Co-designing interventions with on-going circular initiatives to accelerate transformative change

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Abstract
Achieving a circular bioeconomy requires transformative change. Circular initiatives have emerged as frontrunners by demonstrating alternatives through which they generate new

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knowledge and avenues for transformative change. This paper explores how researchers can accelerate initiative's contribution to transformative change by applying transdisciplinary action research. We analysed five interventions, collaboratively designed and implemented by researchers and practitioners, to accelerate key mechanisms crucial for initiative's development. Within the interventions researchers adopted diverse roles, including process facilitator, knowledge broker and change agent. We linked these roles to key mechanisms—such as partnering, professionalization, or learning by doing—to understand how researchers can increase their societal impact through research. Our findings highlight the value of balancing researchers' capacities to play certain roles with the activation of key mechanisms to drive transformative change and support the long-term success of circular initiatives. Furthermore, collaborating with ongoing initiatives, rather than starting new, allows researchers to build on existing achievements, learning and partnerships, fostering a more appreciative approach.

Keywords
Transformative change, Initiatives, Action Research, Circularity, Interventions, Co-design, Mechanisms, Circular bioeconomy

Introduction

The transformation towards a circular bioeconomy (CBE) is considered a promising answer to society's environmental challenges (Muscat et al., 2021; Desing et al., 2020). The success of this transformation depends on society's ability to achieve what is considered 'transformative change.' Transformative change entails '*a fundamental, system-wide reorganization across technological, economic and social factors, including paradigms, goals and values*' (The IPBES Global Assessment, 2019).

Circular initiatives are recognized as important building blocks for such transformations by demonstrating real-life alternatives to the linear fossil-based economy (Bennett et al., 2016). As initiatives evolve, mature, and intensify, their contributions and influence can expand significantly (Linnér & Wibeck, 2021; Tozer et al., 2022). Consequently, within the literature, significant attention has been given to the question of how to bring circular initiatives to their full potential and accelerate their impact (Hebinck et al., 2021; Lam et al., 2020).

However, current research approaches seem insufficient to delivering the knowledge necessary for addressing complex problems, such as fostering the transformative change needed for the CBE (Newig et al., 2019; Sachs et al., 2019). There is a growing recognition that '*science, policy, and practices are not distinct sets of processes, but they are interlinked and co-evolving*' (Tengo & Andersson, 2022), and the involvement of stakeholders and their knowledge is necessary to generate socially robust knowledge (Turnhout et al., 2020). In response to the lack of integration and co-development of scientific knowledge with those who use or help generate it, transdisciplinary research has emerged as a collaborative, solution-oriented approach to address these challenges

(Belcher et al., 2019). Action research emphasizes problem-solving and taking action to address specific challenges, in this case circular initiatives contributing to a circular bioeconomy (Stringer, 2007). Transdisciplinary Action Research (TAR) promotes active engagement and mutual learning among researchers from various disciplines and societal actors throughout the research process (Klein, 2020; Stokols, 2006).

Previous research has identified several roles that researchers can play within TAR, varying in levels of engagement and types of knowledge contribution. Wittmayer and Schäpke (2014) defined five ideal-type roles: reflective scientist, self-reflexive scientist, change agent, process facilitator, and knowledge broker. While these roles help understand how researchers can engage with circular initiatives, they do not necessarily clarify which transformation processes researchers contribute to or how these initiatives can be supported to generate transformative change.

This paper contributes to a clearer understanding of how researchers can support transformative change in circular initiatives. Drawing on eight mechanisms identified as drivers of transformation (Schagen et al., 2023), we explore how interventions co-designed by researchers and practitioners can activate these mechanisms. Our central question is: *How can interventions, co-designed by researchers and practitioners, boost the transformative change of promising circular initiatives?* We address this by reflecting on a transdisciplinary action research project at Wageningen University & Research, involving five initiatives between April 2021 and December 2023. The interventions show how researchers can tailor their roles and capacities to specific mechanisms, enabling feasible and lasting contributions to initiatives. In the following sections, we detail the research background and conceptual framework, explain our TAR approach, describe the intervention activities, and reflect on the mechanisms addressed through these interventions in relation to the adopted researchers' roles, followed by the discussion and conclusion.

Background and conceptual approach

This research took place in the context of the project 'Connected Circularity: Changing Together,' which involved an interdisciplinary core team of nine researchers from Wageningen University & Research who co-created their approach, methodologies, and results with circular initiatives (Figure 2). The project's aim was to understand how circular initiatives sustain or increase their contribution to transformative change (Schagen et al., 2023), and to build on these insights by designing interventions to support circular initiatives using a TAR approach. In this paper, we present the approach, process, outcomes, and reflections on these interventions.

Within the project, we adopted a "small wins" perspective, which understands transformative change as occurring through the continuous accumulation of concrete in-depth results at a moderate scale (Salo et al., 2022; Termeer & Metze, 2019). This perspective is rooted in appreciative inquiry, which emphasizes that focusing on results and strengths open up new possibilities for change (Cooperrider & Whitney, 1999). Following the small wins concept, we understand the contribution of circular initiatives to transformative change as taking place through their further deepening, broadening, and spreading (Schagen et al., 2023). *Deepening* involves an initiative becoming more radical and circular in its ambitions, organization and practices. "More radical" means challenging

underlying assumptions, paradigms, and values (Silvius et al., 2023). "More circular" refers to addressing higher circularity principles, such as shifting from recycling to reducing the use of resources (Muscat et al., 2021). *Broadening* refers to the integration of sectors, ambitions and agendas (Moore et al., 2015; Termeer & Metze, 2019). This includes closing resource and nutrient loops to promote circularity and sustainability, as well as promoting improvements in other areas such as health, education and social equity. Lastly, *spreading* means expanding an initiative by increasing its members, outreach and locations.

Based on a previous study (Schagen et al., 2023), we identified eight mechanisms that contribute to broadening, spreading, and deepening (Table 1). When analysing these mechanisms across a broader set of circular initiatives, we found that deepening the circularity of an initiative primarily occurs through learning by doing, while spreading was facilitated by professionalization, and broadening by partnering (Schagen et al., 2023).

Integrating a transdisciplinary action research approach within the research activities

TAR challenges the linear knowledge production approach in which the role of research is to simply 'deliver' knowledge to decision makers and stakeholders for it to be turned into action (Turnhout et al., 2013). Instead, it states that, to be socially robust and effective, knowledge production and translating this knowledge into action should be more intertwined (Tengo & Andersson, 2022). In our project, we integrated a TAR approach by applying insights on how initiatives develop through mechanisms in the co-design of eight interventions. These interventions aimed to stimulate initiative's further deepening, broadening, and spreading. In the following section, we will provide an overview of the key project activities through which we integrated a TAR approach, and in the next section elaborate on the two levels visible in our approach.

As illustrated in Figure 1, the initial phase of the project consisted of researchers' activities. In monthly meetings, we discussed key concepts (i.e. small wins, mechanisms, and deepening, broadening, and spreading), methods (including interviews, observations, and document analysis), and empirical insights gained. Researchers selected cases within their respective domains (i.e. marine, environment, livestock, biobased products, economy, horticulture), resulting in a set of seventy-eight initiatives. After an initial quick scan, we conducted an in-depth study of thirty-one cases, with approximately five in-depth cases per domain (Schagen et al., 2023, case description format in Online Appendix 1).

Following the initial phase of knowledge building within the project team, the second phase involved collaborative activities with the initiative's representatives. We began by organizing a workshop with these initiatives, focusing on potential interventions (Online Appendix 6 for visual documentation). Drawing on the workshop's insights and the previous case analyses, each project member selected an initiative for further collaboration, prioritizing opportunities for co-designing an intervention and the initiative's willingness. This process led to the selection of eight interventions: five were successfully executed, while three stranded (see section 5 for further elaboration on the stranded interventions).

Table 1. Definitions of eight mechanisms (Schagen et al., 2023).

Mechanisms	Description
Energizing	Concrete outcomes and visible results provide actors with the excitement that these are attainable, thereby encouraging them to look ahead for the next step. A reassuring process of commitment, optimism and trust in the actors involved and the results
Professionalization	Becoming (formally) recognized as a serious player instead of an outsider or temporary experiment. This is for example reflected in the ability to acquire funding and subsidies or being invited to official meetings
Logic of attraction	Financial and human resources tend to flow towards winners and create the preparedness and goodwill to lower financial or legislative barriers. Moreover, positive results discourage the usual opponents and lower existing political and societal resistance
Learning by doing	Uncover resources and barriers, provide quick feedback on the effectiveness of strategies, offer immediate insights into system reactions, and encourage reflection on personal and other belief systems
Partnering	The pooling of resources, competences and capacities between different relevant actors who define shared norms and interests within preferably long-term cooperation. Expanding and connecting the level playing field of the initiative
Stabilizing	The advantages of the practices and narrative of an initiative and the disadvantages of the status quo are internalizing in the minds and routines of actors like members, partners and institutions; making them resilient to resistance and ensuring continuity
Embedding	The embedding of an initiative implies the adoption and integration of its design, approach or outcomes into existing local structures (institutions, regulations, planning, agenda and ambitions) and/or communities of practice
Replicating	The effect when other individuals, companies and organizations start copying the approach or/and practices of an initiative

Within the project team, we developed a standardized format to document each intervention's initial plan and expectations (Online Appendix 2). These expectations outlined how the intervention could address specific mechanisms to facilitate deepening, broadening, and spreading. Moreover, we conducted two interviews (before and after) each intervention with representatives from the initiative to discuss the results and process. Each researcher then wrote a summary and provided advice based on their experiences and reflections (Online Appendix 3 and 6). Further reflection came from the third workshop with the initiatives and a project meeting with the researchers. We also recorded four podcasts: three with initiatives and one discussing the project more broadly and a
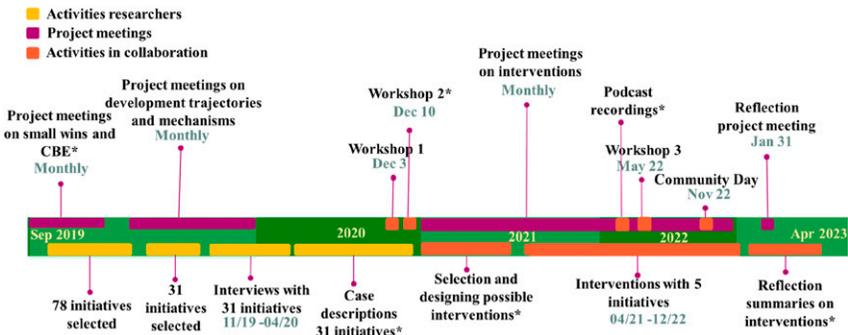
Figure 1. Timeline of most important project activities (*material in Online Appendix).

recording of the lecture on circular horticulture (Online Appendix 4). Interventions also generated additional documentation, such as reports on workshops.

Two levels within our approach

When exploring how researchers can actively engage with and support circular initiatives for transformative change, we identify two levels within our TAR approach. The first level involves conducting TAR in collaboration with representatives from five initiatives. The second level entails the TAR process across the interdisciplinary team (Figure 2). Within the first, our aim was to advance these initiatives by activating mechanisms like professionalization and partnering, ensuring their development beyond initial collaboration. The 'action' component within our TAR research approach is particularly prominent here.
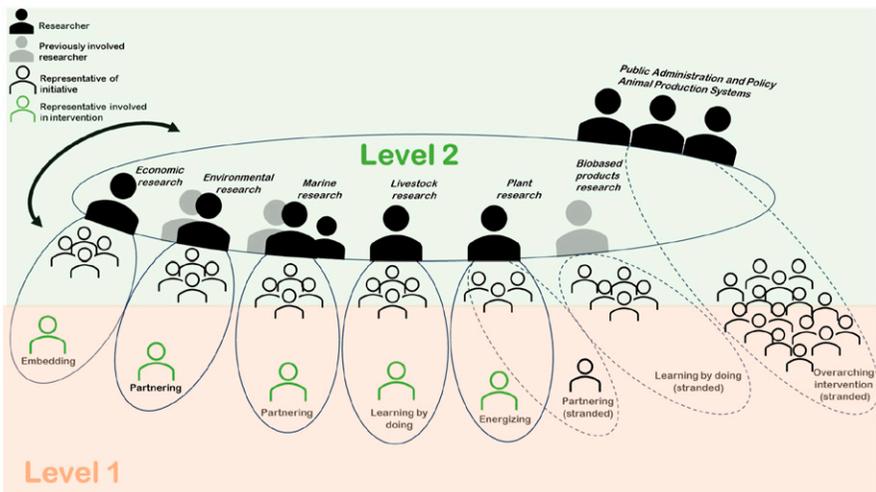

Figure 2. Visualization of the two levels visible within our TAR approach.

Through interviews and workshops focused on pathways to deepen, broaden, and spread these initiatives, initial intervention ideas emerged. It became evident which initiative representatives were enthusiastic and engaged in the project. Each researcher closely collaborated with one initiative they had previously interviewed within their domain. Depending on the collaboration, project members either proposed interventions themselves (Kwatrijnstable, Lecture Circular Horticulture) or worked with initiative representatives to refine objectives (Testlab Tiny House & Forestry, North Sea Farmers, Future Farmers). These initial proposals were co-designed and implemented collaboratively. Throughout the interventions, there was an iterative process of designing and adjusting interventions between researchers and the project team.

The second level involves the interdisciplinary team process. During monthly project meetings focused on interventions, achieving consensus on the definition of an 'intervention' initially posed challenges. It became evident that researchers not only came from different disciplines but also from diverse research traditions. One researcher withdrew early in the project, primarily due to discomfort with the project setup. Later, another researcher withdrew worrying about time constraints for implementing the intervention. In the intervention phase, a third researcher withdrew due to external circumstances.

To understand and reflect on the diverse ways researchers engaged with the initiatives we apply the ideal types of researcher's roles (reflective scientist, self-reflexive scientist, change agent, process facilitator, and knowledge broker) as identified by Wittmayer and Schäpke (2014). In short, the reflective scientist is characterised by traditional research activities such as data collection, analysing and reporting, in which a high level of objectivity is aimed for. The process facilitator initiates and coordinates the learning process across different actors. The knowledge broker takes one step further by acting as an intermediary by connecting and integrating different perspectives and types of knowledge. The role of change agent refers to researchers actively participating in the formulation and facilitating processes with other actors towards solutions of sustainability challenges (Wittmayer & Schäpke, 2014). The self-reflexive scientist reflects on their own role and position in the sustainability challenges it aims to address.

The co-design of interventions

Through the co-design of five interventions, our aim was to accelerate mechanisms enhancing the broadening, deepening, or spreading of circular initiatives. Given the diversity of disciplines, researchers, and initiatives in our project, the resulting interventions varied greatly in nature. In this section, we describe and visualize the processes of the five interventions carried out in collaboration with circular initiatives, along with the main mechanisms they addressed.

Future Farmers: Embedding

The first intervention aimed to connect the Future Farmers initiative with the Ministry of Agriculture, Nature and Food Quality, to increase recognition of alternative sustainable farming practices in legislation (embedding). It included four key activities (Figure 3). First, the researcher organized an introductory webinar on agroecological farming for policy makers from the Ministry's Circular Agriculture working group. Second, a half-day event was held on an agroecological farm—co-organized by the researcher and farmers—including a farm tour, lunch, and discussions on key themes, with twenty-one participants exploring barriers and opportunities. Knowledge gaps and the need for innovation emerged, particularly around monitoring, which led to the third activity: a co-design session involving thirty-three participants (farmers, researchers, policy makers, and intermediaries) to develop a research agenda for integrating agroecological practices into monitoring and evolving a Key Performance Indicators (KPI) based reward scheme. At the same time, a fourth activity unfolded: the participating farmers collaborated with other sustainable farming organizations to develop a Green Farming Plan, advocating for their shared interests. Throughout, researchers and the working group supported the process by translating outcomes into policy input, helping embed future farmers and their practices within broader agricultural policy frameworks.
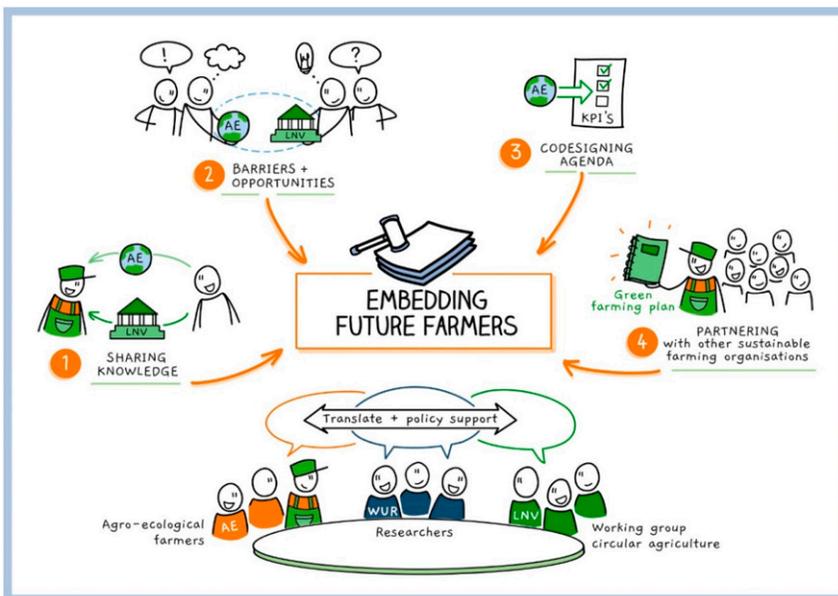

Figure 3. Activities aimed at embedding Future Farmers.

Testlab Tiny House & Forestry: Partnering

Together with the representative of Testlab Tiny House and Forestry, we aimed to develop a pilot case that combined ambitions for increased forestry and sustainable housing, offering a potential business model for converting agricultural land to forest. The intervention followed five steps (Figure 4). First, we focused on engaging potential landowners. Two meetings were co-organized with the initiative's representative to pitch the tiny house–forestry concept to agricultural brokers and appraisers. A third meeting, held with a landowner organization and attended by thirty estate owners, sparked lively discussion, though no follow-up actions have materialized yet. Since engaging landowners proved challenging, as a third step we articulated the barriers they experienced. In the fourth step, we organized workshops at a circularity conference to explore the added value of multifunctional land use across policy domains. Based on insights from these workshops, we identified two alternative pathways as a final step: partnering with the 'Peel Nature Villages' pilot and strengthening ties with supportive municipalities to access public land.
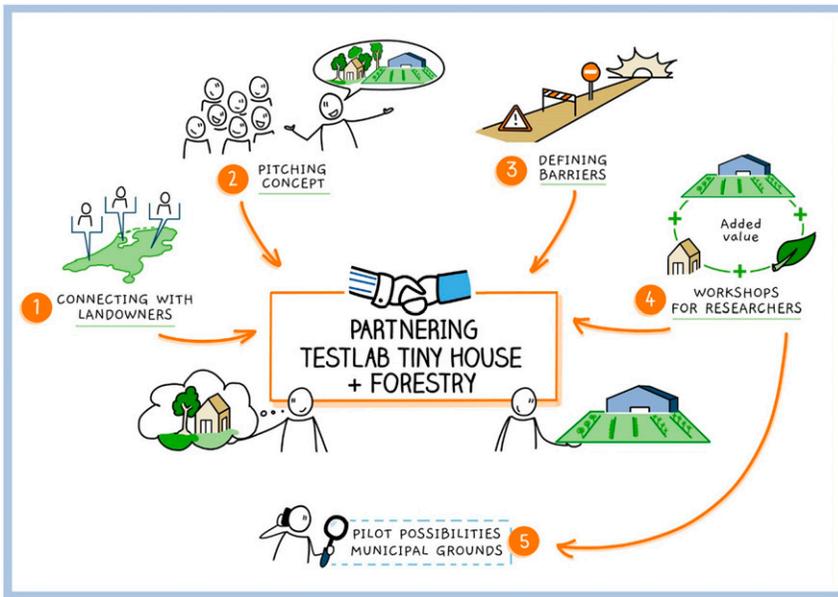

Figure 4. Activities aimed at partnering for Testlab Tiny House & Forestry.

Kwatrijnstable: Learning by doing

Collaborating with Kwatrijnstable's farmer, we improved farm circularity by refining manure management, assessing current practices, designing new measures, and evaluating various substrates for richer organic manure. This effort involved two workshops. The first workshop focused on redesigning the flooring and storage system to improve

manure management and reduce ammonia and greenhouse gases emissions. Participants included livestock producers, advisors, emissions experts, and manure management specialists. We developed options for better manure separation and straw-manure storage. The second workshop aimed at identifying circular alternatives to imported straw and designing an assessment framework to evaluate the circularity of for these and other thinkable alternatives. This session involved dairy farmers, representatives from nature conservation organizations, and experts in manure management, environmental technology, agroecology, biomaterials, and biorefinery. Substituting imported straw with local residual substrates could enhance manure management. The results of these two processes were compiled in user-friendly documents in Dutch.

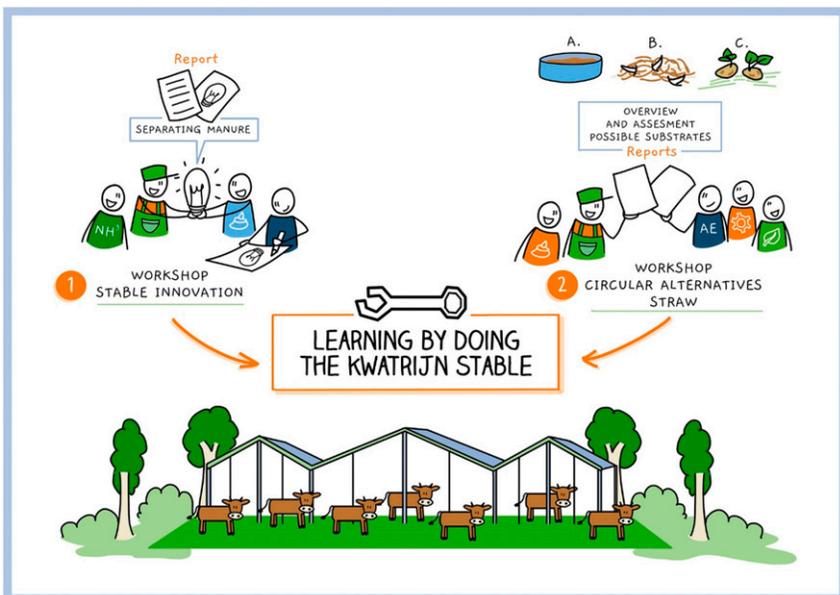**Figure 5.** Example of a visual produced in the design-workshop.

Figure 6. Activities aimed at learning by doing for the Kwatrijnstable.

North Sea Farmers: Partnering

Together with the representative and partners of North Sea Farmers, we explored the risks of multi-use in the North Sea, where goals like biodiversity, food production, and wind energy intersect. Since multi-use initiatives can introduce new risks, permit applicants must submit a risk and mitigation analysis for their proposed activities. North Sea Farmers, as a sector organization, supports its members by developing a standardized risk evaluation template. In this intervention, researchers first analyzed and refined an initial risk register for multi-use activities (Figure 7). Next, stakeholder interviews were conducted with wind farm operators, multi-users, government agencies, and the Coast Guard. Insights from these interviews informed an improved risk evaluation template. Finally, a dialogue session was co-organized to address stakeholder concerns and further develop the register.
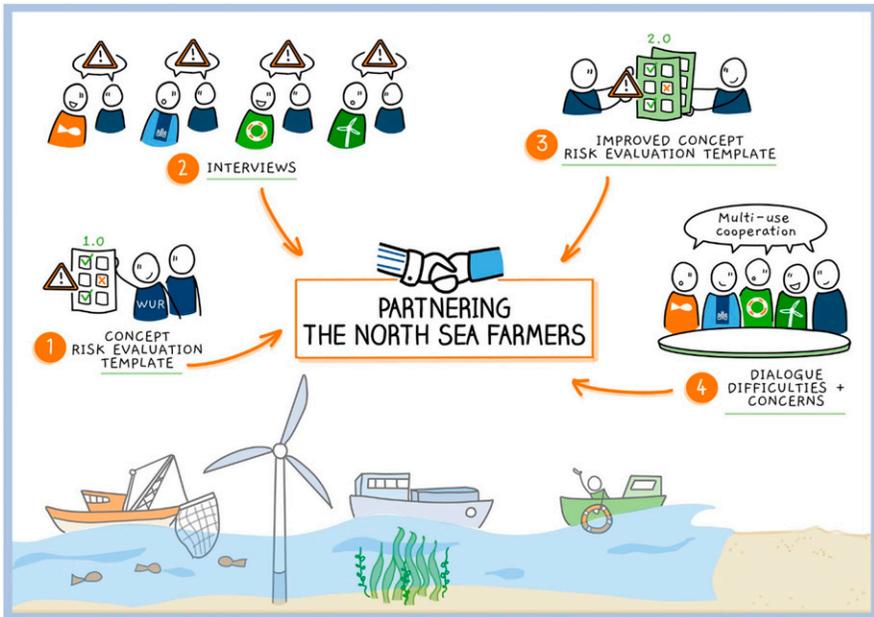

Figure 7. Activities aimed at partnering the North Sea Farmers (correction visual: active fishing close to offshore wind farms is not allowed).

Lecture Circular Horticulture: Energizing

As an alternative to the stranded intervention with Value of Water, we organized an interactive lecture featuring pioneering horticulturalist Ted Duijvestijn of Duijvestijn Tomatoes (Figure 8). The intervention aimed to (1) showcase the possibilities of circular horticulture, (2) connect students with innovative practitioners, and (3) to spread the lecture to further inspire. Duijvestijn, known for his involvement in circular innovations, shared numerous examples of circular practices in horticulture. The lecture, held at the University of Applied Sciences in Delft and moderated by the researcher, followed an interactive format that actively engaged approximately fifty students from both the hosting institution and another institution for secondary vocational education. Throughout the session, student assumptions about circularity in horticulture were surfaced and, in some cases, challenged or debunked. Feedback from the informal evaluation suggested a positive impact on student awareness and interest. The lecture was recorded, edited, and shared via the communication channels of the participating institutes (see Online Appendix 5).
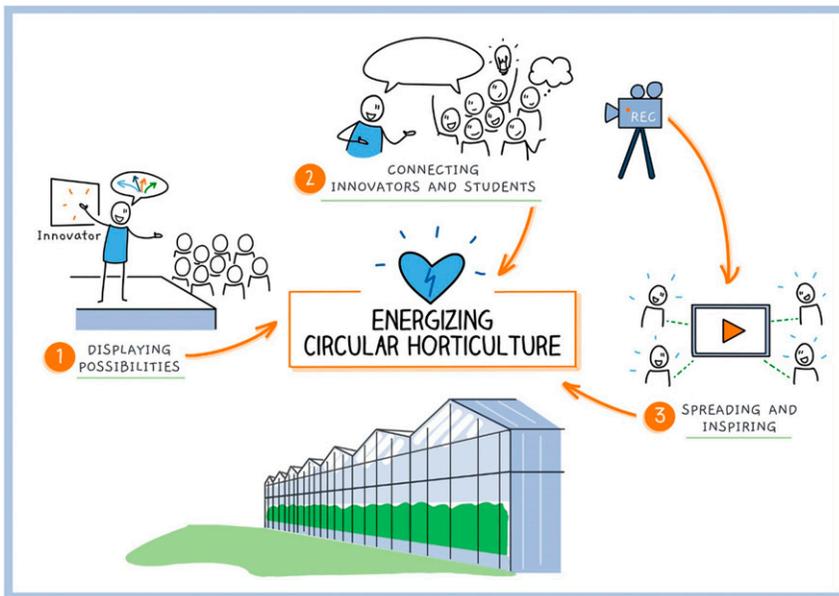

Figure 8. Activities aimed at energizing circular horticulture.

Mechanisms and researcher's roles

Table 2 provides an overview of the intervention's objectives, the involved mechanisms, and the roles researchers played during the interventions. While our initial aim was to impact the deepening, broadening, and spreading of circular initiatives through these

Table 2. Overview of the initiative, interventions, mechanisms and researcher's roles.

Initiative	Aim	Achieving aim by activating relevant mechanisms	Researcher's roles
Future farmers	Policy and legislative recognition for small-scale local farmers to *spread* agro-ecological farming practices	*Learning by doing* about the policy process, *professionalization* to represent themselves and engage in official meetings and *embedding* of their approach and practices within legislation	Change agent, process facilitator,
Testlab tiny house and forestry	*Broadening by* connecting forestry and sustainable housing	To assist in *partnering* by finding landowners, specifically farmers, who would be interested in a pilot. To activate *logic of attraction* with a successful pilot	Change agent, process facilitator
Kwatrijnstable	Dee*pening* the Kwatrijnstable concept by further improving the manure management	*Learning by doing* about manure management by (1) reflecting on current practices and exploring improvements and (2) by evaluating circular substrate options for solid (organic matter rich) manure production. *Partnering* with different experts to share and integrate different types of knowledge	Process facilitator, knowledge broker
North Sea farmers	The risks of multi-use, which were considered necessary for *broadening* this idea of multi-use of the North Sea	The intervention was aimed at the mechanisms of *professionalizing* and *partnering* through knowledge cocreation of a multi-risk register of different users of the North Sea	Knowledge broker, process facilitator, Reflective scientist
Lecture circular horticulture	*Spreading* the circular perspective on horticulture	By *energizing* students and showing the importance and possibilities of circular horticulture by organizing a lecture with Ted Duijvestijn	Process facilitator

(continued)

Table 2. (continued)

Initiative	Aim	Achieving aim by activating relevant mechanisms	Researcher's roles
Value of water (stranded)	*Deepening* of the water management of the regional horticulture	*Learning by doing* on the water management and facilitate *partnering* by bringing interested entrepreneurs and actors of the municipality and waterboards together	Process facilitator
Overarching intervention (stranded)	Aimed at breaking through shared barriers to *spread* circular initiatives	*Partnering* and *embedding* by first mapping the experienced legal barriers; and engaging with Ministry to design policy instruments to overcome those	Change agent
Research proposal (stranded)	*Deepening* insights in effects of consumer behavior on quality of consumer waste	*Learning by doing* and *partnering* with municipalities and waste processing company to generate insights in which waste and separation system is most resource efficient across different regional contexts	Reflective scientist

interventions, in practice, we primarily made progress at the level of individual mechanisms. The following sections will detail our reflection on the activation of specific mechanisms and the roles researchers played in activating them.

Professionalization: Process facilitator and change agent

Professionalization enables initiatives to establish themselves as credible alternatives to current unsustainable practices by bolstering their legitimacy and translating their interests into policy influence and change. The research roles of process facilitator and change agent seem crucial for professionalization, as they enhance legitimacy, foster trust, and bridge the gap between initiatives and policymaking, and scientific knowledge building.

We co-designed interventions with three circular initiatives: Testlab Tiny House & Forestry, North Sea Farmers, and Future Farmers. Already through the collaboration the initiative is attributed a higher professionalization level: "*It is simply useful within the communication to outside actors to be able to say that this project is supported by the WUR* [eds. Wageningen University & Research] *or the LNV (Ministry of Agriculture, Nature and Food Quality)*" (Representative of Testlab Tiny House &

Forestry). Similarly, with North Sea Farmers, researchers' involvement as process facilitators in evaluating and facilitating workshops on a risk-evaluation template bolstered its legitimacy and supported multi-use discussions. Despite not achieving the original goal of gaining detailed information on the multi-use associated risks, this support enabled North Sea Farmers to proceed with more legitimacy. Furthermore, enhancing professionalization served as a catalyst for increasing the partnering within these initiatives because it facilitated connecting potential interested landowners with the concept (Testlab Tiny House & Forestry) and fostering trust among involved stakeholders (North Sea Farmers).

The intervention co-designed with Future Farmers focused mainly on embedding agro-ecological practices but increasing the professionalization contributed to this. Future Farmers sought to enhance their visibility and credibility within the Ministry of Agriculture, Nature, and Food Quality while addressing legislative barriers that hinder agro-ecological farming. However, in representing these interests they so far encountered practical challenges: "*For us, as pioneering farmers, it is practically impossible (due to time restrictions) to join at the table of the Ministry every month*" (Representative Future Farmers in Podcast).

This representation is important to receive policy support in terms of research and innovation funds and assistance in addressing hampering legislation. The involved researcher addressed this issue as a process facilitator by organizing meetings across farmers and policy makers of the working group Circular Agriculture of the Ministry, to which she had access as a member. As a change agent, she assisted in translating the interests of agro-ecological farmers into realistic policy aims and identifying the opportunity to focus on representation within the Ministry's monitoring and reward schemes. This contributed to the initiative's professionalization: "*Representation is for us an ongoing process and challenge, regarding this it is very important that people such as *name researcher* understand these (policy) processes and can represent the people who are working in the field*" (Representative Future Farmers in Podcast).

Learning by doing: Process facilitator and knowledge broker

Learning by doing is essential for identifying barriers and opportunities while receiving timely feedback to refine strategies effectively. This iterative approach allows initiatives to adapt dynamically, ensuring that their objectives remain achievable and aligned with emerging insights. The roles of process facilitator and knowledge broker seem to be particularly important in this context, as they enable productive collaboration, ensure the integration of diverse expertise, and translate findings into actionable strategies.

The intervention co-organized with Kwatrijnstable, aiming to enhance the manure separation system through workshops with experts from various fields, illustrates the significance of these roles.

For these content-driven workshops, it was vital that the researcher understood the technical aspects of manure management and substrates and had access to a network of experts. In addition to acting as a process facilitator, ensuring productive discussions, the

researcher also served as a knowledge broker, processing data from the workshops into comprehensive reports and designing a framework to test alternative substrates. This intervention highlights the importance of multi-expert collaboration for learning by doing to advance circularity and the roles a researcher needs to be equipped to play in this.

In general, adopting a "learning by doing" approach is beneficial in interventions, as it involves organizing subsequent steps based on insights and feedback from initial actions. This often required researchers to shift roles throughout the interventions. For instance, in the Testlab Tiny House & Forestry and North Sea Farmers interventions, the original objectives proved challenging, requiring a change in focus. In the Testlab Tiny House & Forestry intervention, the initial goal of partnering with private landowners for a pilot project was difficult to achieve. This led to two alternative strategies: aligning with an existing project (see 'partnering' for further details) and shifting focus to municipalities willing to support innovative projects without the constraints that private landowners might face. Similarly, in the North Sea Farmers intervention, initial aims were revised based on early feedback. These adaptations showcase how a flexible, learning-oriented approach can help navigate challenges and refocus efforts to align with emerging opportunities and insights (see 'partnering for further details') but requires researchers to be skilled in content and process to function as knowledge broker and process facilitator.

Partnering: Process facilitator, knowledge broker and change agent

Partnering involves sharing knowledge and resources to achieve common goals. Our interventions illustrate that effective partnerships are often built on a foundation of prior collaboration, mutual trust, and a positive atmosphere that encourages the exchange of knowledge. The roles of process facilitator, knowledge broker, and change agent emerged as essential in fostering these collaborations, helping initiatives navigate challenges, align interests, and drive meaningful engagement among stakeholders.

For example, at Kwatrijnstable—a farm integrating organic dairy farming with nature conservation—existing collaborations among companies, NGOs, government agencies, and research institutes were crucial. The farmer's openness to innovation allowed thinking of specific improvements in manure management without seeing them as threat for the company, but as a critical-constructive approach for current practices. This made the role of process facilitator and knowledge broker smoother for the researcher.

Within the intervention for Testlab Tiny House & Forestry, the role of process facilitator to stimulate partnering with farmers proved challenging: "*I really tried by best, but it has been disappointing. The reason is that science stands quite far away for the farmer and my network has its limits*" (Involved researcher in Podcast). Consequently, the role shifted from process facilitation to that of a change agent, exploring alternative strategies. One promising direction was aligning with the existing Peel Nature Villages pilot project, with multiple locations across the region aiming to develop nature inclusive and sustainable business models, instead of trying to connect directly with farmers. By aligning with this initiative, Testlab Tiny House & Forestry could potentially better navigate the regulatory barriers associated with integrating forestry and housing

functions, leveraging the established framework and support of the Peel Nature Villages project.

In the North Sea Farmers intervention, partnering was intended to co-create knowledge about the risks among different North Sea users. Throughout this process, the researchers shifted from being reflective scientists to acting as process facilitators, focusing on fostering dialogue and trust among stakeholders. While stakeholder interviews did not provide the detailed insights on risks as initially expected, they revealed significant challenges in multi-use cooperation. These challenges arose from assumptions about regulations, expectations of roles (like the Coast Guard's involvement), and concerns about technical risks from co-users. To address these issues, the researchers organized a plenary workshop that promoted an open dialogue. This approach helped resolve many discrepancies, reducing negative biases toward multi-use and increasing stakeholders' willingness to cooperate. Initially, partnering was just a tool to achieve the intervention's goals. However, it became essential for building the trust and shared interest crucial for ongoing collaboration and knowledge exchange.

Among the stranded interventions unsuccessful partnering was often the root cause for stranding. For instance, within the Value of Water intervention the collaboration faced challenges and was ultimately cancelled, highlighting the difficulty of organizing interventions with initiatives without stable funding and a robust organizational structure. Similarly, partnership ambitions in the stranded research proposal were hindered by these factors. Lastly, within the first general workshop with multiple initiatives, we sought to identify common barriers and explore potential solutions, with an ambition to create a broad intervention targeting a shared challenge, like restrictive legislation. However, the workshop failed to generate enough momentum. Its online format hindered engagement, and we struggled to pinpoint a specific barrier to address. Additionally, the project team's role as change agents was not effectively executed, resulting in a lack of focus and expertise to drive the process forward.

Embedding: Process facilitator and change agent

Contributing to the embedding, the institutionalization of initiatives, the roles of process facilitator and change agent seem to be of most importance. The intervention with Future Farmers was specifically aimed at embedding the agro-ecological approach and practices. As a process facilitator, the researcher brought together relevant actors to collaboratively design a research agenda that would support the integration of agroecological farming practices. As a change agent, the researcher highlighted the significance of insights and knowledge generated from agroecological farming initiatives to policymakers: "*Researchers can place it in a broader perspective (at the Ministry of Agriculture, Nature and Food Quality), I am of course not sitting there on behalf of Future Farmers but for the broader transition and the role these kind of initiatives play in this transition "..." here (within Future Farmers) insights are derived which can be relevant elsewhere*" (researcher in Podcast).

Logic of attraction: Change agent

Creating logic of attraction—where an initiative draws in resources, members, and reduces barriers—likely requires a change agent, who identifies opportunities, mobilizes stakeholders, and strategically positions the initiative. While crucial, this is often the most challenging role for researchers, as it demands a high level of engagement and actions beyond traditional academic boundaries. This challenge was evident in the intervention with Testlab Tiny House & Forestry, which aimed to establish a pilot project integrating housing and forestry. The goal was to showcase feasibility through one concrete case to generate further momentum and reduce financial and legislative barriers. In an initial session co-organized with private landowner associations, participants expressed strong interest. However, despite this enthusiasm, the researcher and initiators struggled to translate this interest into a concrete pilot. Support remained diffuse and lacked a clear path to realization. To move forward, the initiative would likely require an actor with stronger 'realization power'—such as a municipality or a landowner with available land—capable of overcoming institutional and practical barriers. This highlights the limits of researchers in the change agent role and underscores the importance of aligning ambitions with actors with "realization power".

Energizing: Process facilitator

Energizing played a crucial, though often implicit, role in all interventions, reflecting mutual trust and commitment between researchers and initiatives. Researchers were most effective when working on initiatives that personally inspired them. This effect was strongest in interventions with tangible outcomes, even if unexpected, often leading to new opportunities and reinforcing the value of building on existing partnerships. In contrast, stranded interventions tended to be overly broad, complex, or misaligned with researchers' roles, leading to reduced motivation. This highlights the importance of designing manageable, engaging interventions to maintain energy and commitment.

One intervention specifically aimed at energizing, in which the researcher took up the role of process facilitator, involved collaboration with Ted Duijvestijn to inspire students about the potential of circular horticulture. Duijvestijn, who believes students are key to innovation in his company, stated: "All innovations in our company are realized through students". The intervention took the form of a college tour where Duijvestijn was interviewed by a presenter and students. This format was well-received by the management and teachers of the educational institutions involved, with potential for follow-up opportunities indicated in social media posts.

Discussion

This study applied a TAR approach to understand how interventions, co-designed by researchers and practitioners, can boost the transformative change of promising circular

initiatives. This study shows that integrating diverse researcher roles with mechanisms like partnering or embedding offers broad possibilities for enhancing circular initiatives' deepening, broadening, and spreading. What sets our approach apart is the integration of previously identified acceleration mechanisms with action research, bridging TAR and insights from transition theory. This approach extends the five ideal-type roles by Wittmayer and Schäpke (2014), demonstrating how researchers in different roles activate key mechanisms to advance circular initiatives. Through this, we aimed to contribute to the third quality choice point of 'contribution to action research theory/practice' and the fifth point of 'actionability' as defined by Bradbury et al. (2025) to advance action research focused on enhancing transformative change. By illustrating the activities in each intervention through Figures 2–8, we aim to highlight the significance of alternative methods for presenting action research, as discussed by Friedman et al. (2018). Moreover, the formats in the appendices can provide a set of tools other action researchers could use to work in a transdisciplinary way to accelerate transformation across different innovative initiatives.

We distinguished two levels in our TAR-approach: (1) the action research conducted with initiatives and (2) the internal learning among researchers and across the project team. At the first level, we aimed to integrate knowledge on acceleration mechanisms into the co-design of interventions, contributing to initiatives' deepening, broadening, and spreading. However, this proved overly ambitious within the scope of project-based interventions. In practice, focusing on one key mechanism—either the most urgent or the most feasible—led to more tangible outcomes. Moreover, mechanisms often overlap; for example, in the Future Farmers intervention, efforts to embed the initiative were closely tied to its professionalization. Furthermore, we found it more effective to collaborate with existing initiatives rather than initiate new ones. All our interventions that began from scratch struggled and eventually stranded, highlighting the need for initiatives to be not just willing but also stable enough for collaboration. Established initiatives offer stable ground for co-production, allowing researchers to leverage existing partnerships, knowledge, and momentum. This approach aligns with the principles of appreciative inquiry and the small wins perspective (Cooperrider & Whitney, 1999; Termeer & Metze, 2019). Lastly, the interventions encouraged initiative representatives to become reflective practitioners, learning through experience and engaging in collaborative problem-solving (Schon, 1983). Future research could explore how these practitioner roles evolve over time, deepening our understanding of co-learning in transdisciplinary settings—an aspect beyond the scope of our current study.

Regarding the second level, organizing TAR with an interdisciplinary team from diverse backgrounds posed challenges. Researchers initially leaned towards traditional research approaches when designing the interventions, focusing on defining research questions and formalizing research proposals, rather than activating mechanisms. The project encouraged them to adopt more active roles, such as serving as knowledge brokers or process facilitators, alongside their role as reflective scientists (Wittmayer & Schäpke, 2014).

Furthermore, learning across the researchers also related to specific mechanisms within the interventions, such as partnering, embedding, or professionalization. Engaging with

these mechanisms enabled researchers to gain knowledge and experience, empowering both the initiatives they supported and their own professional growth. Researchers had to acquire new types of knowledge and expand their networks to effectively adopt and play different roles necessary for activating these mechanisms.

However, the ability to play these roles effectively still depends on a researcher's skills, openness, experience, and network on the outset. For some, stepping outside the traditional role of a reflective scientist was uncomfortable, contributing to their eventual withdrawal from the project.

Regarding the interaction of these two levels within our TAR approach, our results demonstrate that when researchers co-organize interventions and aim to activate specific mechanisms this requires them to adopt new and more engaging roles. We found that the roles of change agent and process facilitator were particularly crucial. The change agent role was most relevant when activating mechanisms such as embedding, partnering, professionalization, logic of attraction, and energizing. However, this role proved challenging to fulfill—especially within short-term collaborations—as it requires strategic foresight, ability to move beyond traditional academic boundaries, and a certain level of "realization power" that researchers may not possess. Playing the role of change agent, for instance, should not be assumed as a default expectation for increasing societal impact through research—it is demanding and not always realistic. The process facilitator role was more feasible and impactful across several mechanisms, including professionalization, partnering, embedding, learning by doing, and energizing. Similarly, the knowledge broker role supported partnering and learning by doing. Our interventions extend Wittmayer and Schäpke's (2014) five ideal-type roles by linking them explicitly to specific mechanisms and illustrating how these roles could influence these mechanisms. They also reveal that activating a certain mechanism is unlikely without a researcher adopting a fitting, often more engaged, role.

Importantly, researchers aiming to strengthen a given mechanism should remain flexible and expect to shift roles as the intervention evolves. Interventions at the same mechanisms can be designed from different role positions, but success depends on aligning these roles with researchers' strengths, capacities, and prior experience. In line with the small wins framework (Termeer & Metze, 2019), our findings support the idea of building on existing achievements, identifying feasible next steps to realize concrete results to remain energized, and adopting roles that match researchers' strengths and capacities. Rather than presenting a definitive list, our interventions offer inspiration for how researchers—both in action research and more traditional science—can tailor roles and mechanisms to increase their societal contribution.

Conclusion

In this paper, we addressed the research question: *How can interventions, co-designed by researchers and practitioners, boost the transformative change of promising initiatives?* Our aim was to explore how researchers can actively engage and appreciate circular initiatives. Our findings emphasize that researchers need to balance the different roles they have in activating key mechanisms to drive transformative change. Action research can be demanding for researchers. Therefore, the framework with eight mechanisms is useful as a

heuristic for co-designing interventions that can be tailored to the capacity of the researcher, the collaboration with initiatives, and time and resources available.

Moreover, we show that by collaborating with existing on-going circular initiatives to build on previous learning and partnerships rather than initiating new ones, researchers can adopt an appreciative approach. Researchers can co-develop and promote existing transformative initiatives by leveraging their own expertise, network and capacities to activate relevant mechanisms and resisting the urge to start from scratch.

Authors' note

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Supplemental Material

Supplemental material for this article is available online.

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