Check for updates

RESEARCH ARTICLE

Framing systemic questions to explore the transformative potential of social innovation in the Sicilian aquatic food system

[version 1; peer review: 1 approved]

María Bustamante Liria[1], Concetta Maria Messina[1], Simona Manuguerra[2], Andrea Santulli[2], Giovanna Ottaviani Aalmo[1]

[1]Norwegian Institute of Bioeconomy Research, Ås, Akershus, Norway
[2]Universita degli Studi di Palermo, Palermo, Sicily, Italy

v1 **First published:** 10 Apr 2026, **6**:99
https://doi.org/10.12688/openreseurope.22925.1
Latest published: 10 Apr 2026, **6**:99
https://doi.org/10.12688/openreseurope.22925.1

Abstract

Despite significant progress in understanding the complexity of food systems' challenges, there remains a lack of clarity around how these systems can undergo transformative change and what is required to enable such shifts. This paper focuses on social innovation as a promising mechanism for addressing structural challenges and reconfiguring food systems toward sustainability, equity, justice, and resilience.

Our main contribution is the design of an actionable guidance that helps practitioners and researchers explore and leverage the transformative potential of social innovations. This guidance emerges from a dialogue between a key framework for analyzing social-ecological transformations and recent advancements in Transformative Social Innovation (TSI) theory. By incorporating insights on adaptive, bottom-linked governance and relational dynamics into the SES processual framework, we strengthen its applicability to TSI analysis and make it more adaptable for real-world contexts.

We apply this guidance to a case study in Western Sicily's aquatic food systems, where a long-standing social innovation – rooted in Living Lab methodologies and collaborative governance – demonstrates the potential to challenge dominant values by reconfiguring dominant social relations, empower local actors, and engage with both deep and shallow leverage points, contributing to systemic

Open Peer Review

Approval Status ✓

	1
version 1 10 Apr 2026	✓ view

1. **Shonil Bhagwat**, The Open University, Milton Keynes, UK

Any reports and responses or comments on the article can be found at the end of the article.

transformations.

By combining cross-field dialogue with empirical application, this paper offers both practical tools for analyzing and designing transformative social innovation processes and practical insights into how social innovations can contribute to more sustainable, resilient, and equitable futures. It directly speaks to practitioners, scholars, and policy makers interested in enabling systemic transformation through socially embedded innovation processes.

Keywords
transformative social innovation, systemic transformation, food systems, social environmental systems framework



This article is included in the Horizon Europe gateway.

Corresponding author: Giovanna Ottaviani Aalmo (giovanna.ottaviani.aalmo@nibio.no)

Author roles: Bustamante Liria M: Conceptualization, Formal Analysis, Methodology, Visualization, Writing – Original Draft Preparation, Writing – Review & Editing; **Messina CM**: Data Curation, Investigation, Resources; **Manuguerra S**: Data Curation, Investigation; **Santulli A**: Investigation, Resources; **Ottaviani Aalmo G**: Conceptualization, Funding Acquisition, Investigation, Project Administration, Supervision, Writing – Original Draft Preparation, Writing – Review & Editing

Competing interests: No competing interests were disclosed.

Grant information: This project has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No. 101060537 (BlueRev).
The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Copyright: © 2026 Bustamante Liria M *et al*. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

How to cite this article: Bustamante Liria M, Messina CM, Manuguerra S *et al.* **Framing systemic questions to explore the transformative potential of social innovation in the Sicilian aquatic food system [version 1; peer review: 1 approved]** Open Research Europe 2026, **6**:99 https://doi.org/10.12688/openreseurope.22925.1

First published: 10 Apr 2026, **6**:99 https://doi.org/10.12688/openreseurope.22925.1

1. Introduction

To address the complexity of today's societal challenges worldwide, systems thinking is increasingly informing decision-making across sectors and disciplines.[1,2] In the food systems field, however, only a limited subset of these insights has been effectively translated into practice.[3] As a result, the transition toward more sustainable, equitable, just, and resilient food systems remains elusive. While the need for radical, structural changes is widely recognized[4–7] there is still a lack of clarity on how such transformations can occur and what is required to enable them.[3]

Conventional top-down approaches and solutions are proving insufficient. In response, innovative and participatory approaches are gaining traction for their ability to foster local ownership and long-term impact.[8] Among them, social innovation has emerged as a promising force to respond to major societal challenges by reshaping dominant discourses, perspectives, values, behaviors, and organizational arrangements.[9,10] Social innovation is broadly understood as the creation, renewal, or transformation of social relations through new ways of working together to achieve collective goals aligned with shared desires and aspirations.[11] This involves participatory processes, organizational forms and strategies that empower different groups in society.[12,13]

As social innovations evolve, their potential to foster systemic changes – what has come to be known as Transformative Social Innovation (TSI) - has become a central area of inquiry.[9–11,14–17] TSI refers to changes in governance, agency, values, power relations and resource flows that contribute to societal transformation.[15,18]

Recent scholarships have advanced TSI theory from different angles. Castro-Arce & Vanclay[11] emphasize bottom-linked governance as both an enabler and an outcome of TSI, while Pel et al.[10] propose a relational framework that highlights how changes in social relations underpin transformative processes. These frameworks shed light on what needs to change for social innovations to be transformative. Yet there remains a need for perspectives that also illuminate how transformation processes unfold over time. In this regard, Moore et al.[19] offers a relevant perspective, extending Olsoon et al.'s[20] social-ecological systems transformation framework by incorporating social science insights – particularly on agency and power - into a description of the subprocesses that characterize complex systems' transformation.

This paper builds on Moore et al.'s framework[19] and brings it into dialogue with recent TSI work[10,11,21] to design a practical, practitioner-oriented guidance for analyzing social innovations from a transformative perspective. Rather than proposing a new theoretical model, we adapt Moore et al.'s SES transformation framework and enrich it with insights from TSI theory, proposing a set of subprocesses and guiding questions to analyze both what needs to change and how changes unfold.

We apply this guidance to a case study of aquatic food systems in Western Sicily, Italy. This long-standing, locally grounded social innovation – anchored in Living Lab methodologies and collaborative governance – provides a real-world testing ground to examine the transformative potential of social innovation through structural, relational, and processual dimensions. The application demonstrates how dialogue between SES and TSI frameworks supports the diagnosis of transformation dynamics emerging from social innovations; moreover, it provides empirical evidence of how social innovation can challenge dominant ways of knowing, framing, and organizing aquatic food systems, opening alternative pathways toward more sustainable, resilient, and equitable futures.

2. Recent frameworks on social innovations and systemic change

Scholars have explored a wide range of dimensions and conditions that enable or hinder transformation, including shifts in governance and institutional arrangements, the creation or reconfiguration of social relations, the role of agency and empowerment, structural barriers, and potential leverage points. Broadly, some frameworks emphasize what needs to change to trigger transformation, while others focus on how such changes unfold through feedback mechanisms, shifting structures, and dynamic interactions over time.

In the field of social innovation, transformative change is increasingly understood as the result of interactions between structural conditions and the agency of individuals and institutions operating within them.[22,23] This has prompted calls for integrative frameworks that combine these dimensions to better assess social innovations and their transformative potential. Moore et al.[19] make an important step in this direction by extending Olsson et al.'s[20] framework to understand socio-ecological transformations. Their contribution lies in incorporating social science insights – particularly on agency and power – into the description of subprocesses that characterize complex system transformations.

Although Moore et al.[19] already engage with agency, governance, and power considerations, there is still room to incorporate more recent developments in TSI theory. In this section, we therefore review Moore's[19] SES transformation

framework alongside three key perspectives in the TSI field – the Multi-Level Perspective (MLP), the Analytical Framework for Transformative Social Innovation, and the TSI Relational.

Our approach builds on the hypothesis that recent developments in TSI theory — particularly around adaptive governance[11] and relational dynamics[10] — can further enrich this Moore's perspective by bringing in innovation-specific insights grounded in empirical cases. This complementarity motivates our effort to adapt Moore's framework into actionable guidance while updating it with insights from TSI theory, thereby offering practitioners a systemic way to explore social innovations and their transformative potential.

2.1. Transformative changes in social environnemental system (SES) framework

Moore et al.[19] integrate insights from social science into a well-established SES framework[20] to explore how social-ecological transformations are shaped by both structural constraints and actor agency. Their framework emphasizes the importance of addressing power asymmetries, social justice, and institutional inertia in transformation processes.

Two major assumptions underpinned the integration of social science insights into the description of critical subprocesses to understand transformation.[19] First, transformations toward more sustainable trajectories are not easy due to the capacity of existing societal structures to resist and accommodate most pressures without deep changes.[26] Second, when it does occur, transformations are shaped by both the interrelated elements, i.e. structure, and the agency of actors within the system, whose values and goals influence the system's trajectory.[27]

Moore et al.[19] outline critical subprocesses that should be considered in any analysis of transformation, following four phases: triggers or pre transformation, preparing for change, navigating the transitions, and institutionalizing the new trajectory.

2.2. Multi-levels perspective (MLP) framework

The multi-Level Perspective (MLP), although not explicitly considered a TSI framework, lays the foundations for most methodological developments and theoretical discussions in the field.

The MLP describes transitions as non-linear processes resulting from the interplay of developments at three analytical levels: niches, socio-technical regimes, and exogenous socio-technical landscape. These levels interact with each other to either stabilize or destabilize systems and thus determine the potential for transformative change.[24]

Regime is the level of primary interest, as transitions are defined as shifts from one regime to another.[21] Deep structures, behavior, and rules guiding the actors' behavior and activities are structured in regimes.[21,24] These regimes are affected by landscape factors and may be challenged by niches. Niches are relatively protected spaces where new ideas and practices are developed and tested by innovative actors with special interests and demands. This level provides the "seeds for systemic change"[21] (p.27). For niche ideas to have a change to challenge the regime, three conditions are essential: (i) articulation of expectations to build a common vision, (ii) expansion of social networks to support innovations, and (iii) alignment of learning processes across dimensions.[21] Landscape is where exogenous trends occur, creating opportunities or exerting pressures on the regime. Destabilizing the regime creates the opportunity for niche innovations to foster systemic changes.[21,25]

2.3. Analytical framework for transformative social innovation

Castro-Arce & Vanclay[11] propose an analytical framework centered on bottom-linked governance. They argue that for social innovations to realize their transformative potential, they must scale up to influence governance systems, making them more flexible, collaborative, inclusive, and adaptive. At the same time, when at varying political levels, spatial scales and action arenas interact in new networks and collaborate in new ways, they lead to more flexible, collaborative, inclusive, and adaptive governance systems.

This framework highlights adaptive, bottom-linked governance as both an outcome and an enabling condition of TSI, emphasizing the need for multi-level and multi-actor collaboration to achieve system-wide change.

2.4. Transformative social innovation (TSI) relational framework

Pel et al.[10] introduces a relational framework that unpacks TSI processes through four sets of relations: within initiatives, within SI ecosystems, to institutions, and to the broader socio-material context.

(i) *Relations within SI initiatives*, with particular attention to individual behavior, interpersonal relations newly formed, the development of collective action and the formation of SI initiatives with organizational forms empowering their members.[9,28] TSI initiatives often strive to create spaces where individuals can feel

empowered, whilst simultaneously striving for collective empowerment. Empowerment is conceptualized in terms of the satisfaction of basic psychological needs, such as autonomy, relatedness and competence.[29] The interpersonal relations negotiated, and the organizational forms developed by SI initiatives in part serve to satisfy these needs, which further shapes motivation and agency.

(ii) *Network formation processes* being part of SI ecosystems. SI ecosystems can be understood in three levels: First, the local communities where SI are rooted and that provide key resources[14] and conditions for SI development and innovative actors' empowerment Second, a translocal dimension that connects SI actors with peers, fostering the development of collective political voice, shared identities, and shared narratives of change.[30] Third, more extensive networks of societal discourses for a broader circulation of ideas for discourse formation.

(iii) *Relations to institutional change,* to explain how social innovations are constrained by, can fit with, and may transform the institutional environment – both formal and informal – and the social norms and discourses that shape system's development.[31] To explain the above, it is essential to understand the underlying mechanisms of systems' behavior,[19,32] a condition that, according to Svensson and Nikoleris,[33] TSI theory is still lacking.

(iv) *Relations to the broader socio-material context* to explore the contextual trends and historical trajectories that shape TSI.

The distinctive contribution of this framework is its focus on the relations that must be worked on for social innovations to be transformative. By articulating 12 propositions grounded on a broad range of empirical case studies, the framework provides concrete illustrations along with conceptual clarity of how changing relations underpin empowerment, agency, and institutional change.

3. Methodology

The aim of this study is to design and apply actionable guidance to systemically explore the transformative potential of social innovations. Building on Moore et al.'s SES transformation framework[19] and incorporating recent developments in TSI theory,[10,11,21] we developed a structured set of subprocesses and guiding questions that enable practitioners and researchers to analyze both *what* needs to change and *how* such changes may unfold.

Our methodological approach unfolded in two steps. First, we reviewed the four aforementioned frameworks and identified how Moore's subprocesses could be enriched with insights from TSI theory, particularly around adaptive governance and relational dynamics. This process allowed us to translate the dialogue between SES and TSI into practical, process-based guidance for analyzing social innovations. Second, we applied this guidance to the case of aquatic food systems in Western Sicily, Italy, drawing on qualitative data to assess how local innovations demonstrate transformative potential.

3.1. Designing actionable guidance for TSI analysis

As detailed in section 2, Moore et al.[19] outline four main subprocesses of transformation: triggering events, preparing for change, navigating transitions, and institutionalizing new trajectories. We adapted this sequence into five subprocesses (A–E) to align with the specificities of social innovation processes and the insights provided by recent TSI frameworks.

From the TSI Analytical framework,[11] we incorporated perspectives on adaptive, bottom-linked governance as a critical enabler and outcome of TSI. From the TSI Relational framework,[10] we added attention to changing relations—within initiatives, across ecosystems, with institutions, and in broader socio-material contexts—as essential conditions for transformation. And from the MLP,[21] we retain the structure of logic of niches, regimes, and landscape pressures for situating social innovations within multi-level dynamics.

These insights were mapped onto Moore's subprocesses, producing a methodological approach (Figure 1) that highlights both the key subprocesses and critical elements to be explored in the analysis of transformative processes triggered by social innovations.

Below we describe the five subprocesses that define Transformative Social Innovations, what needs to happen in each subprocess/stage, and how. This approach, as establishing linkages with emerging TSI theory, could be considered an actionable guidance to apply Moore et al.'s[19] framework in the exploration and analysis of TSI.

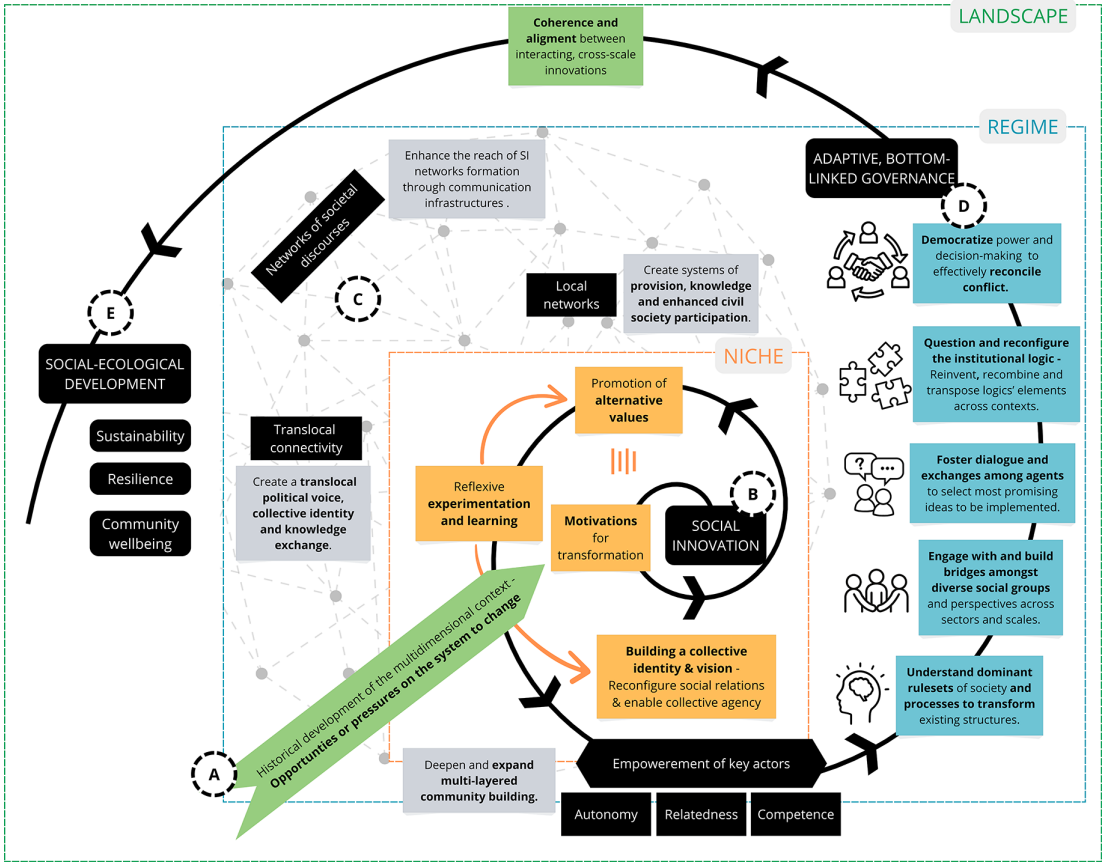


Figure 1. Methodological Approach for exploring Transformative Social Innovations.

A. Background triggers: Contextual pressures and opportunities for change

The rise of social innovations is strongly shaped by crises or perturbations in the broader context that raise concerns among agents and motivate them to promote alternative values that foster transformations in the system to deal with the issues that concern them.[11,19] In this sense, perturbations or disruptions in the broader landscape open windows of opportunity for innovations with transformative ambitions to emerge.

B. Preparing for change in niche-spaces for experimentation and learning

Social innovations usually emerge in relatively controlled and protected spaces called "niches".[21] In these spaces, agents who are interested and motivated to challenge the current "regime" ideate, develop, and test innovative ideas and practices. Pel et al.[10] conceptualizes social innovations as "changing social relations involving new ways of doing, knowing, framing, and organizing" (p.3).

The transformative goals of social innovations usually respond to a combination of general social discontent and individuals' interests for satisfying needs.[10] Niche-spaces aim to promote alternative values that align with the motivations, concerns, and interests of those claiming systemic changes to move away from current unsustainable trajectories.

The promotion of alternative values is made through processes of reflexive experimentation and learning that allow the creation of a collective identity and vision, upon which agents can create new or challenge and reconfigure existing social relationships, while strengthening collective agency to challenge the current "regime".[10] By fostering these processes, niche-spaces will contribute to a better understanding of the system dynamics among the actors involved, shedding light on the interlinkages and feedback loops that explain such behavior.[19,20,34] Thus, social innovations would potentially contribute to identifying leverage points that foster transformative changes in the systems' governance.[35]

In these controlled spaces, agents are empowered to be more autonomous in their decisions, more closely related to others, and competent to carry out the actions needed to pursue their goals.[10,28,29,36]

C. Preparing for change: Networks formations and multi-layered community building

Besides all the knowledge exchanges and learning that occur within niches, it is essential to deepen and expand multi-layered community building if we want social innovations to challenge the regime.[10] Innovations do not create transformative changes in isolation but need to converge, co-exist in parallel, and interact across scales and contexts.[19] Pel et al.[10] call the attention to three layers of networks that work for social innovations to organize themselves as empowering collectives to remain viable over time: supportive SI local ecosystems, trans-local networks, and societal discourses networks.

D. Institutionalization processes: Fostering a more adaptive, bottom-linked governance

To be transformative, social innovations should be supported and uplifted with an adaptive, bottom-linked governance system where actors with diverse values and perspectives come together to share decision-making.[11,12] Hence, transformative social innovations need to question, challenge, and reconfigure existing interpersonal relations and organizational forms, challenging the dominant agents that benefit from and sustain it.[10,11] Empowering processes are critical in this regard.

Understanding what determines the trajectory and outcomes of the system is essential to know what to change to move towards a more sustainable and resilient system.[19,20] Niche spaces – as fostering experimentation and learning – will contribute to identify critical barriers, enabling mechanisms, and leverage points that foster transformative changes in the system.[11,19]

The identification of leverage points – places where a small shift may lead to fundamental changes in the system[37] - is critical to decide where to intervene and identify who are the actors that have the agency to do so.[38] For interventions to lead to transformational change, it is essential to focus on the "deep" leverage points, while recognizing that interventions on shallow leverage points like specific parameters or measures can also be beneficial.[39,40] Deep leverage points refer to social structures and institutions, governance systems, values, goals and worldviews of those actors shaping the system's direction.[41] Hence, social innovations to be transformative need to foster a more adaptive, bottom-linked governance.

A critical step in the direction of a bottom-linked governance is to actively engage agents from diverse social groups and economic sectors, embracing the diversity of perspectives, interests and values.[12] Dialogue and exchange must be promoted among them so that – informed on the insights gained from the experimentation processes in the niches – they can discuss the most promising ideas for transforming the system. It is crucial in the negotiation and selection processes to be aware of power, equity, vulnerability, and agency issues.[19,42]

Social innovations need to be organized in a way that leverages personal, institutional, and societal networks to advance their transformative agenda. Innovative solutions can rely on reinventing logic, recombining elements of different institutional or entrepreneurship models, or transposing elements of alternative logic into the dominant one to promote bottom-linked governance.[19] Nevertheless, it should be noted that social innovations require an "institutional home" to be integrated in the system, thus representing the paradox of those who seek support and productive relationships with the same dominant institutions they aim to challenge.[42]

The last relevant element in the interactions between the niche spaces where innovations emerged and the regime, is the democratization of power and decision-making resulting from the aforementioned processes, which helps to effectively reconcile conflict inherent to a system with a wide diversity of agents and perspectives.[12]

E. Establishing a new trajectory for the systems

Transformative processes usually involve diverse and co-existing initiatives that interact across contexts and scales, moved by different values and worldviews.[19,43] Coherence and alignments in the transformative visions across social innovations and networks is therefore critical for them to converge in a way that stabilizes a new trajectory for the system.[10] In that line, Castro-Arce & Vanclay[11] acknowledge that "only by scaling-up and rolling-out at multiple levels will local action deliver better outcomes".

Moore et al.[19] highlight the importance of both agency and empowerment for transformative agents to be able to push for alternative pathways in the system, as powerful and dominant agents more likely will work to maintain the current regime, from which they benefit.

The aforementioned approach is expressed through a set of guiding questions (Table 1), designed to help practitioners and researchers explore TSI.

3.2. Case study and data collection

To operationalize this guidance, we applied it to the aquatic food system in Western Sicily. Data collection involved semi-structured interviews with a wide array of stakeholders, including fisherfolks, SMEs engaged in fish processing, local authorities, civil society organizations, and academia. All participants were informed about the purpose of the study, and written consent was obtained prior to data collection. No sensitive personal data was collected. Data management followed GDPR requirements, with all personal data pseudonymised and shared only among project partners under the oversight of institutional Data Protection Officers.

Interviews were conducted between 2023 and 2024 and explored social, political, economic, technical, human, and environmental dimensions. This systemic scope allowed us to identify key innovative interventions and assess their transformative potential.

The datasets generated during the interviews are available in Zenodo repository.[44]

In relation to social innovations, we gathered information on the values and motivations guiding actors to foster alternative ways of doing, framing, knowing, and organizing the system, as well as on the processes of learning and experimentation that accompanied these new ideas.

The data was organized using the subprocesses and guiding questions in Table 1. This allowed us to analyze how social innovations in Western Sicily emerged in response to contextual trigger; how they foster experimentation and learning among agents; what networks they build or strengthened; how they reconfigured governance arrangements; and what processes contributed to the stabilization of a new system trajectory.

4. Results and discussions

Our analysis showed a robust and well-established network of researchers, fisherfolks, producers' associations, processing industries, and coastal action groups in the local AFS. The active collaboration between research institutions and industries over the last decades – particularly with SMEs –have yielded interesting results in technological innovation to produce new seafood products, new marine ingredients, and circular economy solutions [e.g.,[45–50]] able to meet both blue growth and green deal goals for environmental and economic sustainability. An emblematic example of collaboration between stakeholders in the local MFS is the *Innovittica* research project, whose results in the territory have endured over time, contributing to the sustainability of the system.

Based on these observations, we decided to focus on the case of the *Innovittica* project, which comprises a set of collective-driven initiatives that illustrate the transformative potential of social innovations.

The *Innovittica* project was funded by the Department of Mediterranean Fisheries of Sicilian Region, financed by the "European Fund for Maritime Affairs and Fisheries" 2014-2020, relating to measure 1.26. The project, coordinated by the University Consortium of Trapani, was conceived to implement EU directives aimed at increasing sustainability in the Sicilian seafood processing sector by focusing on new sustainable fishery and aquaculture species, new products, and new processing technologies. By applying *a* "living lab *diffuso*" model that brings together researchers, businesses, SMEs and communities, the *Innovittica* project shows how innovation, health, and tradition can come together to build a stronger and more sustainable future for coastal communities.

The results and discussions in this section are organized around the five sub-processes proposed in the actionable guidance to explore Transformative Social Innovations.

4.1. Background triggers: Contextual pressures and opportunities for change

In Sicily, and in the province of Trapani in particular, there is a very old tradition linked to the fishing sector and the transformation of its main raw materials and side streams, which in the past brought much added value to the area with its "*tonnare*" (infrastructure for tuna processing).

In the past decades, issues like marine ecosystem degradation, under-utilization of fishery by-products, an aging workforce, and fragmented knowledge networks highlighted the inadequacy of this traditional, linear, siloed fisheries regime. In particular, the valorization potential of processing side-streams was brought to light, underscoring a pressing need for sustainable, circular solutions.

Table 1. Guiding questions to explore key subprocesses and elements of Transformative Social Innovations.

Subprocesses	Elements	Guiding question
A. Background triggers: Contextual pressures and opportunities for change	**A.1.** Crises or perturbations	How do contextual disruptions translate into innovative ideas that question the current regime and claim for transformative changes?
B. Initiating changes in niche-spaces for experimentation and learning	**B.1.** Niches and innovative agents	Describe the experimentation and learning space where social innovations emerge (i.e., niche). Who was involved in creating and establishing the "niche"?
	B.2. Emergent social innovation	What kind of social innovations emerge from the "niche"? - New ways of doing *(e.g., new products, technologies or services).* - New ways of learning and knowing *(e.g., new educational or training programs).* - New ways of understanding and framing *(e.g., new values)* - New ways of governing *(e.g., new institutional/social collaboration arrangements, policies or regulations).*
	B.3. Guiding values, motivations, interests, and concerns	What are the motivations, interests, and concerns that guide the design of social innovations, and what values underlie them?
	B.4. Experimentation and learning processes	How and to what extent does the experimentation with social innovations help actors to have a systemic understanding of what is happening, what is preventing transformations (lock-in mechanisms) and where are the main opportunities to act upon (leverage points)?
	B.5. Collective identity and vision for transformation	How do the stakeholders engaged in experimentation processes manage to bring together their perspectives on the current situation and desired future and create a collective identity and vision upon which to discuss potential transformative initiatives?
	B.6. Empowerment	How do the experimentation and learning processes in "niches" empower key agents? - *Improve agency* to be autonomous in their decisions and actions and to actively participate in shaping the future of the system in which they are embedded. - *Improve connection through collaboration networks* that strengthen their agency and elevate their transformative potential. - *Improve competences and knowledge.*
C. Preparing for change: Networks formations and multi-layered community building	**C.1.** Local network	Describe the local ecosystem where social innovations found the immediate supportive environment and institutional home *(resource provision, knowledge, civil society participation).*
	C.2. Trans-local connectivity	How and to what extent connections across diverse contexts enable the creation of translocal political voice and collective identity? *Think about how the increased awareness of other realities beyond the own system contributes to questioning and challenging the regime with fresh ideas.*
	C.3. Networks of societal discourses	How does the connection with broader networks of societal discourses enhance the reach of social innovations and their narratives for change?
D. Institutionalisation processes: Fostering a more adaptive, bottom-linked governance	**D.1.** Systemic understanding	What are the main barriers, lock-ins, and enabling mechanisms to be identified while experimenting with social innovations? How do you identify and decide to act on leverage points in the governance systems, societal structure and values that guide the

Table 1. *Continued*

Subprocesses	Elements	Guiding question
		direction of the system? Which are these key intervention points?
	D.2. Engagement of diverse stakeholders and perspectives	Describe how and to what extent do you actively engage with diverse stakeholders and perspectives in processes of dialogue and exchange to analyze the results of experimentation processes with social innovations.
	D.3. Negotiation and selection of most promising ideas	How do stakeholders discuss and negotiate over the most promising innovative ideas - tested in the niche spaces - for scaling up? Do you take any measures to deal with power, equity, vulnerability, and agency issues when fostering negotiation processes to select innovative ideas for scaling up?
	D.5. Institutional reconfiguration	How and to what extent social innovations contribute to reconfiguring the interpersonal relations and organizational forms that sustain the current regime, hence promoting a bottom-linked governance? - Reinvent logic - Recombine elements of different societal/ institutional models - Transpose elements of alternative logics into the dominant one.
	D.6. Power democratization	How do the social innovations, by fostering bottom-linked governance, contribute to democratize power and reconcile conflicts between stakeholders with different perspectives?
E. Stabilization of the new trajectory: Systems transformation	**E.1.** Coherent and aligned visions across social innovations	How do diverse social innovation initiatives converge in a way that stabilizes a new trajectory for the system? Think of coherence and alignment between their visions and approaches as essential conditions for scaling up and rolling out.
	E.2. Agency and empowerment of transformative agents	Do the transforming agents have the necessary conditions - agency and empowerment - for pushing for alternative pathways in the system, against the powerful agents willing to maintain the current regime?

4.2. Initiating changes in niche-spaces for experimentation and learning

Because of the pressing need for sustainable, circular solutions at local level, a "niche" space emerged in the form of the *Innovittica'*s Living Lab, which was initiated by the University Consortium of Trapani as a reaction to the fisherfolks wishes for more knowledge and access to technology. The Living Lab is a network of in-company "nodes" where researchers, technologists, entrepreneurs and end-users co-create and co-design, test and validate new products and processes under authentic production conditions. This approach allows stakeholders to act as active co-designers of innovative solutions, instead of just users. By providing stakeholders with an enabling space for transdisciplinary learning and experimentation in real-world settings, the Living Lab fosters alternative R&D approaches that move away from the traditional top-down approach, preserving research-industry-user feedback loops.

Based on new or strengthened social relations among diverse stakeholders, the Living Lab fosters new ways of doing, new ways of knowing and learning, new ways of thinking and framing situations, and new ways of organization among agents and institutions. The innovations detailed below were mostly guided by a societal interest and political will for revitalizing local communities, a strategic decision that is very much aligned with fisherfolks' main concerns around jobs opportunities and income creation. The overall goal of local communities' revitalization is coupled with a commitment toward circular-economy principles to be more efficient and sustainable in resource utilization.

New ways of doing:

Novel seafood products are co-created in the frame of Innovittica project in response to key societal needs and interests. For example, salted and smoked fish with significantly reduced sodium content was developed in response to a rising

market demand for low-sodium products to reduce health risk. Another example is the fifth-range ready-to-eat items which extend shelf-life without compromising quality.

The project activities also covered the valorisation of invasive species such as the blue crab (*Callinectes sapidus*), an allochthonous species recently established in the Mediterranean, with the aim of using them as a resource for production and income generation, rather than simply considering them an invasive species.[51] Fresh sauces, crab-meat patties and burgers were produced from its flesh, and activities are undergoing to mechanically extract crab pulp for improved yields. The Living Lab is also piloting the extraction of bioactive compounds from processing residues (e.g. antioxidants, fish protein hydrolysates, omega-3 oils), to feed nutraceutical, cosmeceutical, food, feed and packaging value-chains. The valorization of these alternative products and by-products is considered a clear path toward local communities' revitalization that, in turn, is underpinned by circular-economy values.

The products developed are finally tested through sensorial and consumer testing. Dedicated sensory analysis labs with trained panels for validating product acceptability are done under the supervision of UNIPA, before market launch.

New ways of knowing and learning:

The knowledge gaps identified during the process of ideation, design, and experimentation are filled with co-creation workshops where applied sessions on specific products e.g. on fish dry-aging, low-sodium smoking, were led by technology providers, bringing together company production managers, researchers and enterprise staff to iteratively refine processes.

New ways of understanding and framing:

Here we include two examples that exemplify how the Innovittica project fostered new values and framings.

Firstly, by reframing "waste" streams (e.g. fish processing side streams, invasive crab biomass) as valuable biomasses and feedstocks, the project fostered a shift of mindsets from a linear logic to closed-loop valorization aligned with Circular Bioeconomy principles thanks to well setup technologies [e.g.,[47,50–52]]. The second example refers to the demonstration of low-sodium seafood being organoleptically equivalent to traditional products, as a strategy to foster the consumption of processed marine products that improve both health and the environment.

New ways of organizing and governing:

The Diffuse Living Lab also promotes new ways of organization and governance among stakeholders in the MFS in Trapani that makes innovation a more participative and democratic process.

The "Associazione Temporanea di Scopo" (ATS), a temporary association combining the University Consortium of Trapani, University of Palermo, University of Messina, producer organizations, technology firms and the Regional Fisheries Department, is the governing body of the Innovittica project and as such determines R&D priorities and resource allocation. The participation of diverse actors in the ATS enabled the decentralization of innovative efforts along a network of integrated enterprise-embedded "nodes" that ensure rapid knowledge transfer and co-ownership of outcomes.

Values of community building, social inclusion and justice underpin the Living Labs infrastructure within the Innovittica project. The Innovittica's Living Labs infrastructure is, as explained above, distributed across Western Sicily in strategic locations to be closer to the fisherfolks. This decision has been instrumental for making research and researchers more available and closer to fisherfolks, in a way that promotes co-creation and horizontal collaboration. Additionally, by locating part of the Living lab facilities in infrastructures seized from the mafia, the project and the wide array of actors engaged, send a strong message in post of community and social justice values, and embed them into the innovation ecosystem.

With regards to the exit strategy for the project's infrastructure, the lab's future management will be jointly held by the marine-biology institute, producers' associations engaged in certain Living Labs' infrastructures, and the local competence center, embedding collaborative governance beyond the project's life.

The Innovittica project, through the ATS, promotes alternative values of circularity, sustainability, social justice, social equity, and community building. By establishing participatory routines such as visioning exercises and iterative

prototyping, the ATS creates a common language and understanding among diverse stakeholders on the MFS in Trapani, increasing their awareness on systemic issues and mechanisms that may enable or hinder the transformative potential of social innovations.

Once stakeholders developed a common understanding of the situation, they participated in workshops to articulate a joint vision: "A resilient, circular Mediterranean seafood sector built over a collective identity grounded in sustainability and regional heritage".

The social structures created in the Living Labs contribute to the empowerment of stakeholders. By equipping local managers and processors with decision-making roles in R&D, the project fosters autonomy over process choices and accelerates ownership of innovations. By arranging regular multi-actor interactions organized in an accessible and friendly setting for different stakeholders i.e. SMEs, universities and public bodies, the project develop a sense of trust, resource sharing and collective problem-solving capacity. Finally, by delivering ad-hoc, applied training and sensory-panel workshops, the project contributed to systematically upgrading technical know-how, elevating participants from passive adopters to active innovators.

4.3. Preparing for change: Networks formations and multi-layered community building

For the Innovittica project to give rise to empowering collectives and to remain viable over time, it has a strong network of connections at different levels – locally, nationally, at EU level, and with broader societal communities or discourses.

Supportive local ecosystems:

European Maritime and Fisheries Fund (EMFF) 2014-2020, Measure 1.26, delivered through the Sicilian Regional Government's Department for Mediterranean Fisheries, provide both the capital and political backing for niche experimentation within the Innovittica project. The scientific expertise, lab facilities and pilot-scale equipment were delivered through the Marine Biology Institute (University Consortium of Trapani), University of Palermo, University of Messina (Dept. of Veterinary Sciences), the Distretto della Pesca e Crescita Blu - Co.S.Va.P, the Centro di Competenza Distrettuale and private partner Medicair Industries. The laboratories and pilot equipment are installed at the industrial partners' premises (e.g. Euroittica Lilybetana in Marsala, OP della Pesca di Trapani, Blue Ocean S.R.L.), enabling rapid technology transfer and immediate scaling of successful experiments.

All research and development activities were brought closer to the fisherfolks, fish processing enterprises, cooperatives, technology providers and citizens panels, creating an energetic environment for social innovation.

Trans-local networks and broader societal discourses:

Innovittica's actors leveraged cross-project and transnational linkages to promote their agenda. By presenting *Innovittica* alongside EU-funded projects with activities across Europe in the G7 Agriculture & Fisheries Conference in Syracuse 2024, connections were strengthened between MFS stakeholders in Western Sicily and EU policymakers, reinforcing their position within the emerging Blue Bioeconomy community.

4.4. Institutionalization process: Fostering a more adaptive, bottom-linked governance.

As mentioned in 4.2, the dialogue and knowledge exchange taking place during participatory exercises in the Living Labs set the groundwork for stakeholders to be more aware of the complexity of the issues they look to address, and to better understand the mechanisms that enable or hinder the transformative potential of social innovations. The following is a brief description of key lock-in mechanisms and potential levers identified while making sense of social innovations' potential within the MFS.

The strict regulatory framework for product innovation, e.g. the rigid definitions of "fish product" and the labelling standards, represents a major barrier for R&D in the MFS. Related to this are the fragmented small-scale operations performed with a very limited R&D capacity in value chains currently relying on salt preservation.

The Innovittica initiative with its widespread lab-infrastructure represents a powerful lever to improve R&D through training and knowledge transfer beyond the project's durability. To foster a more inclusive, bottom-linked governance that helps overcome the lock-in mechanisms in the MFS in Trapani, stakeholders within the Innovittica's Living Lab promote actions on three deep leverage points. First, a normative shift to reframe waste as a resource for production and income generation. Second, a policy reform that includes by-product valorization in the EMFF. Third, governance

re-design, by institutionalizing the Living Lab as a regional innovation platform with rotating leader responsibility among SMEs, research institutes and civil society.

Engaging with diverse stakeholders along the participatory processes in the Living Labs was essential to foster more inclusive governance and decision-making within the region. To that end, the ATS established regular multi-stakeholder roundtables convening diverse groups to deliberate on important issues and collaboratively shape the path forward. These roundtables brought together representatives from various sectors, ensuring that all voices were heard and considered in the decision-making process.

To deal with power, equity, vulnerability, and agency issues, trained external facilitators guide discussions and mediate conflicts during the participatory activities organized by the ATS. They employ transparent evaluation criteria, e.g., speaking time quotas, to warrant equal opportunities for everyone to express their opinion and concerns, preventing dominant voices from overshadowing the contributions of others. Neutral venues are used to minimize the influence of power dynamics, much more present in familiar locations, and thus balance the diverse interests at stake.

Additionally, capacity-building initiatives have been launched to support under-resourced SMEs, providing them with the necessary tools and knowledge to engage effectively in negotiations and advocate for their interests. These efforts aim to level the playing field through empowerment.

The decision-making criteria in scaling innovations are meticulously designed to incorporate technical feasibility, market potential, and social-value impact. The ATS recognized the importance of consumer feedback in scaling decisions. They systematically incorporated consumer-test results into their decision-making processes, creating a feedback loop that informs and refines scaling strategies. This practice not only improved the relevance and effectiveness of their initiatives but also fostered a sense of ownership among consumers.

By adopting a multi-dimensional approach that recognizes technical, economic, and societal values and impacts, the ATS ensures that diverse and often marginalized voices have a significant influence on scaling choices. By considering the broader implications of each decision, stakeholders can make informed choices aligned with the goals of inclusivity and social equity. This method not only enhances the sustainability of the scaling process but promotes the active involvement of all participants in shaping the system's future trajectory.

By creating the widespread Living Lab infrastructure detailed above, the Innovittica project institutionalizes a regional innovation platform that contributes to democratizing power with rotating leadership among SMEs, research institutes, and civil society. The steering committees of the ATS exemplify how the Living Lab recombines elements from various societal and institutional models to promote a more inclusive, participatory, and responsive governance structure that adapts to evolving needs and priorities.

The participatory and empowering nature of the Living Lab facilitates dialogue and knowledge exchanges between actors with diverse perspectives, e.g., traditional fisherfolks and innovation champions, reducing conflicts.

4.5. Stabilization of the new trajectory: Systems transformation

The Innovittica nodes installed in partner companies share the same principles that innovation, governance, and communication to raise societal awareness must be act upon together rather than in isolation to foster systemic changes. This alignment manifests in shared infrastructure, unified vision documents guided by blue bioeconomy principles, and a multi-actor governance comprising visioning, back-casting, and prototyping routines that inform scale-up decisions.

By linking these dimensions, social innovations no longer sit as isolated experiments. They form mutually reinforcing elements of a new regime, stabilizing a trajectory that can be rolled out across Sicily's blue-economy sector.

The agents driving these innovations, fisherfolks, enterprise managers, researchers and citizen-panel facilitators, have been equipped with both the resources and the legitimacy to challenge the existing authorities and the status quo. The EMFF 2014–2020 funding led to the establishment of lasting research infrastructures that extended beyond the project's duration, providing crucial material resources. Additionally, Living Lab workshops and technology-transfer sessions contributed significantly to capacity building by equipping managers and technicians with the skills necessary for making autonomous process decisions. In terms of political capital, involvement in the G7 Fisheries Conference and EU Blue Bioeconomy clusters allowed for substantial influence in lobbying for changes in EMFF 2021–2027. Furthermore, network legitimacy was achieved through collaboration with universities, cooperatives, and civil-society associations, ensuring that smaller SMEs have fair representation.

5. Conclusions

This paper contributes primarily to the Transformative Social Innovation (TSI) theory by providing actionable guidance that helps practitioners, researchers, and policy makers to systemically explore and leverage the transformative potential of social innovations. The guidance integrates structural (institutions, governance, agency),[11] processual,[19] and relational dimensions,[10] making it possible to analyze not only what needs to change but also how such changes unfold in practice.

To achieve this, we adapted and updated Moore et al.' framework,[19] a decade-old but still highly influential tool for understanding social-ecological transformations. Moore et al. made a significant contribution by embedding social science insights into SES transformation analysis, particularly on agency and power. Our work builds on this framework, enriching it with recent advances from TSI theory. In particular, insights on adaptive, bottom-linked governance[11] and relational dynamics[10] were incorporated into Moore's subprocesses, allowing us to produce a guidance that is both theoretically robust and easy to apply in real-world case studies. This dialogue between SES and TSI frameworks ensures that the guidance reflects both processual logics of system change and innovation-specific insights, grounded in empirical practice.

From a practical standpoint, the case study of the *Innovittica* project in Western Sicily provides grounded insights into how social innovations can challenge dominant ways of doing, thinking, learning, and organizing.[10] The project demonstrates how networks of complementary and aligned innovations,[14,30] rather than isolated initiatives, can collectively pursue a shared vision of change.[10] The Living Lab structure was central to this process, providing an inclusive and experimental space where diverse actors co-created knowledge, exchanged perspectives, and advocated collectively for alternative values – a condition necessary for social innovation to have transformative potential.[10,19,20]

Importantly, the case study also exemplifies the synergy between top-down priorities and bottom-up action. EU funding priorities aligned with local concerns about the future of fisheries and coastal communities, showing how policy frameworks can support societal claims when grounded in inclusive and participatory structures. At the same time, the project underlines the importance of innovation ecosystems, which can be understood at three levels[10]: (i) close networks that, in this case, will sustain the innovative infrastructure after the project is finished; (ii) networks for the exchange of knowledge and experiences across contexts to develop the capacity to question the system itself, and (iii) belonging to broader societal discourses or societal groups with common interests that open up a greater platform for communication and exchange. These networks are crucial for empowering innovative actors and reinforcing the agency and visibility of innovation experimentation within marine food systems.

Moreover, the case study shows how social innovations can work across multiple leverage points, both shallow and deep (e.g., the design of new technologies and processes, and the creation of participatory social structures that enable knowledge transfer and foster the adoption of Circular Bioeconomy values). This layered intervention strategy increases the likelihood of producing systemic, sustained, and relevant change.[41,43]

Beyond this specific case, the guiding questions developed here can serve as an exploratory tool in their own right. They provide a structured way to engage stakeholders in participatory inquiry, helping them to collectively reflect on what needs to change and how transformations may unfold in their systems. At the same time, questions can inform the design of more deliberate and context-sensitive innovation processes by guiding practitioners and policymakers. Because they are adaptable across contexts and sectors, the guiding questions offer an actionable bridge between theory and practice to advance grounded, systemic change.

Ethics and consent

This study was conducted within the Horizon Europe BlueRev project. This study involved ONLY qualitative interviews and workshops with adult stakeholders. All participants provided informed consent prior to participation. Data were anonymised at source and handled according to the BlueRev Data Management Plan. The study did not require to follow the principles of the Declaration of Helsinki as it was **not including medical experiments**. Ethical review was conducted by the EU during the Grant Agreement process. Human-participant procedures were also reviewed by each of the consortium's member and it was determined that the interview- and workshop-based research did not fall under biomedical/health research legislation that triggers mandatory national ethics committee review; nonetheless, the protocol underwent institutional ethics and GDPR review. Participation was voluntary; written informed consent was obtained from all participants prior to data collection. All personal data were handled in compliance with the GDPR, under the oversight of the institutional Ethic Officer of NIBIO (Elin Thingnæs Lid, elin.lid@nibio.no) and Data Protection Officers of UNIPA (Antonino Pollara dpo@unipa.it); only pseudonymized data were shared across partners.

Informed consent statement

Written Informed consent was obtained from all subjects involved in the study. The Informed Consent template used in this research can be found here: https://doi.org/10.5281/zenodo.10591239.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used Co-pilot in order to improve readability. After using this tool/service, the authors reviewed and edited the content as needed, taking full responsibility for the content of the publication.

Data availability

The raw data clustered and anonymised, for the Italian interviews has been published here: https://zenodo.org/records/18656303.

DOI: https://doi.org/10.5281/zenodo.18656303

The data set is elaborated as a project deliverable: BlueRev Dataset: Protocol for data collection, guiding questions and interviews summaries for the three case studies. Available in Zenodo repository: https://zenodo.org/records/14135095.

DOI: https://doi.org/10.5281/zenodo.10591239

The deliverable includes the informed consent and the protocols used for data collection, the interview guidelines and the interviews summaries, used to identify key innovative interventions and assess their transformative potential. This paper only focuses on the Italian case study.

Data is available under the terms of the Creative Commons Zero (CCO).

References

1. Reynolds M, Holwell S: **Introducing systems approaches.** Reynolds R, Holwell S, editors. *Systems Approaches to Managing Change: A Practical Guide.* London: Springer; 2010; pp. 1–23. **Publisher Full Text**
2. Walton M, Gates EF, Vidueira P: **Insights and future directions for systems and complexity-informed evaluation.** *N. Dir. Eval.* 2021; **2021**: 159–171. **Publisher Full Text**
3. Bustamante M, Vidueira P, Baker L: **Insights from systems thinking and complexity science to strengthen food systems frameworks.** *Glob. Food Sec.* 2024; **42**: 100777. **Publisher Full Text**
4. Béné C, Oosterveer P, Lamotte L, *et al.*: **When food systems meet sustainability – Current narratives and implications for actions.** *World Dev.* 2019; **113**: 116–130. **Publisher Full Text**
5. Dury S, Bendjebbar P, Hainzelin E, *et al.*: *Food Systems at risk: trends and challenges.* Rome, Montpellier, Brussels: FAO, CIRAD and European Commission; 2019. **Publisher Full Text**
6. HLPE: *Food security and nutrition: building a global narrative towards 2030.* Rome: High-Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security; 2020.
7. TEEB: *TEEB for Agriculture and Food: Scientific and Economic Foundations.* Geneva: UN Environment; 2018.
8. Howaldt J, Kopp R: **Shaping social innovation by social research.** Franz H-W, Hochgerner J, Howaldt J, editors. *Challenge Social Innovation.* Berlin: Springer;Edition 127 2012; pp. 43–55.
9. Haxeltine A, Pel B, Dumitru A, *et al.*: **Consolidated version of TSI theory (TRANSIT Deliverable D3.4).** 2017.
10. Pel B, Haxeltine A, Avelino F, *et al.*: **Towards a theory of transformative social innovation: A relational framework and 12 propositions.** *Res. Policy.* 2020; **49**: 104080. **Publisher Full Text**
11. Castro-Arce K, Vanclay F: **Transformative social innovation for sustainable rural development: An analytical framework to assist community-based initiatives.** *J. Rural. Stud.* 2020; **74**: 45–54. **Publisher Full Text**
12. Castro-Arce K, Parra C, Vanclay F: **Social innovation, sustainability and the governance of protected areas: revealing theory as it plays out in practice in Costa Rica.** *J. Environ. Plan. Manag.* 2019; **62**(13): 2255–2272. **Publisher Full Text**
13. Moulaert F: *The international handbook on social innovation: Collective action, social learning and transdisciplinary research.* Edward: Elgar Publishing; 2013.
14. Avelino F, Wittmayer JM, Kemp R, *et al.*: **Game-changers and transformative social innovation.** *Ecol. Soc.* 2017; **22**(4): 41. **Publisher Full Text**
15. Avelino F, Wittmayer JM, Pel B, *et al.*: **Transformative social innovation and (dis)empowerment.** *Technol. Forecast. Soc. Change.* 2019; **145**: 195–206. **Publisher Full Text**
16. Haxeltine A, Avelino F, Pel B, *et al.*: **A framework for transformative social innovation (TRANSIT Working Paper 5).** November 2016.
17. Westley F, McGowan K, Tjörnbo O: *The Evolution of Social Innovation Building Resilience Through Transitions.* Edward Elgar; 2017.
18. Parés M, Ospina SM, Subirats J: *Social innovation and democratic leadership.* Cheltenham: Edward Elgar; 2017.
19. Moore ML, Tjornbo O, Enfors E, *et al.*: **Studying the complexity of change: Toward an analytical framework for understanding deliberate social-ecological transformations.** *Ecol. Soc.* 2014; **19**(4): 54. **Publisher Full Text**
20. Olsson P, Folke C, Hahn T: **Social-ecological transformation for ecosystem management: the development of adaptive co-management of a wetland landscape in southern Sweden.** *Ecol. Soc.* 2004; **9**(4): 2. **Publisher Full Text** | **Reference Source**
21. Geels FW: **The multi-level perspective on sustainability transitions: Responses to seven criticisms.** *Environ. Innov. Soc. Trans.* 2011; **1**: 24–40. **Publisher Full Text**
22. Nicholls A, Murdock A: *Social innovation: Blurring boundaries to reconfigure markets.* Basingstoke: Palgrave Macmillan; 2012.
23. Westley FR, Zimmerman B, Patton MQ: *Getting to maybe: how the world is changed.* Toronto: Vintage Canada; 2006.

24. El Bilali H, Probst L: **Towards an integrated analytical framework to map sustainability transitions in food systems. AGROFOR.** *Int. J.* 2017; **2**(2).
Publisher Full Text

25. Markard J, Truffer B: **Technological innovation systems and the multi-level perspective: towards an integrated framework.** *Res. Policy.* 2008; **37**(4): 596–615.
Publisher Full Text

26. Park SE, Marshall NA, Jakku E, *et al.*: **Informing adaptation responses to climate change through theories of transformation.** *Glob. Environ. Chang.* 2012; **22**(1): 115–126.
Publisher Full Text

27. Westley FR, Tjornbo O, Schultz L, *et al.*: **A theory of transformative agency in linked social-ecological systems.** *Ecol. Soc.* 2013; **18**(3): 27.
Publisher Full Text

28. Moulaert F, Mehmood A, MacCallum D, Leubolt B: **Social innovation as a trigger for transformations - The role of research. EU Technical Report.** 2017.

29. Grouzet F, Kasser T, Ahuvia A, *et al.*: **The structure of goal contents across 15 cultures.** *J. Pers. Soc. Psychol.* 2005; **89**: 800–816.
PubMed Abstract | **Publisher Full Text**

30. Wittmayer JM, Avelino F, Backhaus J, *et al.*: **Narratives of change: how social innovation initiatives construct societal transformation.** *Futures.* 2019; **112**: 102433.
Publisher Full Text

31. Smith A, Raven R: **What is protective space? Reconsidering niches in transitions to sustainability.** *Res. Policy.* 2012; **41**: 1025–1036.
Publisher Full Text

32. Gring J, Rotmans J, Schot J: *Transitions to Sustainable Development: New Directions in the Study of Long Term Transformative Change.* New York: Routledge; 2010.
Publisher Full Text

33. Svensson O, Nikoleris A: **Structure reconsidered: towards new foundations of explanatory transitions theory.** *Res. Policy.* 2018; **47**: 462–473.
Publisher Full Text

34. Geels FW: **Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study.** *Res. Policy.* 2002; **31**: 1257–1274.
Publisher Full Text

35. Biggs R, Westley FR, Carpenter SR: **Navigating the back loop: fostering social innovation and transformation in ecosystem management.** *Ecol. Soc.* 2010; **15**(2): 9.
Publisher Full Text | **Reference Source**

36. Haxeltine A, Pel B, Wittmayer J, *et al.*: **Building a middle-range theory of Transformative Social Innovation; theoretical pitfalls and methodological responses.** *European Public and Social Innovation Review.* 2017; **2**(1): 59–77.
Publisher Full Text

37. Meadows D: *Leverage points: Places to intervene in a system.* Harland: The Sustainability Institute; 1999.

38. Korhonen-Kuri K, Horn S, Entsalo H, *et al.*: **Leverage points for sustainability transformation: Identifying past and future changes in the Finnish (circular) plastic packing system.** *Ecol. Econ.* 2024; **219**: 108136.
Publisher Full Text

39. Abson D, Fisher J, Leventon J, *et al.*: **Leverage points for sustainability transformation.** *Ambio.* 2017; **46**: 30–39.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

40. Gaziulusoy I, Veselova E, Hodson E, *et al.*: **Design for sustainability transformations: A deep leverage points research agenda for the (post-) pandemic context.** *Strategic Design Research Journal.* 2021; **14**(01): 19–31.
Publisher Full Text

41. Smith A, Stirling A: **The politics of social-ecological resilience and sustainable socio-technical transitions.** *Ecol. Soc.* 2010; **15**(1): 11.
Reference Source

42. Seo MG, Creed WED: **Institutional contradictions, praxis, and institutional change: a dialectical perspective.** *Acad. Manag. Rev.* 2002; **27**: 222–247.
Publisher Full Text

43. Westley FR, Antadze N: **Making a difference: strategies for scaling social innovation for greater impact.** *Public Sector Innovation Journal.* 2010; **15**(2): 2.
Reference Source

44. Ottavianni G: **BlueRev DataSet: Protocol for data collection, guiding questions and interviews summaries for the three case studies.** November 2023.
Publisher Full Text

45. Messina CM, Manuguerra S, Arena R, *et al.*: ***In Vitro* Bioactivity of Astaxanthin and Peptides from Hydrolisates of Shrimp (*Parapenaeus longirostris*) By-Products: From the Extraction Process to Biological Effect Evaluation, as Pilot Actions for the Strategy "From Waste to Profit.".** *Mar. Drugs.* 2021; **19**: 216.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

46. Messina CM, Arena R, Ficano G, *et al.*: **Effect of Cold Smoking and Natural Antioxidants on Quality Traits, Safety and Shelf Life of Farmed Meagre (*Argyrosomus regius*) Fillets, as a Strategy to Diversify Aquaculture Products.** *Foods.* 2021; **10**: 2522.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

47. Messina CM, Manuguerra S, Renda G, *et al.*: **Biotechnological Applications for the Sustainable Use of Marine By-products: in vitro Antioxidant and Pro-apoptotic Effects of Astaxanthin Extracted with Supercritical CO_2 from *Parapeneus longirostris*.** *Mar. Biotechnol.* 2019; **21**: 565–576.
PubMed Abstract | **Publisher Full Text**

48. Messina CM, Bono G, Arena R, *et al.*: **The combined impact of cold smoking and natural antioxidants on quality and shelf life of dolphinfish (*Coryphaena hippurus*) fillets.** *Food Sci. Nutr.* 2019; **7**(4): 1239–1250.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

49. Messina CM, Bono G, Arena R, *et al.*: **Polyphenols from halophytes and modified atmosphere packaging improve sensorial and biochemical markers of quality of common dolphinfish (*Coryphaena hippurus*) fillets.** *Food Sci. Nutr.* 2016; **4**(5): 723–732.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

50. Messina CM, Renda G, La Barbera L, *et al.*: **By-products of farmed European sea bass (*Dicentrarchus labrax L.*) as a potential source of n-3 PUFA.** *Biologia.* 2013; **68**: 288–293.
Publisher Full Text

51. Messina CM, Arena R, Manuguerra S, *et al.*: **Farmed Gilthead Sea Bream (*Sparus aurata*) by-Products Valorization: Viscera Oil ω-3 Enrichment by Short-Path Distillation and *In Vitro* Bioactivity Evaluation.** *Mar. Drugs.* 2021; **19**.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

52. Messina CM, Arena R, Manuguerra S, *et al.*: **Valorization of Side Stream Products from Sea Cage Fattened Bluefin Tuna (*Thunnus thynnus*): Production and *In Vitro* Bioactivity Evaluation of Enriched ω-3 Polyunsaturated Fatty Acids.** *Mar. Drugs.* 2022; **20**.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

Open Peer Review

Current Peer Review Status: ✔

Version 1

Reviewer Report 08 June 2026

https://doi.org/10.21956/openreseurope.24791.r74606

© **2026 Bhagwat S.** This is an open access peer review report distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

✔ **Shonil Bhagwat**
The Open University, Milton Keynes, England, UK

This paper presents an insightful case study of a specific section of the food system (food from aquatic and marine sources) in Sicily, Italy. The methodological protocols were developed in EU-funded flagship BlueRev project, ensuring rigour and robustness of methodological design and protocols.
The paper's unique contribution is actionable guidance to help practitioners and researchers explore and leverage transformative potential of social innovations. To this end, Table 1 in the paper is the key resource. This resource is valuable for checklist for researchers of social innovation. Importantly, this resource is underpinned by the combined framework of social ecological systems and transformative social innovation theories.

Their combination adds to the novelty of the paper. Overall, the paper's findings are transferable to other contexts and scalable to other geographies, making it a valuable addition to the literature on social innovation.

Is the work clearly and accurately presented and does it engage with the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

Are all the source data and materials underlying the results available?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Not applicable

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Agrifood systems, community-based innovation, social-ecological systems

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.