European Countryside | volume 17 | No. 4 | p. 657-677 | DOI: 10.2478/euco-2025-0033

FOSTERING SUSTAINABILITY TRANSITIONS IN RURAL AREAS: A PARTICIPATORY FUTURING PROCESS

Naomi di Santo[1], Simona Negro[2], Roberta Sisto[3]

[1] Dr. Naomi di Santo, corresponding author, Department of Soil, Plant and Food Sciences, University of Bari Aldo Moro, Bari, Italy; ORCID: 0000-0002-5525-4126, e-mail: naomi.disanto@uniba.it

[2] Dr. Simona Negro, University of Utrecht, the Netherlands; ORCID: 0000-0002-8532-0825, e-mail: s.o.negro@uu.nl

[3] Prof. Roberta Sisto, University of Foggia, Italy; ORCID: 0000-0002-1112-0919, e-mail: roberta.sisto@unifg.it

Received 29 April 2025, Evaluated 14 October 2025, Revised 21 October 2025, Accepted 25 October 2025

Abstract: In recent years, policies have increasingly emphasized the need to support sustainability transitions. Aligned with this focus, scholars consider the circular economy a valuable strategy for advancing sustainable development. It is widely argued in the literature that overcoming the traditional approach of addressing individual environmental issues with specific policies can be achieved through the adoption of a policy mix. Moreover, a complex problem like sustainability transition, defined by specific characteristics, requires a solution with those same traits. In the literature, a policy mix is often presented as a solution to support sustainability transitions. To this end, the study wants to support evidence-informed policymaking by offering a multistage method based on participatory futuring to identify barriers and key actions for a policy mix formulation towards a circular economy. Specifically, implementing a backcasting approach allows for identifying key actions and actively integrating stakeholders' perspectives involving visions and pathways of system transformation. In particular, the process was divided into different stages: i) formulation of a circular economy scenario, ii) exploration of barriers, and iii) delineation of key actions to implement the scenario. This paper contributes to the literature on policy mix, employing a hybrid approach that combines backcasting and focus group techniques, using rural areas as a case study. This approach supports the idea that identifying future scenarios is a prerequisite for sustainable development and could be a strategic tool for encompassing environmental, social and economic spheres.

Keywords: Circular economy transition, Participatory approach, Rural Areas, Local Action Group, Sustainability transition

Highlights

- Overcoming sectoral policy challenges through a comprehensive participatory approach.
- Uncover barriers to support the circular economy transition.
- The aim was achieved through a participatory approach in a Local Action Group.
- Territorial identity or stakeholder involvement are crucial in the policy process.

1. Introduction

Sustainability transitions represent a multidimensional and multi-actor challenge, increasingly recognised as a priority by both scholars and policymakers (Williams and Robinson, 2020; Geels, 2023). These processes, which often unfold over extended timescales, require governance frameworks capable of integrating environmental, economic, and social considerations. In this context, the concept of **policy mix** has emerged as a strategic response to complexity, aiming to coordinate diverse instruments and actors in a coherent, goal-oriented manner (Rogge and Reichardt, 2016).

For this reason, these transitions require a *long-term vision* and *resilience* to various shocks, spanning extended timescales. They are usually *goal-oriented* and often they involve *conflict and struggle*, challenging the status quo and generating resistance. Moreover, sustainability transitions are *non-linear, uncertain,* and *open-ended* processes that integrate innovations difficult to predict because of factors like social acceptance, technical adaptation, and competition among emerging innovations (Geels, 2023).

Basically, from a policy view, the complexity of this issue calls for the adoption of a policy mix rather than traditional practice, where several specific policies (Scordato et al., 2018) address individual problems. Coherently, because the various global challenges are interconnected, many Scholars (di Santo et al., 2024; Quitzow, 2015; Schmieder et al., 2021; Wilts and O'Brien, 2019) highlight that a coherent policy mix can yield positive results, reducing the risk of overlapping policies, wasted funds, and inefficient management of resources.

This study is placed into this thematic area and its core idea is that if the problem is complex and defined by several key aspects, as is the case with sustainability transitions, then the solution must also be complex and share these same characteristics. Furthermore, for this to be truly suitable to address the problem, it should be obtained through a methodology already incorporating these aspects. Therefore, the adoption of a methodological approach aligning with the problem's needs makes it much more likely that the outcome will be consistent and effective.

In these research fields, the extended timescales have made studies on future scenario design increasingly attractive. From this perspective, a real sustainability transition needs to focus on new opportunities for collaboration and proactive initiatives while minimising the risk of policymakers relying on future predictions (Ramos et al., 2019). Despite advancements in the literature emphasizing i) the urgency of adopting a policy mix perspective, ii) the positive impacts of a participatory approach, and iii) the need for a transition toward sustainability, there remains a gap in the formulation of a specific policy mix that incorporates the characteristics of sustainability transitions.

More specifically, the paper presents a starting point for formulating an efficient policy mix in rural areas, developing a methodological contribution to support evidence-informed policymaking by proposing a multistage participatory futuring process. Indeed, according to the seminal work by Rogge and Reichardt (Rogge and Reichardt, 2016), policy mixes are divided into three fundamental aspects: i) objectives, ii) policy strategies, and iii) assessment methods. Consequently, this method, based on participatory futuring, could help define specific objectives that must be considered when formulating a policy mix.

In particular, a backcasting approach was employed. The foundation of backcasting lies in the participatory approach, which, in this study, involved the formulation of two focus groups. The participatory nature of the method aims to minimize the risks of failure of the resulting policy mix. To ensure alignment with the paper's aim, this approach is pertinent, as it involves the exploration of technological and policy options to attain desirable futures, consistent with the concept of retrospective scenarios. The methodology is applied step by step to the example of reusing agricultural waste in the territory of the Local Action Group "Daunia Rurale 2020" in Southern Italy.

The strength of the study lies in several aspects of innovative features and its consistency with the prevailing EU orientations and recommendations for a more democratic and effective policymaking. Firstly, the focus has been shifted from isolated aspects of the circular economy to the interdependencies within policy frameworks as suggested by Milios (2018). Secondly, this research contributes to the field of participatory futuring by proposing new ways to support sustainability transitions through integrated policy design (di Santo et al., 2025). Specifically, the adopted participatory approach enabled the identification of barriers to sustainable futures as suggested by Kah et al. (2023) and the definition of strategic actions toward desirable future scenarios (Sisto et al., 2018). Finally, the study emphasizes the importance of rural areas, specifically of Local Action Groups (LAGs), which, despite their relevance to local development efforts, remain marginal in academic discussions.

2. Background

2.1 Investigating obstacles to circular economy implementation

The circular economy is increasingly acknowledged as a key strategy for achieving sustainability, yet its practical implementation continues to pose significant challenges for both scholars and practitioners. Since the early 2000s, academic interest has steadily grown around the adoption of innovations (Wisdom et al., 2014), reflecting the broader concern with how to facilitate complex, multi-actor and multi-level transitions in response to the unsustainable dynamics of current systems (Yalçın & Foxon, 2021). Given its critical role in driving systemic change and supporting sustainable development (Chizaryfard et al., 2021), this transition has been the subject of extensive research across countries (Yalçın & Foxon, 2021) and sectors, including textiles (Reike et al., 2023). Nonetheless, gaining a deeper understanding of the barriers impeding progress toward circularity remains essential. Identifying and analysing these obstacles is a necessary step for developing effective strategies capable of fostering a meaningful transition to more sustainable models (Ferrari et al., 2022). In this context, research has increasingly turned its attention to

specific implementation barriers, particularly as principles such as waste reduction, reuse, and repair become more embedded in local and regional policies, and more widely embraced by diverse social and economic stakeholders.

Barriers to this transition can be grouped into several major categories:

1. Market and sector-specific barriers: These include difficulties related to new technology adoption, such as building new infrastructure or adapting existing systems (de Jesus & Mendonça, 2018). Additional barriers include low demand for circular products due to limited consumer interest, lower costs of raw materials, and international competition (Kirchherr et al., 2018).
2. Economic and financial barriers: These concern the financial viability of circular innovations and the availability of fundings. Economic uncertainty and unfamiliarity with new markets further complicate the adoption of sustainable models (Bechini et al., 2020)
3. Institutional and policy-related barriers: Regulatory inefficiencies, bureaucratic complexities, and a lack of standards for circular products are among the key institutional challenges. In some cases, financial incentives still favour linear economy practices, despite official support for circular approaches. At the territorial level, governance has been recognized as a critical enabler or inhibitor of these transitions (Salmenperä et al., 2021; Masi et al., 2018; Vermunt et al., 2019).
4. Sociocultural and informational barriers: These obstacles relate to awareness, knowledge, and cultural readiness. They include limited technical know-how, low awareness of environmental impacts, and resistance from stakeholders who benefit from the status quo. A lack of communication and collaboration networks also contributes to inertia (Lee & Gambiza, 2022; Verburg et al., 2022).

2.2 Participatory futuring: a backcasting approach

Some scholars (see Leminen et al. 2021; Neuhoff et al., 2023) argued that collaborative and innovative approaches are necessary to achieve sustainability, because such a complex issue involves interconnected variables and relies on long periods in which changes must occur. In this direction, the Agenda 2030 characterises a forward-looking perspective, establishing medium to long-term goals to support the transition towards a circular economy (Bonsu et al., 2020; Yumnam et al., 2024). Over time, the issue's complexity has made traditional policy planning approaches based on past trends ineffective and necessarily outdated, as highlighted by Sisto et al. (2020). According to Neuhoff et al. (2023), it is essential to enhance and strengthen societies' abilities to envision and achieve alternative futures based on new collaborative opportunities. A forward-looking perspective is based on merging both scientific and tacit knowledge (such as beliefs, values, and community preferences) to identify plausible scenarios truly achievable by society and participatory futuring can well incorporate these factors (Miller, 2013). The characterisation of participatory futuring is based on the notion that, to delineate plausible and sustainable scenarios, it is necessary to blend and cooperate with a broader range of actors, including policymakers, decision-makers, the local community, and society (Ramos et al., 2019). This principle is not only reinforced by various academic studies on the subject but is also emphasised internationally. Accordingly, the United Nations Conference on Environment and Development (1992) identifies the involvement of less influential actors in decision-making as essential for sustainable development. Specifically, this principle underpins the growing interest in participatory futuring, a theoretical approach that both acknowledges the complexity of current challenges and promotes the co-construction of plausible futures through the engagement of diverse stakeholders (Neuhoff et al., 2023).

The advantages of participatory approaches, including the active involvement of most community members, lie in increased democratisation of decisions, the increase of information resulting from the blending of tacit and explicit knowledge, and the strengthening of relationships among various stakeholders (Sisto et al., 2018). While several authors have highlighted the positive impact of the participatory approach, tokenism and uncertainty remain on the flip side (Neuhoff et al. 2023; Sisto et al. 2022). Specifically, tokenism is considered the phenomenon of false and only apparent participation of underrepresented stakeholders to increase public consensus and emphasise illusory mere involvement,

also because there is still a widespread belief that issues related to sustainability or the circular economy need to be simplified to be handled by non-experts (di Santo et al., 2023). On the other hand, there is a need to increase practical studies in this field to recognise uncertainty as imperfect knowledge of behaviour, unpredictability, and risk in considering desirable futures (Sisto et al., 2020).

Various approaches are used in literature to analyse desirable futures, for example, backcasting scenarios are widely used to imagine desirable futures with a significant deviation from the present (Zimmermann et al., 2012). Therefore, this study developed a backcasting approach because it fits the study's objective and ensures high participation from heterogeneous stakeholders in defining long-term strategies. This approach was widely used in energy (Giurco et al., 2011), in rural areas (Sisto et al., 2016), and in LEADER-Community Led Local Development (CLLD) contexts (Sisto et al., 2018). Specifically, backcasting is an approach, rather than a methodology, that fits well with participatory planning, where criteria and key actions are based on exploring desirable futures in terms of society and the environment (Kok et al. 2011; van Vliet and Kok, 2015). Operationally, backcasting defines the endpoint as a future with a high degree of desirability and, working backwards, outlines the key actions to reach that scenario in the present. Given its nature, this approach facilitates the participation of multiple stakeholder categories. Also, it aids in identifying a timeline to support policymakers in defining the most effective medium to long-term strategy (Sisto et al., 2018).

3. Materials and methods

As highlighted in the Introduction, the backcasting approach enabled us to identify the key actions on which to formulate a policy mix while actively including stakeholders' opinions (Quist et al., 2011). More specifically, to this aim, the process was segmented into different stages: i) definition of a circular economy scenario by experts, ii) investigation of barriers to its achievement, iii) formulation of key actions needed towards its realization (Table 1). Considering that several Authors emphasises that the context of analysis and their intrinsic characteristics are key elements for examining barriers and potential solutions (Mantino and Vanni 2019; Milhorance et al. 2020), a specific rural area was chosen as a case study unit.

This structure (Table 1) was designed to ensure that each stage built upon the previous one, progressively translating expert visions into locally grounded strategies. Unlike other approaches commonly used in the policy mix field (such as document analysis (Zhang et al., 2025), evaluation methods (Magro et al., 2019), or life cycle approach (Milios, 2018), this study adopts a bottom-up, dialogue-oriented approach. It differs from previous works by proposing a policy mix grounded in both tacit and explicit knowledge, thereby offering deeper insights into the technical and social barriers to sustainability transitions and providing a flexible, replicable framework for evidence-informed policymaking.

The method is designed as a multistage participatory futuring process based on a backcasting approach, consisting of three main phases. The first phase focused on scenario development. Specifically, a focus group with experts was organised to co-create a desirable circular economy scenario aligned with the characteristics of the territory, ensuring that it was both context-specific and technically feasible. The second stage involved a focus group with a broader range of stakeholders, during which the previously developed scenario was discussed to identify key barriers and the corresponding actions needed to address them. Participants also created a timeline to prioritise the proposed actions based on their urgency. This step helped to broaden stakeholder consensus and reduce the subjectivity biases that may emerge when relying solely on a limited group of experts.

The third stage focused on validation and reflection. It involved questionnaires and collective feedback to verify the outcomes and assess their credibility and alignment with local needs. Finally, a closing focus group was conducted to gather further reflections and overall evaluations of the results.

Tab. 1 Overview of the multistage method. Source: own elaboration

Data sources	Respondent details	Research question	Methods	When used
Focus Group with expert	11 experts with relevant skills and case study knowledge	What are the feasible scenarios within the LAG Daunia Rurale 2020 area oriented towards a circular economy? What are the potential barriers to implementing these scenarios?	Qualitative analysis, backcasting	January, 2024
Focus Group with stakeholders	13 local stakeholders	What are the key actions to overcome the barriers identified by the experts? What are the most urgent actions to implement to achieve the defined scenario?	Qualitative analysis, backcasting	June, 2024
Results validation (questionnaire)	Local stakeholders	How do you evaluate the results emerged from the focus groups?	Quantitative analysis	June, 2024
Focus group with expert and stakeholders	12 stakeholders	Do you have any final considerations that you deem appropriate to include in our research? How do you assess the overall results?	Qualitative analysis	April, 2024

The overall approach centred on focus groups. These sessions involved interviews with carefully selected participants who possessed specific qualifications, such as a deep understanding of the subject matter, shared sociodemographic characteristics, and a willingness to engage in facilitated group discussions (Rabiee, 2004). This method was well suited to the study's objectives, as it enabled the collection of diverse viewpoints, consideration of participants' varied backgrounds, and the legitimisation and democratisation of results (Šantrůčkova et al., 2013; Sisto et al., 2016). The exchange among stakeholders fostered crucial discussions on future strategies to be implemented in the area (Rabiee, 2004; Redden et al., 2023). This methodological approach falls within the broader spectrum of participatory techniques, whose primary aim is to minimise information asymmetry between researchers and participants. Additionally, involving diverse categories of stakeholders allows the integration of different forms of knowledge, thereby supporting the development of more effective and context-specific strategies. Fundamentally, participatory approaches are based on two key principles: subsidiarity and partnership. This implies that decision-making should take place as close as possible to the site of implementation and should involve representatives from a wide range of governmental and non-governmental groups (Sisto et al., 2018).

The following sections illustrate the real-life application of this process through the case of the Local Action Group Daunia Rurale 2020, detailing the participants, meetings, and results.

3.1 Case study

Given the growing recognition of rural areas in policy documents and sustainability agendas, this study investigated the potential barriers to innovation implementation within a LAG. The selection of a LAG as a case study stems from its established role in promoting strategies and proposing solutions aimed at the regeneration and advancement of rural territories. These groups are characterized by collaborative efforts between public and private actors to design and implement territorial development plans that address not only economic and environmental dimensions but also, crucially, the social fabric of local communities (Sisto et al., 2018).

In light of ongoing and future strategic planning activities involving LAGs, it becomes essential to examine the key barriers to a successful transition toward a circular economy. In this context, the LAG *Daunia Rurale 2020* was chosen as a representative case. This development agency is situated in the Apulia Region, which is notable for its predominantly rural character (Figure 1).

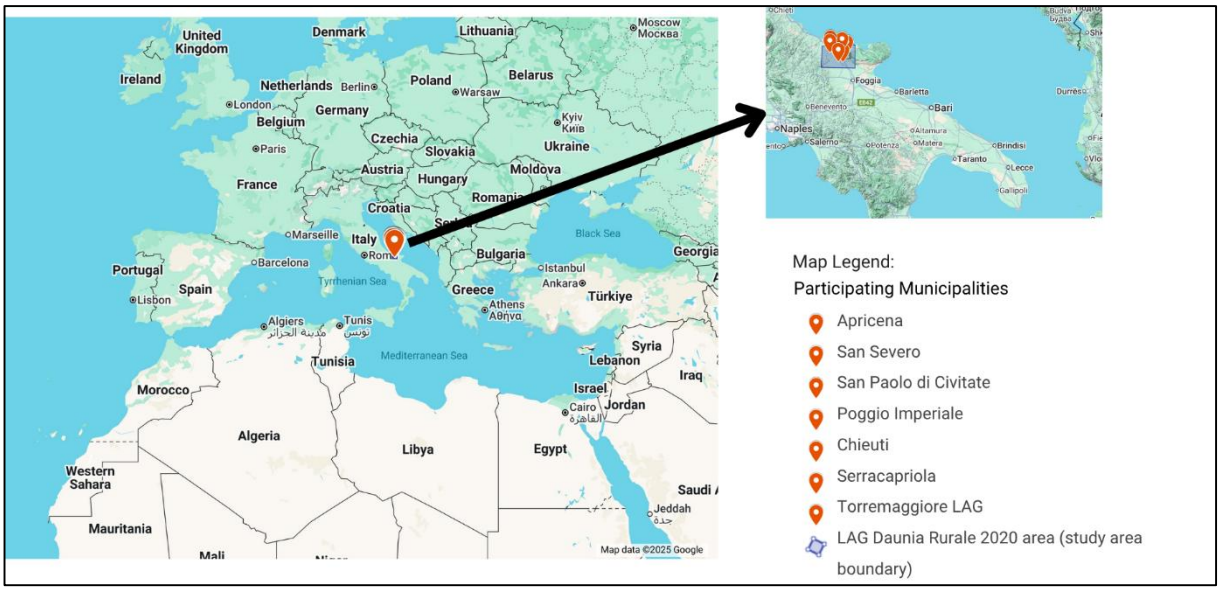

Fig 1. Location of the LAG Daunia Rurale 2020 within the Apulia Region (Southern Italy).

The group is composed of 80 members from both the public and private sectors, including two research and education bodies, six trade associations, seven private organizations and consortia, and 69 businesses.

An analysis of the LAG's territorial composition highlights the prevalence of traditional rural architecture and infrastructure. The landscape is particularly marked by the widespread presence of oil mills and wineries, which reflect a deep-rooted territorial identity. This strong connection to place is a distinguishing feature of the region's economic and productive activities. Additional competitive advantages lie in the area's association with certified quality agricultural products under the European Union's quality schemes. For instance, the municipality of Apricena is known for producing traditional wines, while the production of extra virgin olive oil is significant in San Severo and other nearby municipalities. These examples underscore the importance of the region's rich eco-gastronomic offerings.

Environmental and cultural assets further strengthen the region's development potential. Cultural traditions like transhumance as well as established wine and oil tourism routes, contribute to a unique and attractive territorial identity. The presence of historical landmarks, such as castles and archaeological sites, presents additional opportunities for cultural preservation and tourism-driven growth.

However, the area also faces critical demographic challenges. Population decline and an aging population are prominent issues that often affect rural regions. These dynamics hinder generational turnover and reduce the willingness to adopt innovations, such as agricultural insurance systems (Caffaro et al., 2020;

Rizzo et al., 2023). These demographic challenges are made worse by broader issues, such as a declining population and lower-than-average income levels. Regional data show particularly high unemployment rates among women and young people, along with generally low education levels. Additionally, the lack of generational renewal has led to limited openness to innovation in farming practices, making it harder for the region to fully engage with rural development policies.

3.2 Overview of the focus group sessions

Focus groups are part of a broader set of participatory tools aimed at reducing the gap in information and understanding between researchers and participants. By engaging stakeholders from various backgrounds, these sessions facilitate the integration of different forms of knowledge, ultimately contributing to the creation of more comprehensive and effective strategies. Such participatory practices are strongly aligned with the key ideas of the Community-Led Local Development (CLLD) approach in rural development. These principles emphasize that decisions should be made as locally as possible and involve a wide range of actors from both the public and private sectors (Sisto et al., 2018).

The stakeholders included in the participatory approach phase were chosen by developing a sample that incorporated diverse viewpoints and relevant experience. Expertise in rural development and the circular economy guided the selection of the experts, while members of the LAG served as stakeholders. However, since participation was voluntary, less active or more sceptical individuals may be underrepresented. Nevertheless, this risk is mitigated by the heterogeneity of the participants and the involvement of numerous actors from the LAG.

The first focus group session took place online in January 2024 and lasted for approximately three hours. A total of eleven participants were involved, each chosen for their specialized expertise and deep familiarity with the subject matter and case study. The group included university academics, a researcher specializing in rural development, an expert in socio-technical transitions, an organic chemistry professional, a regional government official working in local development funding, as well as the president and director of LAG Daunia Rurale 2020. Additionally, representatives from a regional agri-food district and professionals with knowledge of marketing and the local Action Plan were present (Table 2).

Tab 2. The participants of first focus group. Source: our elaboration

PARTICIPANTS	FOCUS GROUP	ROLE
Expert 1	Experts focus group	LAG Daunia Rurale 2020 Director
Expert 2	Experts focus group	LAG Daunia Rurale 2020 President
Expert 3	Experts focus group	Organic chemical
Expert 4	Experts focus group	Apulia region delegate operating on Local Development Funds linked to LEADER program
Expert 5	Experts focus group	UNIFG Grant Office Delegate and Coordinator
Expert 6	Experts focus group	Regional agribusiness district delegate
Expert 7	Experts focus group	Participant in the drafting of the local development strategy of the LAG
Expert 8	Stakeholders and experts focus groups	University researcher
Expert 9	Stakeholders and experts focus groups	Circular economy consultant
Expert 10	Stakeholders and experts focus groups	Rural development scholar
Expert 11	Stakeholders and experts focus groups	Socio-technical transition expert

After all participants gave their consent, the facilitator guided the discussion using prepared questions and added new ones based on what came up during the session. The primary objective was to outline a practical circular economy scenario for the LAG Daunia Rurale 2020 region and to pinpoint potential challenges to its implementation.

The next phase involved organizing a second focus group in June 2024, designed to complement the first. This session aimed to evaluate the practicality of the scenario proposed by the experts and to explore possible ways to overcome the identified obstacles. Local stakeholders, including producers, were invited by email to join the meeting in person at the LAG headquarters in San Severo. Twelve participants took part in this discussion (Table 3).

Tab 3. The participants of second focus group. Source: own elaboration

PARTICIPANTS	FOCUS GROUP	ROLE
Farmer 1	Stakeholders focus group	LAG member farm
Farmer 2	Stakeholders focus group	LAG member farm
Farmer 3	Stakeholders focus group	LAG member farm
Farmer 4	Stakeholders focus group	LAG member farm
Farmer 5	Stakeholders focus group	LAG member farm
Farmer 6	Stakeholders focus group	LAG member farm
Farmer 7	Stakeholders focus group	LAG member farm
Farmer 8	Stakeholders focus group	LAG member farm
Farmer 9	Stakeholders focus group	LAG member farm
Expert 1	Stakeholders and experts focus groups	University researcher
Expert 2	Stakeholders and experts focus groups	Circular economy consultant
Expert 3	Stakeholders and experts focus groups	Rural development scholar
Expert 4	Stakeholders and experts focus groups	Socio-technical transition expert

The session began with a presentation covering the subject matter, objectives of the focus group, expert insights, territorial biomass data, and tangible examples of potential solutions. During the focus group, participants were split into smaller groups of 6 to 7 members, a size considered optimal to ensure everyone had the opportunity to contribute (Cortini et al., 2019). These groups focused on identifying factors that could help overcome obstacles to the transition and address the key weaknesses of the proposed scenario.

Following the focus groups, participants completed evaluation questionnaires designed to assess different elements of the meeting, such as the clarity of goals and their sense of engagement. The questionnaires also featured open-ended questions to collect detailed feedback and suggestions. This approach served multiple purposes: *i*) to obtain valuable insights for enhancing the participatory method (Dagenais et al., 2012), *ii*) to assess participant satisfaction (Dagenais et al., 2012), and *iii*) to support the creation of a participatory process that goes beyond token involvement, fostering meaningful engagement and a reciprocal exchange of information between researchers and participants (di Santo et al., 2023).

4. Results

4.1 Future scenario identified by experts

The first focus group aims to explore potential pathways for the sustainable transformation of the LAG Daunia Rurale 2020, taking into account opportunities linked to the circular and bio-economy as highlighted in the Apulia Region's Regional Programming Complement. Through discussion, participants agreed on one key scenario tailored to the specific features of the territory. A detailed description of this scenario is provided in Table 4.

Tab 4. The scenario description. Source: own elaboration

ITEMS	DESCRIPTION
Name	Valorisation of agricultural waste
Reference documents	Regional Programming Supplement of the Apulia Region
Motivation	Rural territory development considering the circular economy perspective and bioeconomy
Description	Building a biorefinery capable of reusing agricultural waste with a view to the circular economy
Site	LAG Daunia Rurale 2020 jurisdiction
Raw Material Collection	Straw Olive tree pruning Vineyard pruning
Agricultural waste available	Straw → 130,745.76 (ton) Olive tree pruning → 33,754.73 (ton) Vineyard pruning → 22,270.74 (ton)
Actors/ Governance	- Local farmers - Research institutions/University - Biorefinery experts - Category associations - LAG governance - Municipalities governance - Agricultural Activity Coordination - A third entity manages and develops cooperation between individuals
Pre-requirements	- Available budget - Available facilities - Available agricultural waste - Managing waste collection and logistics
Infrastructures	Using existing facilities in the area, focusing on olive oil mills and wineries
Envisioned outputs of the scenario	• Use of agricultural waste • Implementation of circular economy • Networking development • Reinforcing social networks within the LAG • Efficient management of local structures

The decision to focus on a single scenario – the establishment of a biorefinery – was the outcome of a collective agreement reached during the first focus group. At the outset of the meeting, several potential future scenarios were proposed, including composting systems, small-scale renewable energy production, and the reuse of waste for local agri-food supply chains. However, experts unanimously agreed that the biorefinery represented the most relevant and feasible strategy for LAG Daunia Rurale 2020. This choice reflects both territorial and strategic priorities: the area is characterised by a strong agricultural economy and existing infrastructures, such as olive mills and wineries, which could be integrated into a circular production network. Moreover, the reuse of agricultural residues aligns directly with regional strategies promoting the bioeconomy and sustainable rural development, as outlined in the Proposal for Local Development Strategy 2023–2027. Participants also recognised that this scenario could deliver environmental benefits by reducing agricultural waste, as well as socio-economic advantages, including job creation and the strengthening of local value chains.

For these reasons, experts opted to focus on a single scenario rather than exploring multiple alternatives with limited feasibility.

The future scenario focuses on establishing a biorefinery by leveraging existing local infrastructure, particularly olive oil mills and wineries. A key objective within this framework is the creation of a cooperative network. By integrating these facilities into the biorefinery, the plan aims to reduce seasonal fluctuations in operations and promote the formation of social and logistical connections across the region. This approach benefits from several advantages, such as strong agri-food production, established local know-how, and the availability of small-scale technologies that can be effectively adapted and applied. Nonetheless, the scenario faces several challenges, including difficulties in encouraging collaboration among businesses, cultural barriers within organizations, technological constraints, and the inherent complexity of implementing innovative changes.

4.2 Overview of barriers experienced by experts

Table 5 presents the key barriers identified during the focus group, categorized into broad areas. For example, economic challenges include the scarcity of financial resources dedicated to rural development. Social obstacles involve the sociocultural resistance among local workers. Market-related difficulties highlighted by experts include the complexity associated with technological innovation. Additionally, institutional barriers such as weak networking between institutions were also noted.

Following the experts' discussions, several critical insights emerged. Notably, there is a clear need to adopt a systemic perspective within the territory, where different productive activities are interconnected through material flows, enabling the waste from one sector to serve as input for others.

Tab 5. Barriers to circular economy on LAG Daunia Rurale 2020. Source: our elaboration

BARRIERS	DESCRIPTION
Economic-financial barriers	Limited financial resources for rural development
	Substandard infrastructure
	Scant territorial size
Social barriers	Low willingness of operators to cooperate
	Sociocultural inertia of local workers
	Lack of green vision of local operators
	Use of waste in non-legal practices
	Lack of social security
Market barriers	Market uncertainty for new products
	Complexity of technological innovation
	Competition in the use of residues from off-site alternatives
Institutional barriers	New CAP incentives
	Limited institutional networking
	Central planning unsuited to the needs of the territory
	Dispersion/overlapping of calls
	Rigorous regulations that place administrative constraints

Another important reflection from the focus group concerns revitalizing the entrepreneurial role of the LAG, which involves building a strong network of relationships. Due to the complexity and high costs of such projects, significant funding, especially from European sources beyond the LAG's own budget, is important.

Additionally, fostering networks for exchanging knowledge and materials is crucial. A central issue raised is the readiness of local agri-food businesses to embrace this transition. The challenge is to shift from isolated contracts to collaborative network agreements, with the LAG playing a pivotal role in enhancing cooperation across rural communities.

4.3 The stakeholders' perspective

The second focus group involved local stakeholders who were invited to identify essential actions to address the barriers hindering the circular economy transition. At the start of the session, the bio-refinery scenario was presented and received general agreement as a viable future strategy. As mentioned earlier, participants were divided into two subgroups of about 7–8 members each to ensure everyone's input was captured. To enhance the effectiveness of the discussion, one group concentrated on economic, financial, and social issues, while the other focused on institutional and market-related challenges. Each subgroup associated specific key actions with the particular barriers they were expected to overcome. The identified actions include: (A1) upgrading of processing facilities (oil mills and wineries); (A2) creation of green job opportunities; (A3) realization of pilot facilities; (A4) fund raising; (A5) knowledge sharing; (A6) organization of guided tours and/or invitation of highly specialized entrepreneurs and technicians; (A7) participation in exhibitions; (A8) sharing of machinery and facilities; (A9) implementation of common infrastructure and logistics platforms; (A10) dissemination of technical knowledge; (A11) creation of subsidized finance opportunities; (A12) use of winery and oil mill plants and facilities for other closely related production activities; (A13) fostering the exchange of waste material within a shared network; (A14) research on market readiness; (A15) creating network contracts; (A16) generational renewal; (A17) specific training for biorefinery technicians; and (A18) value chain organization. Table 6 provides a summary of the meeting's outcomes, highlighting key actions proposed to overcome each identified barrier.

Table 6 highlights that some enabling actions are cross-cutting, addressing multiple types of barriers simultaneously. In particular, knowledge sharing (A5) and networking contracts (A15) emerged as the most spread actions, being linked to all barrier categories. Other measures, such as pilot facilities (A3), shared infrastructure (A8–A9), and technical dissemination (A10–A11), showed a broad yet more targeted scope, mainly addressing economic, market, and social barriers.

Conversely, actions such as fundraising (A4), creation of green jobs (A2), or market research (A14) were more specific, focusing on individual constraints.

Additionally, each group was tasked with creating a timeline to prioritize the urgency of the key actions and to identify the main actors responsible for their implementation. Figure 2 shows the key actions prioritization indicated by stakeholders during the focus group. For visualization purposes and considering that the stakeholders used cardinal numbers to sort the key actions, only one action is visible at a specific time without overlapping. Even though this is unrealistic given the complexity and dynamics of urban planning, this result provides interesting insights for the study discussion.

Concerning the economic and social dimensions, knowledge sharing was prioritized, followed by organizing guided tours, inviting specialized entrepreneurs and technicians, and securing funding. Key stakeholders in these efforts include research institutions, universities, biorefinery experts, local businesses, development agencies, and trade associations. Actions deemed less urgent, such as creating green jobs, sharing equipment and facilities, and establishing joint infrastructure and logistics platforms, were suggested for later implementation. Stakeholders highlighted the critical role of research institutions in tackling these challenges.

Tab 6. Key actions to overcome barriers to the circular economy in the Daunia Rurale 2020 LAG. Source: our elaboration

TYPE OF BARRIERS	TYPE OF BARRIERS	KEY ACTIONS (codes)
Economic-financial	Limited financial resources for rural development	A3; A4; A8; A11
	Substandard infrastructure	A3; A9
	Scant territorial size	A15
Social	Low willingness of operators to cooperate	A3; A6; A7; A9 A10; A13; A16
	Sociocultural inertia of local workers	A5; A6; A7; A13
	Lack of a green vision of local operators	A2; A6; A10; A16
	Use of waste in non-legal practices	A15; A16
	Lack of social security	A8; A15; A16
Market	Market uncertainty for new products	A3; A5; A6; A7 A10; A14
	Complexity of technological innovation	A1; A3; A5; A8 A9; A10; A12; A13 A17
	Competition in the use of residues from off-site alternatives	A5; A8; A9; A11 A12; A13; A15; A18
Institutional	New CAP incentives	A11; A15; A18
	Limited institutional networking	A5; A15; A18
	Central planning is unsuited to the needs of the territory	A5; A15
	Dispersion/overlapping of calls	A5; A10
	Rigorous regulations that place administrative constraints	A5; A10
New barrier	Lack of territorial identity	A5; A15; A16; A17

A notable outcome from the focus group was the identification of a new barrier, labelled “Lack of territorial identity”. Some participants felt this issue, not previously addressed by experts, is a significant obstacle to genuine sustainability transition in the area. They noted that many local entrepreneurs are unprepared for change, concentrating mainly on short-term economic gains rather than long-term impacts. Proposed solutions to this barrier included promoting generational renewal and enhancing knowledge sharing. Research centres, the university, and the LAG were seen as key actors in overcoming this challenge.

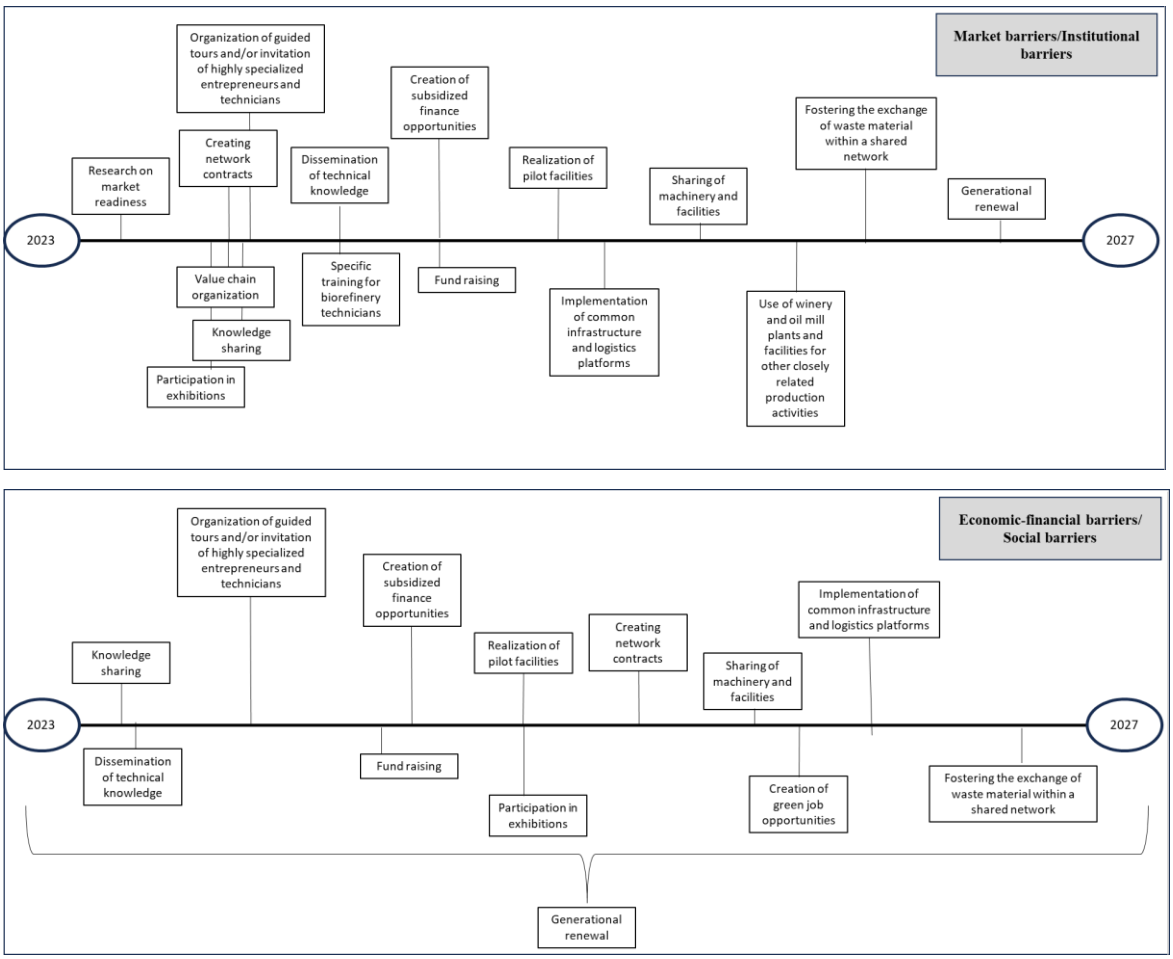

Fig 2. Timelines for key actions. Source: our elaboration on stakeholders' perspectives. The figure splits the key actions into two timelines: one for the Market and Institutional scenario and one for the Economic-Financial and Social scenario.

5. Discussion

A first result of this study is the identification of key actions, summarized in Table 6, which should be taken into account when designing a policy mix to promote the circular economy within the area of LAG Daunia Rurale 2020. A significant insight is that the barriers identified are not only linked to productive and economic factors but also strongly relate to the social sustainability of the territory. In line with the overall aim of the paper, the barriers highlighted by the focus groups can be categorized into two groups: those that are common across different territories and those specific to rural contexts. This distinction allows the findings to be applicable beyond the studied area.

Common barriers include i) market challenges, such as difficulties adopting new innovative technologies and market uncertainties for new products, and ii) institutional barriers, like administrative and institutional constraints. Conversely, barriers specific to rural areas involve i) economic issues such as limited financial resources and underdeveloped infrastructure, and ii) social challenges like reluctance among entrepreneurs to cooperate and a weak sense of territorial identity, which can impact some rural communities.

Given that social inclusion is a core objective of LAGs, the role of these rural organizations as facilitators is critical in supporting a sustainable transition. They foster stakeholder participation, promote gender equality, and encourage the sharing of knowledge within the community.

Another notable finding is the consensus among both experts and stakeholders to prioritize strategies focused on the reuse of agricultural processing waste when envisioning future sustainable scenarios for the territory. Alternative scenarios, such as food waste reuse at the household level, were not explored.

Importantly, the developed scenario integrates environmental, economic, and social dimensions of sustainability.

The qualitative approach used enabled broader stakeholder inclusion and revealed a crucial insight. While experts primarily focused on social barriers related to farmers' lack of entrepreneurial awareness and information, the second focus group participants independently introduced the concept of territorial identity as a key challenge. This emergence, without moderator prompting, underscores the value of participatory methods, as local actors uniquely recognize and stress the importance of territorial identity (di Santo et al., 2023). This highlights territorial identity as a potential driver for sustainable innovation adoption in rural areas, though it often needs strengthening. According to Tapia (2021) the role of territorial implications remains unexplored. Considering the territory as a geographic space that a community should perceive as its own, the need arises to overcome the gaps in the literature on social cohesion and the significant role of territorial identity. Despite the extensive investigation of "identity" being important in various research strands (Banini, 2017; Christoforou, 2013), its role in adopting innovation in this field still needs to be explored. While some authors examine how the likelihood of innovation adoption may increase when individuals align themselves with their group's strategy, several social barriers still need sufficient consideration (Smaldino et al., 2017). These encompass, for example, the above concepts, like the role of territorial identity, social value, or the necessity for a sense of urgency in adopting innovation.

So, an important reflection must be made on territorial identity, as it represents a key element that can strongly influence the processes and development of rural areas. Territorial identity is more than a symbolic attachment to a specific place; it includes the network of meanings, values, and social relations through which communities interpret and act upon their environment. As Biddau et al. (2023) pointed out, the sense of place and territorial identity are key to understanding how communities respond to environmental and economic transformations, especially in degraded or marginalised areas. In such cases, territorial identity serves both as a psychological resource and as a potential barrier to transformation. From a socio-economic perspective, territorial identity is closely connected with social capital and the forms of cooperation that support local innovation. According to Christoforou (2013), identity and social capital reinforce each other: a shared sense of belonging encourages reciprocity, while participation in common projects strengthens identification with place. This mutual reinforcement is particularly relevant in rural areas, where development trajectories depend on cooperation among fragmented actors. This confirms how identity-based embeddedness (Christoforou, 2013) can contribute to the social foundations of territorial innovation. At the same time, territorial identity dynamics influence how innovative practices are accepted and diffused. As shown by Smaldino et al. (2017), the adoption of innovation is strongly mediated by social identity: individuals are more likely to embrace new ideas or technologies when these are coherent with their group values. Similarly, Baker and Mehmood (2015) emphasise that place-based social innovation can emerge when local identities are mobilised as drivers of transformation, linking social cohesion with environmental responsibility. In this sense, strengthening territorial identity through participatory processes can turn it from a conservative force into a generative one that supports social learning, the diffusion of innovation, and the collective construction of sustainable futures.

Furthermore, for the institutional and market-related aspects, the top priority is the exchange of knowledge, followed by organizing guided tours, inviting specialized entrepreneurs and technicians, and participating in exhibitions. The main stakeholders responsible for these actions include the LAG, universities, and trade associations.

In summary, while economic, financial, and institutional backing are essential for facilitating the circular economy transition, equally important is cultivating a supportive mindset among rural stakeholders. This includes i) willingness to collaborate, ii) fostering a strong and positive territorial identity to encourage innovation acceptance, iii) openness to embracing circular economy principles and related technological changes, and iv) a proactive attitude toward acquiring knowledge about sustainable practices to implement locally.

The actions proposed in the participatory process align closely with the objectives of regional policies such as the Apulia Region's Complement to Programming, and with broader EU frameworks including the Green Deal and the Circular Economy Action Plan. For example, the creation of cooperative networks and pilot biorefineries could be supported under EAFRD measures or Horizon Europe calls addressing bioeconomy and territorial innovation. The participatory approach ensures that these actions are not only technically viable but also socially embedded, increasing their chances of successful integration into existing policy tools.

6. Concluding remarks

A complex problem like sustainability transition, defined by specific characteristics, requires a solution with those same traits. In the literature, a policy mix is often presented as a solution to support sustainability transitions. Therefore, developing such a solution through a methodology that aligns with the characteristics of sustainability transitions increases the chances of a consistent and effective outcome.

The study aims to support evidence-based policymaking by proposing a multi-step methodology grounded in participatory futuring. Through a backcasting approach, it identified barriers and key actions to facilitate the transition to a circular economy in rural areas, aiding the development of an effective policy mix. The approach involves a backcasting method, utilizing a participatory approach to identify key barriers to the circular economy and proposing key actions to overcome them. The first session, involving experts, helped define a future scenario and identify barriers to innovation adoption, while the second, with local stakeholders, focused on extracting actionable steps to facilitate the implementation of circular economy innovations in the area.

A significant reflection deserves to be made on the strength of the methodological approach adopted, which goes beyond the limits of using single traditional approaches. For example, although the Delphi method is widely used in policy scenarios, it is more suitable when information is limited (Beiderbeck et al., 2021). In this case, however, access was available to extensive inputs from experts, contextual knowledge, and territorial documents. The adoption of a participatory futuring approach addresses this issue by engaging stakeholders in a collective process of envisioning desirable futures and working backward to identify coherent strategies. This method allows for the integration and alignment of multiple knowledge sources within a shared framework, transforming different inputs into a resource for building a more holistic and context-sensitive vision. More specifically, the used method has been proposed for designing retrospective scenarios to enable a systematic process for designing participatory futures as tools for comprehensive planning, incorporating crucial facets of social dynamics, environmental considerations, and technological advancements. The participatory futuring can, for example, overcome the limitations of relying on documents as a single input source. Indeed, while document analysis provides a solid informational basis, it fails to incorporate local and experiential perspectives, which are essential for capturing the complexity and context-specific dynamics of sustainability transitions. Moreover, participatory backcasting can address the limitations of forecasting approaches, which tend to constrain the development of a shared vision of a desirable future, as they are often bound by the current trends and conditions of the territory (Goodwin and Wright, 2010).

The results of the used method highlighted that the integration of expert knowledge and local stakeholders' perspectives can effectively increase the accuracy of the results and the creation of a policy mix tailored to specific regional contexts. Considering the complex situation faced on rural areas social cohesion, local identity and the availability of tacit knowledge play an important role in shaping sustainable development strategies.

This study is a crucial step in defining the foundational pillar of objectives, essential for shaping subsequent elements of policy mix design, like policy strategies and assessment methods and to contribute to evidence-based policymaking.

Therefore, the contribution of this paper lies in the use of a mixed approach to conduct a participatory futuring process in a real-world rural setting. This approach bridges the gap between theoretical

frameworks and practical strategies. By merging tacit and explicit knowledge, it contributes to a more holistic understanding of sustainability changes, thus complementing and extending existing approaches in the literature. The dissemination of the policy mix concept to address contemporary environmental challenges has been translated into literature through various papers analysing the policy mix for different issues, for instance, in the field of biodiversity conservation (Barton et al., 2017), land use (Rezende et al., 2018), limited access to natural resources (Matti et al., 2017), waste management (Wilts & O'Brien, 2019), and sustainability transitions (Rogge & Reichardt, 2016; Zhang & Yu, 2019). Additionally, to support the innovativeness of the approach and the challenges of both ex-ante and ex-post analysis of the policy mix, literature has witnessed a succession of case study analyses involving numerous instances of data analysis or individual interviews on existing policy mixes (Milios, 2018; Nykamp, 2020; Sarker et al., 2022; Trotter & Brophy, 2022).

Furthermore, these findings make a meaningful contribution to the literature on policy mix formulation. Although the concept is widely acknowledged as important, there is still a need to focus on how to design policy mixes that effectively support rural areas in adopting circular economy practices. Therefore, analyzing obstacles that may hinder scenario implementation is crucial to tailoring policy mixes that avoid unintended consequences and address key challenges. The use of a participatory approach, as encouraged by several policy documents, strengthens the validity of our results, as the barriers identified by diverse local stakeholders demonstrate the practical relevance of the proposed policies. Moreover, the participatory process helped identify key obstacles to innovation, propose targeted actions to overcome them, and recognize critical actors to involve in the policy mix design. Ultimately, these findings offer important insights to policymakers, enhancing their ability to identify, evaluate, and design policy options that can serve as a foundation for efficient and evidence-informed policymaking in rural regions. In summary, while focused on one case study, the insights gained can be applied to other contexts by accounting for each area's specific characteristics, consistent with the categorization of barriers into those that are transversal and those specific to rural settings. These results are valuable from several perspectives: entrepreneurs gain awareness of innovation barriers crucial for developing effective growth strategies, researchers benefit from addressing a literature gap on local development agencies and sustainable transitions with a future-oriented technological outlook, and policymakers are provided with a clearer understanding of options for crafting supportive policies.

Despite these contributions, the study has some limitations. First, the analysis focused on a single scenario that was agreed upon by everyone rather than looking at different alternatives. Second, non-members were also invited to the second focus group; however, no one outside the LAG members showed up, this may lead to self-selection bias; however this issue does not invalidate the results because the represented stakeholders had a shared understanding of the needs of the territory. Third, as a qualitative single-case study, the findings are specific to the context and cannot be generalized to other rural areas. Moreover, the study is a reflection of a particular moment and a specific policy environment; hence, further study can determine the replicability of this participatory futuring process in different territorial contexts and its long-term applicability. Another limitation concerns the participatory process itself. The relationship among the participants and the existing power dynamics may have influenced the discussions or the prioritization of actions, thus possibly limiting the expression of minority viewpoints. Finally, although it was effective from the operational point of view, it would be more advantageous if it had more theoretical support and if it were evaluated comparatively in different cases. Future research could therefore implement this participatory futuring process in different territorial contexts or policy domains and explore ways to integrate complementary quantitative or longitudinal analyses. Such developments would help increase the robustness and transferability of the approach, as well as enhance the theoretical basis of sustainability transition studies.

The findings provide clear implications for policy design in rural contexts. Firstly, the adoption of participatory futuring techniques, such as backcasting, can improve the legitimacy and feasibility of circular economy strategies. Secondly, actions supporting social capital – like fostering territorial identity and cooperation – should be prioritized alongside financial and technical measures. Finally, regional policymakers should tailor funding schemes and administrative procedures to reflect the specific needs of rural communities, integrating the insights gained from participatory processes.

[1] Baker, S. & Mehmood, A. (2015). Social innovation and the governance of sustainable places. *Local Environment*, *20*(3), 321–334. DOI: 10.1080/13549839.2013.842964.

[2] Banini, T. (2017). Proposing a Theoretical Framework for Local Territorial Identities: Concepts, Questions and Pitfalls. *Territorial Identity and Development* 2(2), 16–23. DOI: 10.23740/tid220172.

[3] Bechini, L., Costamagna, C., Zavattaro, L., Grignani, C., Bijttebier, J. & Ruysschaert, G. (2020). Drivers and barriers to adopt best management practices. Survey among Italian dairy farmers. *Journal of Cleaner Production*, 245, 118825. DOI: 10.1016/j.jclepro.2019.118825.

[4] Biddau, F., D'Oria, E. & Brondi, S. (2023). Coping with Territorial Stigma and Devalued Identities: How Do Social Representations of an Environmentally Degraded Place Affect Identity and Agency? *Sustainability* 15(3), 2686. DOI: 10.3390/su15032686.

[5] Bonsu, N. O., Tyreehageman, J. & Kele, J. (2020). Beyond Agenda 2030: Future-Oriented Mechanisms in Localising the Sustainable Development Goals (SDGs). *Sustainability* 12(23), 9797. DOI: 10.3390/su12239797.

[6] Beiderbeck, D., Frevel, N., von der Gracht, H. A., Schmidt, S. L., Schweitzer, V. M. (2021). Preparing, conducting, and analyzing Delphi surveys: Cross-disciplinary practices, new directions, and advancements. *MethodsX*, 8, 101401. DOI: 10.1016/j.mex.2021.101401.

[7] Caffaro, F., Micheletti Cremasco, M., Roccato, M. & Cavallo, E. (2020). Drivers of farmers' intention to adopt technological innovations in Italy: The role of information sources, perceived usefulness, and perceived ease of use. *Journal of Rural Studies*, 76, 264–271. DOI: 10.1016/j.jrurstud.2020.04.028.

[8] Chizaryfard, A., Trucco, P. & Nuur, C. (2021). The transformation to a circular economy: framing an evolutionary view. *Journal of Evolutionary Economics*, 31(2), 475–504. DOI: 10.1007/s00191-020-00709-0.

[9] Christoforou, A. (2013). On the Identity of Social Capital and the Social Capital of Identity. *Cambridge Journal of Economics* 37(4), 719–736. DOI: 10.1093/cje/bes059.

[10] Cortini, M., Galanti, T. & Fantinelli, S. (2019). Focus group discussion: How many participants in a group? *Encyclopaideia*, 23(54), 29–43. DOI: 10.6092/issn.1825-8670/9603.

[11] Dagenais, C., Dargis-Damphousse, L. & Dutil, J. (2012). The essential skills series in evaluation: Assessing the validity of the ESS participant workshop evaluation questionnaire. *Canadian Journal of Program Evaluation*, 26(2), 89–100. DOI: 10.3138/cjpe.26.006.

[12] de Jesus, A. & Mendonça, S. (2018). Lost in Transition? Drivers and Barriers in the Eco-innovation Road to the Circular Economy. *Ecological Economics*, 145, 75–89. DOI: 10.1016/j.ecolecon.2017.08.001.

[13] di Santo, N., Yazdani, M., Lopolito, A., Sica, E. & Sisto, R. (2025). Towards policy Mixes Formulation to Support Green Transitions in Rural Areas: A methodological Approach, *Sustainable Development* 33(5), 6378–6398. DOI: 10.1002/sd.3455.

[14] di Santo, N., Lopolito A. & Sisto R. (2023). Tokenism in Territorial Development: Enabling Factors and Mitigation Measures. *European Countryside* 15(3), 346–365. DOI: 10.2478/euco-2023-0019.

[15] di Santo, N., Del Giudice, T. & Sisto, R. (2024). Policy mixes in rural areas: a scoping literature review. *Italian Review of Agricultural Economics*, *79*(3), 83–99. DOI: 10.36253/rea-15149.

[16] Ferrari, A., Bacco, M., Gaber, K., Jedlitschka, A., Hess, S., Kaipainen, J., Koltsida, P., Toli, E. & Brunori, G. (2022). Drivers, barriers and impacts of digitalisation in rural areas from the viewpoint of experts. *Information and Software Technology*, 145, 106816. DOI: 10.1016/j.infsof.2021.106816.

[17] Geels, F. W. (2023). *Advanced Introduction to Sustainability Transitions*. Cheltenham: Edward Elgar.

[18] Giurco, D., Cohen, B., Langham, E. & Warnken, M. (2011). Backcasting Energy Futures Using Industrial Ecology. *Technological Forecasting and Social Change* 78(5), 797–818. DOI: 10.1016/j.techfore.2010.09.004.

[19] Goodwin, P. & Wright, G. (2010). The limits of forecasting methods in anticipating rare events. *Technological Forecasting and Social Change*, 77(3), 355–368. DOI: 10.1016/j.techfore.2009.10.008.

[20] Kah, S., Martinos, H. & Budzich-Tabor, U. (2023). CLLD in the 2014–2020 EU Programming Period: An Innovative Framework for Local Development. *World*, 4(1), 122–139. DOI: 10.3390/world4010009.

[21] Kirchherr, J., Piscicelli, L., Bour, R., Kostense-Smit, E., Muller, J., Huibrechtse-Truijens, A. & Hekkert, M. (2018). Barriers to the Circular Economy: Evidence from the European Union (EU). *Ecological Economics*, 150, 264–272. DOI: 10.1016/j.ecolecon.2018.04.028.

[22] Kok, K., van Vliet, M., Bärlund I., Dubel, A. & Sendzimir, J. 2011. Combining Participative Backcasting and Exploratory Scenario Development: Experiences from the SCENES Project. *Technological Forecasting and Social Change* 78(5), 835–851. DOI: 10.1016/j.techfore.2011.01.004.

[23] Lee, M. & Gambiza, J. (2022). The adoption of conservation agriculture by smallholder farmers in southern Africa: A scoping review of barriers and enablers. *Journal of Rural Studies*, 92, 214–225. DOI: 10.1016/j.jrurstud.2022.03.031.

[24] Leminen, S., Rajahonka, M., Westerlund, M. & Hossain, M. (2021). Collaborative Innovation for Sustainability in Nordic Cities. Journal of Cleaner Production 328, 129549. DOI: 10.1016/j.jclepro.2021.129549.

[25] Magro, E. & Wilson, J. R. (2019). Policy-mix evaluation: Governance challenges from new place-based innovation policies. *Research Policy*, 48(10), 103612. DOI: 10.1016/j.respol.2018.06.010.

[26] Mantino, F. & Vanni, F. (2019). Policy Mixes as a Strategy to Provide More Effective Social and Environmental Benefits: Evidence from Six Rural Areas in Europe. *Sustainability* 11(23), 6632. DOI: 10.3390/su11236632.

[27] Milhorance, C., Sabourin, E., Le Coq, J. F. & Mendes, P. (2020). Unpacking the Policy Mix of Adaptation to Climate Change in Brazil's Semiarid Region: Enabling Instruments and Coordination Mechanisms. *Climate Policy* 20(5), 593–608. DOI: 10.1080/14693062.2020.1753640.

[28] Milios, L. (2018). Advancing to a Circular Economy: three essential ingredients for a comprehensive policy mix. *Sustainability Science*, 13(3), 861–878. DOI: 10.1007/s11625-017-0502-9.

[29] Miller, T. R. (2013). Constructing Sustainability Science: Emerging Perspectives and Research Trajectories. *Sustainability Science* 8(2), 279–293. DOI: 10.1007/s11625-012-0180-6.

[30] Neuhoff, R., Simeone, L. & Holst Laursen, L. (2023). Forms of Participatory Futuring for Urban Sustainability: A Systematic Review. *Futures* 154, 103268. DOI: 10.1016/j.futures.2023.103268.

[31] Quist, J., Thissen, W. & Vergragt, P. J. (2011). The Impact and Spin-off of Participatory Backcasting: From Vision to Niche. *Technological Forecasting and Social Change* 78(5), 883–897. DOI: 10.1016/j.techfore.2011.01.011.

[32] Quitzow, R. (2015). Assessing Policy Strategies for the Promotion of Environmental Technologies: A Review of India's National Solar Mission. *Research Policy* 44(1), 233–243. DOI: 10.1016/j.respol.2014.09.003.

[33] Ramos, J., Sweeney, J. A., Peach, K. & Smith, L. (2019). *Our Futures: By the People, for the People*. London: NESTA.

[34] Reike, D., Hekkert, M. P. & Negro, S. O. (2023). Understanding circular economy transitions: The case of circular textiles. *Business Strategy and the Environment*, 32(3), 1032–1058. DOI: 10.1002/bse.3114.

[35] Rizzo, G., Migliore, G., Schifani, G. & Vecchio, R. (2023). Key factors influencing farmers' adoption of sustainable innovations: a systematic literature review and research agenda. *Organic Agriculture*, 14, 57–84. DOI: 10.1007/s13165-023-00440-7.

[36] Rogge, K. S. & Reichardt, K. (2016). Policy Mixes for Sustainability Transitions: An Extended Concept and Framework for Analysis. *Research Policy* 45(8), 1620–1635. DOI: 10.1016/j.respol.2016.04.004.

[37] Schmieder, L., Scheer, D. & Iurato, Ch. (2021). Streams Analysis for Better Air Quality: The German Lead City Program Assessed by the Policy Package Approach and the Multiple Streams Framework. *Energies* 14(3), 57–84. DOI: 10.3390/en14030596.

[38] Scordato, L., Klitkou, A., Tartiu, V. E. & Coenen, L. (2018). Policy Mixes for the Sustainability Transition of the Pulp and Paper Industry in Sweden. *Journal of Cleaner Production* 183, 1216–1227. DOI: 10.1016/j.jclepro.2018.02.212.

[39] Sisto, R., Lopolito, A. & van Vliet, M. (2018). Stakeholder Participation in Planning Rural Development Strategies: Using Backcasting to Support Local Action Groups in Complying with CLLD Requirements. *Land Use Policy* 70, 442–450. DOI: 10.1016/j.landusepol.2017.11.022.

[40] Sisto, R., Sica, E. & Cappelletti, G. M. (2020). Drafting the Strategy for Sustainability in Universities: A Backcasting Approach. *Sustainability* 12(10), 4288. DOI: 10.3390/su12104288.

[41] Sisto, R., Fernández-Portillo, J. L., Yazdani, M., Estepa-Mohedano, L. & Ebadi Torkayeshi, A. (2022). Strategic Planning of Rural Areas: Integrating Participatory Backcasting and Multiple Criteria Decision Analysis Tools. *Socio-Economic Planning Sciences* 82A, 101248. DOI: 10.1016/j.seps.2022.101248.

[42] Sisto, R., van Vliet, M. & Prosperi, M. (2016). Puzzling Stakeholder Views for Long-Term Planning in the Bio-Economy: A Back-Casting Application. *Futures* 76, 42–54. DOI: 10.1016/j.futures.2015.04.002.

[43] Smaldino, P. E., Janssen, M. A, Hillis, V. & Bednar, J. (2017). Adoption as a Social Marker: Innovation Diffusion with Outgroup Aversion. *Journal of Mathematical Sociology* 41(1), 26–45. DOI: 10.1080/0022250X.2016.1250083.

[44] Tapia, C., Bianchi, M., Pallaske, G. & Bassi, A. M. (2021). Towards a Territorial Definition of a Circular Economy: Exploring the Role of Territorial Factors in Closed-Loop Systems. *European Planning Studies* 29(8), 1438–1457. DOI: 10.1080/09654313.2020.1867511.

[45] Timilsina, R. R., Kotani, K. & Kamijo, Y. (2019). Generativity and Social Value Orientation between Rural and Urban Societies in a Developing Country. Futures 105, 124–132. DOI: 10.1016/j.futures.2018.09.003.

[46] van Vliet, M. & Kok, K. (2015). Combining Backcasting and Exploratory Scenarios to Develop Robust Water Strategies in Face of Uncertain Futures. *Migration and Adaptation Strategies for Global Change* 20, 43–74. DOI: 10.1007/s11027+013-9479-6.

[47] Verburg, R. W., Verberne, E. & Negro, S. O. (2022). Accelerating the transition towards sustainable agriculture: The case of organic dairy farming in the Netherlands. *Agricultural Systems*, 198. DOI: 10.1016/j.agsy.2022.103368.

[48] Vermunt, D. A., Negro, S. O., Verweij, P. A., Kuppens, D. V. & Hekkert, M. P. (2019). Exploring barriers to implementing different circular business models. *Journal of Cleaner Production*, 222, 891–902. DOI: 10.1016/j.jclepro.2019.03.052.

[49] Williams, S. & Robinson, J. (2020). Measuring Sustainability: An Evaluation Framework for Sustainability Transition Experiments. *Environmental Science and Policy* 103, 58–66. DOI: 10.1016/j.envsci.2019.10.012.

[50] Wilts, H. & O'Brien, M. (2019). A Policy Mix for Resource Efficiency in the EU: Key Instruments, Challenges and Research Needs. *Ecological Economics* 155, 59–69. DOI: 10.1016/j.ecolecon.2018.05.004.

[51] Wisdom, J. P., Chor, K. H. B., Hoagwood, K. E. & Horwitz, S. M. (2014). Innovation adoption: A review of theories and constructs. *Administration and Policy in Mental Health and Mental Health Services Research*, 41(4), 480–502. DOI: 10.1007/s10488-013-0486-4.

[52] Yalçın, N. G. & Foxon, T. J. (2021). A systemic approach to transitions towards circular economy: The case of Brighton and Hove. *Cleaner Environmental Systems*, 3. DOI: 10.1016/j.cesys.2021.100038.

[53] Yumnam, G., Gyanendra, J. & Ibohal Singh, Ch. (2024). A Systematic Bibliometric Review of the Global Research Dynamics of United Nations Sustainable Development Goals 2030. *Sustainable Futures* 7, 100192. DOI: 10.1016/j.sftr.2024.100192.

[54] Zhang, J., Luo, G. & Yan, Y. (2025). Toward an effective policy mix for domestic waste management in China: Interdepartmental cooperation as an enabler. *Review of Policy Research*, 42(3), 658–681. DOI: 10.1111/ropr.12571.

[55] Zimmermann, M., Darkow, I. L. & von der Gracht, H. A. (2012). Integrating Delphi and Participatory Backcasting in Pursuit of Trustworthiness – The Case of Electric Mobility in Germany. *Technological Forecasting and Social Change* 79(9), 1605–1621. DOI: 10.1016/j.techfore.2012.05.016.