future to draw on different varieties from diverse cultivated plant species, to be able to work with them for future generations" (interviewee KS12, personal communication, own translation). At the genetic level, the initiative cultivates diversity through its focus on robust, open-pollinated varieties. At the species level, Kultursaat aims to develop a wider range of organic varieties. At the landscape level, the initiative contributes to agrobiodiversity by focusing on varieties that are bred under organic conditions and are specifically adapted to the requirements of organic agriculture.

Kultursaat further promotes a diversity of institutions and perspectives within its structures. Its members cherish how their colleagues approach breeding differently from themselves and differ in their views about their work and how the association should develop. They also have varying views on strictness and pragmatism toward bio-dynamic farming values. Breeders are organized into working groups focused on specific vegetable species, which allows them to self-organize and independently take decisions on breeding goals and agenda setting.

Manage connectivity: Local interdependence and global autonomy have been deemed particularly important in this context (Cabell and Oelofse, 2012). Kultursaat aims for independence from globalized value chains and agribusiness, by refraining from the use of patented material in its breeding, by developing varieties that are independent from external inputs for cultivation such as fertilizers and pesticides, and by promoting free access to seeds and varieties. A farmer-breeder mentions this aspect as the central contribution of Kultursaat: "The most important for me is a certain gained independence of the gardener, because gardeners have become extremely dependent on seed suppliers in the last hundred years" (interviewee KS14, personal communication, own translation). At the same time, the association fosters a high degree of local connectedness, by encouraging the use of regional resources (e.g. local planting and breeding material or fertilization from regionally available resources) and engaging in collaborations, for instance with the seed producer Bingenheimer Saatgut AG.

Manage slow variables and feedbacks: Kultursaat focuses on the development of robust varieties that are specifically adapted to local biophysical conditions. Acknowledging that continuously changing climatic conditions are a particularly relevant variable (Hampton et al., 2016), the initiative breeds varieties decentrally and in-situ (on farm), to expose new varieties to local environmental and climatic conditions. Through the continuous cultivation of varieties, they can slowly adapt to local particularities and develop robustness due to the long-term exposure to local environmental pressures.

Foster complex adaptive systems thinking: Kultursaat adopts holistic breeding and seed production approaches, based on a worldview of working with nature. It aims to take into consideration the complex social-ecological systems of which they are part. Hence breeders stress that they will not interfere with single genes of plants in laboratory conditions, but rather 'guide' the plants in adapting as a whole to the specific agro-ecological conditions in which they are embedded. The resulting newly bred vegetable varieties are "particularly suited for specific local conditions, but not globally. So, I see this as an advantage", comments a farmer-breeder (interviewee KS12, personal communication, own translation). While breeding locally, the initiative sees its work in the context of global and local power dynamics, such as increasing concentration and privatization in the food sector, as well as ecological and economic constraints. In light of current trends of agricultural intensification and digitalization, it does not oppose progress, but adopts a 'no regrets' approach to risk management and strives to align its practices with sustainability and resilience goals.

Encourage learning and experimentation: Kultursaat encourages collective learning, sharing of experiences and experimentation through various means. In self-organized, crop-specific working groups, members can share insights and experiences and critically discuss their current breeding projects. Moreover, regular farm visits and meetings within the broader organic breeder community allow for continuous knowledge exchange and capacity building. Moreover, Kultursaat breeders are encouraged to engage in experimentation during variety development and they embrace creativity and observation to advance existing knowledge and generate novelty. Kultursaat has also developed its own two-year training program for new breeders, in which members pass on both theoretical and practical breeding expertise from one generation of breeders to the next.

Promote polycentric governance systems: Kultursaat has polycentric governance structures. While the association follows shared values, objectives and principles, it relies on organizationally and financially independent breeders, organized in crop-specific working groups, which have a great degree of decision-making competencies.

Breeding projects are carried out decentrally and are spread across various locations in four countries, which allows for adaptation to specific local needs. The decentralized organizational structure of the initiative allows for flexible, local responses to changing social, economic and environmental conditions. Is also ensures that farmers' and breeders' needs are at the center of all decisions.

Include a diversity of knowledges through participatory engagement: Kultursaat makes use of a diversity of knowledge types and sources, as well as degrees of knowledge formality. The initiatives' farmer-breeders come from different knowledge backgrounds, varying from trained to studied to self-taught. Many have formerly worked in conventional farming and breeding. This formalized and/or scientific farming and breeding knowledge is then complemented by traditional, experimental organic and localized knowledge, depending on the individual farmer-breeders' inclinations.

Extend scope and enable choice: The production and distribution of seeds is organized following an alternative set of institutions, creating a new choice option for external actors. Ensuring long-term access to organic varieties as a cultural good is a central aim of Kultursaat. It develops new seeds and varieties and provides them in an open manner, without claiming property rights that would restrict access of farmers, gardeners and breeders. As one interviewee highlights: "It is precisely what we want, that farmers and gardeners have reproducible varieties. (…) We are actually really happy when other firms and also individuals make more seeds from our varieties" (personal communication, interview KSI, own translation). The organization's main contribution is providing varieties adapted to low-input, organic agriculture, especially for European farmers. Thereby it fills a void left by the conventionally-bred and organically-multiplied seeds that are often still used in organic farming due to the lacking availability of seeds from organically bred varieties. Hence, the development and provision of new organic varieties offered by Kultursaat effectively broadens farmers' choices.

Attend to rights, equity and power: Kultursaat is characterized by democratic, non-hierarchical decision-making processes. Within Kultursaat, members have one voice each and decisions are taken by consensus whenever possible. We did not find evidence of conscious processes of reflecting on implicit power dynamics that might arise for instance through knowledge hierarchies. As Kultursaat breeders of different generations vary in their views on biodynamic breeding and on public presentation of the organization, there have been requests by some members for a more attentive conversation culture and equity of perspectives in decision-making processes.

To sum up, the example of Kultursaat shows how this Seed Commons initiative connects the criticism of the three incumbent paradigms with its claim for strengthening food and seed sovereignty, farmers' rights and agroecology. They further implement justice and resilience principles in their own internal organization and governance processes to a great extent.

6. Meso level: The transformative impact of Seed Commons

The meso level aims to assess whether transformative change processes of Seed Commons reach beyond the niche to impact larger societal processes and structures. In this section, we first briefly evaluate food and in particular seed governance structures with regard to their integrative, adaptive, inclusive and pluralist qualities, to assess in how far they are able to facilitate transformative change. We then assess to what degree Kultursaat and similar seed initiatives in Europe have challenged incumbent power relations and paradigms manifested in these governance structures.

6.1. Top-down: Global food governance stabilizes the incumbent regime

For the global agri-food and seed sector, a low degree of *integrative governance* must be asserted. Food governance is a highly fragmented and complex field stretching across various sectors, policy domains and scales (McKeon, 2021). The 'regime complex' around food (security) spans various, partially overlapping regimes with distinct actors and forums, including climate change, agriculture and food, international trade, human rights, biodiversity conservation, development and humanitarian assistance (Margulis, 2021; McKeon, 2021; Tschersich, 2021a). These regimes often have diverging norms and objectives that lead to conflicts across issue areas of governance, in particular between trade regimes or intellectual property rights regimes and biodiversity conservation and access and benefit-sharing regimes (Tschersich, 2021a). In addition, global food governance is strongly shaped by multi-lateral corporations and public-private partnerships (McKeon, 2021). The UN Committee on World Food Security (CFS) provides a coordinating body for food governance with the mandate to develop guidelines and recommendations (Clapp, 2018) and aims to promote a more systemic view on food systems and their transformations (McKeon, 2021). However, this forum is threatened by the increasing role of large corporations in global food governance (McKeon, 2021; McMichael, 2021).

A lack of *adaptive governance* is reflected in the productivist, technocratic and free market orientation in (global) food governance (McKeon, 2021). For seeds in particular, this is institutionalized in the systems of variety approval, variety protection and patents on seeds that stimulate the development of uniform, high-performing varieties for cultivation in highly-mechanized monocultures under optimal conditions (Tschersich, 2021a). These varieties provide only limited resilience in face of changing climate or marginal cultivation conditions. The regulations hence do not account well for uncertainty and learning, as they restrict the use of more heterogeneous varieties or populations as well as on-field adaptations (Tschersich, 2021a).

Contrary to *inclusive governance*, food governance is strongly affected by market and power consolidation which significantly shapes decision making (Clapp, 2021). This is reflected for instance in the 2021 UN Food Systems Summit, which has been widely criticized for its corporate capture, as well as its lack of basic democratic principles such as transparency and accountability, with insufficient voice given to marginalized stakeholders (Canfield et al., 2021). As such, the current institutional structures favor already powerful actors at the expense of more marginalized actors. The CFS as a highly inclusive forum based on a human-rights framework addresses these power imbalances by giving voice to small-scale producers, Indigenous peoples and other civil society actors, but its impact on wider food governance remains limited (Canfield et al., 2021; McKeon, 2021; McMichael, 2021).

The incumbent paradigm of expert knowledge and specialization affects potentials for *pluralist governance*: As discussed above, current food governance strongly relies on expert and technological knowledge. These Western types of knowledge are reflected in various institutions such as the uniform standards to variety approval or the possibility of granting private (intellectual) property rights on plants. In the International Seed Treaty and the Convention on Biological Diversity, regard has been given to including diverse types of knowledge and perspectives, including traditional knowledge, yet the focus is still on technical and scientific knowledge (Sievers-Glotzbach et al., 2020a). The High-Level Panel of Experts, a supportive science-policy interface body to the CFS, has taken a more pluralist approach by integrating different forms of expertise in its assessments. It promotes alternative visions for a transformation of food systems, such as agroecology.

6.2. Bottom-up: Seed initiatives challenge incumbent paradigms through advocacy and network building

In light of these rather unfavorable frame conditions, network building plays a central role for Seed Commons initiatives to enhance their transformative impact: Kultursaat e.V. emerged from the 'Initiative Circle for Vegetable Seeds of Organic and Biodynamic Gardeners'. Within and beyond this group, Seed Commons in Germany have built **horizontal networks** across the value chain. These range from various

biodynamic and organic breeding and seed conservation initiatives, over seed multipliers, the organic seed distributor Bingenheimer Saatgut AG and the biodynamic cultivation association Demeter, to foundations supporting organic agriculture. Moreover, they include retail (e.g. the supermarket tegut) and food processing (e.g. the organic juice producer Voelkel). They are also **connected vertically** in organic associations and policy and advocacy networks such as the German interest group 'IG Saatgut', the platform for organic breeders in Europe 'Bioverita', the European Consortium for Organic Plant Breeding (ECO-PB), the European and International Research Institute of Organic Agriculture (FiBL) and the International Federation of Organic Agriculture Movements (IFOAM).

This strong engagement of seed (commons) initiatives in networks helps to enhance their impact on all of the three dimensions of the amplification framework. The horizontal network of Kultursaat around the Initiative Circle supports **amplifying within** and **beyond.** Alternative ways to financing breeding are developed to enhance financial robustness **within**: Kultursaat receives variety development contributions e.g. from Bingenheimer Saatgut AG, funding for breeding from foundations, and a breeder's cent is experimented with to include retail and consumers in costs for variety development. Kultursaat officially registers its varieties with the German Federal Plant Variety Office, which puts it on solid legal ground. Kultursaat's cooperation with Bingenheimer helps to professionalize seed treatment and distribution to organic farmers beyond the initiative. Moreover, the networks also support **amplifying beyond** as best practices of Seed Commoning are shared in the Initiative Circle and can hence spread to other initiatives and across the value chain. As an example, in 2021, the Initiative Circle's work was recognized on an international level by IFOAM's Organic Farming Innovation Award 2021. Its cooperation across the value chain also increases independence from the conventional sector.

As Seed Commons initiatives are embedded in complex governance structures that strongly affect their work (see Tschersich, 2021a, for a comprehensive analysis), **amplifying out** necessitates building supportive institutions to enhance their transformative practices. Kultursaat's close cooperation with the German Federal Plant Variety Office has contributed in this regard. It led to the adaptation of procedural guidelines for field testing to account for the specific characteristics of open-pollinated vegetable varieties. This eases the adoption and diffusion of organic varieties in the formal seed system and thereby in organic cultivation (Tschersich, 2021b). Yet, the cultivation of these varieties in organic farming is still marginal, and its produce hardly reaches retail and end consumers (Rohe et al., 2022). Key barriers to the wider diffusion of organically bred varieties are the lacking knowledge and awareness of organic breeding, and a mismatch of values and institutional logics of organic breeding initiatives and further along the value chain (Rohe et al., 2022). The conscious decision not to focus on yield optimization and standardization as main objectives in breeding is in stark contrast to the dominant logic of the conventional agri-food system. While this complicates diffusion and upscaling of Seed Commons in the current system, challenging this underlying paradigm of growth is also what makes these Seed Commons initiatives transformative and prevents co-option within the incumbent regime. Hence there is a tension between the societal reach of the initiatives, and maintaining their transformative potential in this process.

European seed initiatives have also advocated for and taken legal action against patents, especially through the initiative 'No Patents on Seeds', which has resulted in the withdrawal of patents and a reevaluation of standards for granting patents.[7]

Moreover, seed initiatives are mobilizing norms advocated by the Convention for Biological Diversity and the International Seed Treaty such as 'farmers' rights' and 'conservation and sustainable use of (plant) genetic resources' in past and current reforms of seed legislation (see Tschersich, 2021a). This has contributed to essential derogations in EU guidelines to otherwise strict (uniformity) standards for the approval of varieties (Tschersich, 2021a). Moreover, the recently reformed EU Organic Act now allows for organic heterogeneous material to be distributed without registration (Tschersich, 2021b). However, awareness of the values and practices of Seed Commons is still marginal across economic, political and societal spheres, and a paradigm shift in wider society has not yet been achieved.

7. Discussion and conclusion

In this paper, we have argued that small initiatives can contribute to larger agri-food transformations, if they challenge and unmake incumbent unsustainable paradigms and promote alternative narratives both within their own initiative (micro level) and in their attempts to upscale and reach broader societal impact (meso level). In this way, focusing on paradigms as central levers of change can help to connect different levels of transformations.

By applying the SET framework to Seed Commons, we show that the incumbent paradigms of 'materialistic culture and growth'; 'control and autonomy of humans over nature' and 'expert knowledge and specialization' are deeply embedded in the dominant agri-food system. In order to achieve fundamental change, these need to be altered. We identified several emerging alternative narratives that aim to rethink and transform food systems toward visions of agro-ecology, food sovereignty and resilience. These include diverse value perspectives on food and seeds more generally, highlighting food and seeds as commons, cultural goods, or as a human right (Vivero-Pol, 2017).

Our analysis shows that alternative visions outlined for the macro level correspond well with Seed Commons initiatives: By emphasizing multiple values associated with seeds and striving toward farmer empowerment and food sovereignty, Kultursaat challenges incumbent paradigms and aims for food system transformation. The initiative can be attributed a transformative character, as its work also strongly aligns with resilience and justice principles. It follows a holistic approach that regards seeds and breeding as embedded in the wider agro-ecological system, applies organic principles and strives to enhance resilience and agrobiodiversity. Moreover, Kultursaat aims to be inclusive, values a diversity of perspectives and knowledges and encourages learning. Kultursaat's strong value set in opposition to incumbent paradigms prevents co-option of the initiative, but also limits its reach for instance to conventional food retail. Yet, to enhance transformative impact, Seed Commons initiatives are engaged in extensive network building, which has helped them in creating visible political impact. They have been successful in altering several regulations (bottom-up) to enhance their scope for action. However, the dominant institutional and power structures especially in food and seed governance are still major barriers to fundamental agri-food systems transformation (top-down).

The application of the SET framework to Seed Commons and agri-food transformations has proven its suitability for in-depth empirical analysis. The adaptation of the original set of evaluation principles to the agri-food context and newer contributions in the field shows the high flexibility of the SET framework. This is a valuable asset in light of the dynamic nature of the transformation discourse, as it allows to systematize even evolving literatures and frameworks. A wider empirical application can help to further improve, adapt and operationalize the proposed evaluative principles depending on the specific empirical context.

A broader application of the framework could also serve to link individual cases, to enhance comparability across case studies and increase cross-case learning (see El Bilali, 2019a; Weber et al., 2020). Moreover, this could help initiatives with boosting their transformative impact by pointing to areas for improvement. For instance, to enhance effective political action, collective power and the ability to replace current structures, Seed Commons initiatives could further extend their networks to other initiatives across the value chain and across sectors.

[7] See for more information: No Patents on Seeds (2022).

Collaborations with the climate (justice) movement could help to challenge wider socio-economic system structures and underlying paradigms beyond the food sector. This also shows that the orientation of the framework to wider social-ecological system (dynamics) can enhance analytical linkages between agri-food transformations and other sectors and issue areas. As emphasized in the literature, this is of particular importance as food is at the nexus of climate, land, energy and water (Hebinck et al., 2021a; Liu et al., 2018). The reference of the SET framework to incumbent paradigms as overarching functional principles of the current system and its normative orientation toward overall intra- and intergenerational justice objectives are well suited in this regard.

Due to the complex nature of the framework, a comprehensive analysis of the various dimensions of transformation can be challenging to realize within the scope of an academic paper. Consequently, the framework serves best as an integrative tool to combine and evaluate (previous) empirical insights on the transformative potential of change processes or focus on specific dimensions of the framework in more depth. As such, it can help to highlight blind spots in previous research, for instance by providing a critical evaluation of transition experiments and processes from perspectives of power or justice, or with regard to their potential cross-scale effects. This makes the SET framework a suitable tool to structure larger research programs or projects around transformation.

Credit author statement

Julia Tschersich: conceptualization, methodology, investigation, analysis, writing – original draft and review/editing, visualization, Stefanie Sievers-Glotzbach: conceptualization, methodology, investigation, analysis, writing – original draft and review/editing, supervision, funding acquisition, Lea Kliem & Nina Gmeiner: methodology, investigation, analysis, writing – original draft.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

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