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RESEARCH ARTICLE

Social Innovation for Rural Bioeconomies

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Abstract

Background

The SCALE-UP project aims to support regional bioeconomies, fostering social, environmental, and economic benefits for rural areas. It improves the multi-actor partnerships—comprising private companies, governments, policymakers, civil society groups, and researchers—to scale innovative, sustainable, bio-based value chains utilizing regional resources. An essential aspect of this target is the inclusion of citizens and attention to the social dimensions of bio-based solutions, with social innovation playing a critical role in promoting sustainable development.

Methods

In the frame of SCALE-UP project, the concept of social innovation was explored, focusing on its application in bioeconomy projects. Best practices were identified through a detailed analysis of regional contexts, gathering data from various stakeholders involved in bio-based initiatives. This information was systematically collected and synthesized to provide a comprehensive understanding of how social innovation can be integrated into bioeconomy development.

Results

The research highlighted several successful examples of social innovation in regional bioeconomy projects. These practices showed the importance of inclusive approaches, where local communities play a significant role in shaping and benefiting from sustainable bio-based value chains. The findings also highlighted the need for collaborative efforts across different sectors to effectively scale such practices.

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

Conclusions

The results of this work offer valuable insights for regional stakeholders aiming to develop sustainable bioeconomies. The analysis of social innovation within the SCALE-UP project provides a framework for integrating social dimensions into bio-based solutions, ensuring that they contribute to long-term rural development. The best practices identified serve as a useful reference for stakeholders seeking to implement or enhance bioeconomy initiatives in their regions.

Keywords
Rural Development, Regional Multi-Actor Partnerships, Sustainable Solutions, Regional Resources, Citizen Inclusion, Social Dimensions, Social Innovation, Sustainable Development

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Introduction

There is an increasing awareness about how important is to include citizens and social aspects in the context of rural bioeconomies. Without this dimension, the impact of any action of bio-based innovations in rural areas will not be sufficient. Social innovation can be seen as the boost for the adaptation of sustainable and innovative practices. This work has been developed in the framework of SCALE-UP project with the aim of providing stakeholders with guidelines for the identification of good practises of social innovation in rural bioeconomies.

The focus is on the stakeholders of the SCALE-UP project case study areas: Northern Sweden, Mazovia/Poland, French Atlantic Arc, Upper Austria, Strumica/North Macedonia, Andalusia/Spain, and any activities addressing the research question of the SCALE-UP project:

"How can social innovation increase the role of the social actors in a rural bioeconomy context?"

The overall concept underpinning the SCALE-UP project builds on a holistic approach to boost the development of regional bioeconomies and promote social, environmental and economic benefits in the broader context of rural development. The 'second pillar' of the EU's Common Agricultural Policy (CAP), aiming at strengthening the social, environmental and economic sustainability of rural areas, provides a relevant framework for the proposed activities[1].

The first initiative to support social innovation was launched in 2011 by Manuel Barroso, at that time President of the European Commission[2]. This initiative differs from other EU innovation strategies since it does not only focus on business-driven innovation, but also includes other areas such as health, social services and education. Since then, social innovation has been promoted and supported in different ways by the Commission, including competitions, calls, funding opportunities. Despite these commendable efforts, it is crucial to acknowledge the existing gaps, notably the absence of a robust, mature European-focused network of social innovators. The unequal access to new technologies across European countries poses a challenge in disseminating social innovation initiatives uniformly.

Addressing these challenges will be integral to the success of the SCALE-UP project and the broader mission of integrating social innovation into the essence of rural bioeconomies across Europe.

Methods

The methodology employed in selecting social innovations for the SCALE-UP project ensures a comprehensive and replicable approach that can be adapted for use in diverse regions and sectors beyond rural bioeconomies of SCALE-UP. The systematic process of the selected methodology unfolds through a series of key steps, described in the next paragraphs, emphasizing a holistic understanding of social innovation and its application in the specific context of rural bioeconomies. Throughout the entire process, ethical considerations were prioritized. Informed consent was obtained from the interviewed stakeholders, and the name of all references consulted are included in this work.

Literature review and projects analysis

A thorough investigation of related studies, reports, and outcomes of sister projects and relevant initiatives was conducted. Reference projects are as follows: BE-Rural, MainStreamBio, RuralBioUp, SafeHabitus, Ruralities, BE-Rural, Power4Bio, BIOEASTsUP, Magic, BIOREGIO, BRIGAID, SIMRA, Social-RES, RurAction, CircuBAD, SI-DRIVE, CoSIE, COOPID, CEE2ACT, ROBIN, and SONNET. Relevant documents, including deliverables, websites, digital platforms, and policy briefs, were scrutinized to extract valuable insights into social innovation within the bioeconomy context.

EU policy analysis

The approach of the European Union towards social innovation was analysed by examining Commission's policy frameworks, funding-financial instruments, and social innovation ecosystems. This step ensures alignment with EU strategies and guidelines in the development of social innovations. The social innovation policy in the European Union was underpinned by three core frameworks: the Europe 2020 strategy (2010–2020), the Social Business Initiative, and the Social Investment Package. These frameworks served to provide coherence and organization to the implementation of social innovation policies. They not only outlined the specific objectives of social innovation initiatives but also contextualized them within the broader social, political, and economic goals of the EU. However, it is crucial to understand social innovation policies within their wider context to recognize how competing priorities, interests, and challenges are managed by public bodies and stakeholders[3].

Scientific publications and knowledge synthesis

A comprehensive review of scientific publications, focusing on academic papers, reports, case studies, and books related to social innovation, rural development, and bioeconomies, was conducted and listed in the references. This synthesized existing knowledge and identified key concepts, theories, good practices, and challenges in the field.

Definition of social innovation

Following the collection of up-to-date information, a precise definition of social innovation was drafted (see chapter 3.1). This definition served as a guiding framework for the subsequent selection of social innovations in the six SCALE-UP regions.

Project partner interactions

Continuous engagement and collaboration with SCALE-UP project partners played a pivotal role. Regular project meetings provided a platform to exchange information, understand regional needs, and shape recommendations for the handbook.

Value chain investigation and match-making process

The investigation of each SCALE-UP region's value chains was a crucial step, ensuring a tailored selection of social innovations. A match-making process was utilized to identify

social innovations that aligned best with the specific needs of each region.

Identification of good practices of social innovation

Based on the information collected during the previous step, good practices on social innovations were collected to draw insights from various social innovation approaches. This facilitated the identification of good practices of social innovation identified for the SCALE-UP regions based on their value chain.

One-to-One online meetings and feedback round

Main authors of this article organized one-to-one online meetings with partners responsible for each region of the SCALE-UP project. These meetings included an overview of their value chains, confirmation of proposed value chains, approval of the definition of social innovation, and the presentation of identified social innovations. Partners provided valuable feedback, confirming feasibility, and offering insights into local implementation.

Iterative development

The development of the handbook followed an iterative process, with multiple drafts reviewed by the consortium. Feedback and suggestions were incorporated to enhance the quality and clarity of the content, ensuring a robust and collaborative final outcome.

Results

Social innovation concept

In the field of policy-making and social progress, the concept of social innovation has emerged as a major force in providing new solutions to complex societal problems. This chapter examines the diverse landscape of social innovation, exploring its definitions, and relevance in contemporary contexts. Beginning with an examination of the various definitions of social innovation, this chapter clarifies the various interpretations. It then addresses the importance of social innovation, highlighting its role in overcoming pressing social problems and promoting inclusive development. This chapter sets the stage for a comprehensive understanding of social innovation as a catalyst for positive change in society.

Definitions of social innovation

Within the diverse aspects of social innovation definitions, it was essential for the SCALE-UP project to adopt a conceptual framework that aligns with the dynamics of the rural bioeconomies investigated during the project.

Social innovation does not have to be a product or service, it may be a model, idea or process developed by a person or institutions. Cooperation with other disciplines (sociology, psychology, natural sciences) is mandatory, because social issues need to be analysed in a holistic way.

Social innovation has the uniqueness of acting to solve social needs that frequently go unnoticed or unmet by actors who are motivated by profit, but which frequently involve cooperation across the public, private, and community sectors[4].

The multifaceted nature of social innovation is highlighted by various perspectives, each shedding light on its unique dimensions and applications. The EU Horizon 2020 project SIMRA defined social innovation as "*the reconfiguring of social practices, in response to societal challenges, which seeks to enhance outcomes on societal well-being and necessarily includes the engagement of civil society actors*"[5].

Another valuable formulation of social innovation in energy sector has been produced by SI DRIVE project, which defines social innovation as the "*efforts made by individuals or groups of individuals to solve societal needs and challenges in ways that differ from current methods"*. In the energy sector, this translates into developing sustainable methods including renewable energy sources which differ from the current top-down, central, primarily fossil fuel-based approach. By including renewable energy sources, local communities, civic initiatives, market participants, and/or government can play a significant role[6]. Social innovation contributes to the low-carbon energy transition, enhanced citizenship, and social goals through initiatives such as new forms of governance, social composition, supporting policies and regulations, and new business models[7].

According to CircuBED Horizon EU project, social innovation involves people in alternative social practices through different products, services, processes, markets, platforms, or organizational forms 8,8.

In the framework of the EU project SocialRES, social innovations are defined as: "*New ideas (products, services and models) that simultaneously meet social needs (more effectively than alternatives) and create new social relationships or collaborations. In other words, they are innovations that are not only good for society but also enhance society's capacity to act*"[9].

Researchers have emphasised the interactive nature of social innovation, noting that it often features a range of actors from public, private and non-profit sectors, and thus 'necessitates the reconciliation of various interests and cooperation over organisational and administrative borders'[4,10]. From this standpoint, it can be concluded that social innovation is a very inclusive concept and does not have a single dimension.

Social innovation allows recognizing and understanding key challenges that may arise when attempting to shift policies or approaches. By identifying these barriers, social innovation can contribute to more informed decision-making and potentially lead to more successful policy transitions[11]. There are several reasons for that:

I. First, social innovation is typically developed through community-driven processes that prioritize the needs and perspectives of those affected by the transition. This enables social innovators to identify barriers often overlooked by policymakers and traditional industry players.

II. Secondly, social innovation often involves experimentation, enabling rapid learning and adaptation to change

conditions for the community. This helps to identify and address key transition barriers as they arise, rather than waiting for them to become difficult to overcome.

III. Third, social innovation engages a wide range of stakeholders, who may have different perspectives and priorities than traditional industry players.

Overall, social innovation identifies key barriers to transition during policy experimentation by prioritizing community-driven processes, fostering rapid learning and adaptation, and involving diverse stakeholders in the innovation process. This will help policy experiments effectively address the challenges of the transition and ensure that the benefits of the transition are more widely shared in society. With this handbook, stakeholders are provided with a practical tool to support the involvement of citizens in bioeconomies for rural areas with the support of social innovation.

The definition adopted for social innovation in the framework of the SCALE-UP project is the following:

"Social innovation is an innovation that provides a valuable and sustainable product and/or service to the market and meets the needs of the society. Social innovation creates new relationships and collaborations among citizens and stakeholders, providing a sense of contribution and/or community, which improve the health and well-being of the actors implementing it".

The definition elaborated for the SCALE-UP project combines the diverse perspectives of the investigated definition of social innovations into a comprehensive framework tailored to the goals and challenges of rural bioeconomies. This definition emphasizes the dual role of social innovation in providing valuable and sustainable products and services to the market while addressing societal needs. Crucially, it underscores the creation of new relationships and collaborations among citizens and stakeholders, fostering a sense of contribution and community that enhances the health and well-being of those involved. In essence, the SCALE-UP definition encapsulates the essence of social innovation in a manner finely attuned to the complex socio-economic context of rural bioeconomies.

The relevance of social innovation

Poverty and inequality, environmental sustainability, health and well-being, civic engagement and participation, personal and economic development, human rights, and justice are the issues addressed by social innovation.

Social innovation can drive economic growth by giving companies new opportunities to innovate, create jobs, and improve their products and services[12]. These added values can be exemplified as improved access to basic services, job creations, advancing environmental sustainability, fostering social inclusion and climate change mitigation. Those are some of the most urgent issues affecting society. Social innovation creates resilient and sustainable economic systems, facilitates the shift to a low-carbon economy, and improves social cohesion and well-being.

The concept of social innovation can be implemented in many different contexts such as energy, governance, public management, finance or social transformation. Mostly being applied in social issues, it also has room for technical areas to create new technologies, products, and services that address social and environmental challenges, while also generating economic and social value. Developing sustainable technologies, bridging the digital divide, enhancing carbon reduction technologies are potential fields of application.

The fact that it can be applied in such a wide and diverse range of areas makes this concept attractive and has been a factor in the increasing amount of research. Social innovation is fundamental in citizen-based activity associated with reducing emissions or increasing renewable energy production[13,14].

Social innovation is being discussed more nowadays since citizens engagement has been recognized essential for the mitigation of climate change. With the actual trend of CO_2 emissions, the target of the Paris Agreement to limit the temperature increase to 1.5 °C above pre-industrial levels will be reached in September 2033 according to Copernico Climate Services[15].

Otto *et al.* identifies in Social Tipping Interventions (STI) the solution to provide a fundamental contribution in limiting global warming to 1.5°C[16]. The scenario Share Socioeconomic Pathways (SSP) 1.5°C, is the scenario that includes the Social Tipping Interventions and is the only scenario able to respect the Paris Agreement, blue square, in keeping global warming below 1.5°C until 2100.

Social Tipping Interventions (STIs) are processes able to rapidly spread technologies, behaviors, social norms and trigger Social Tipping Elements (STEs). Otto *et al.* refers to STEs as "*subdomains of the planetary socioeconomic system where the required disruptive change may take place and lead to a sufficient fast reduction in anthropogenic greenhouse gas emissions*"[16].

Social innovation such as energy communities, based on decentralized energy generation for carbon neutral cities with active citizen participation, play a key role as Social Tipping Interventions able to provide a contribution to reduce CO_2 emissions and therefore stabilizing Earth's climate by 2050.

There are several examples of renewable energy communities in the field of bioeconomies such as the renewable energy communities Smolyan and Ardino in Bulgaria, supplied by biomass district heating, and the renewable energy communities Riegsee and Spatzenhau in Germany also based on biomass district heating[17].

In addition to that, citizens can contribute for 25–27% in reducing CO_2 emissions until 2030[18]. In this framework and in the contest of bioeconomies, it has been quantified that citizens can reduce up to 12% of CO_2 emissions in North America and European Countries by combining reducing household food waste to zero (3% of CO_2 reduction) and shifting to a mostly plant-based diet (9% of CO_2 reduction)[19].

There is a clear link between social innovation and sustainable, collective development. It can be exemplified by several ways. Social innovation, for instance, can support the development of more environmentally friendly business models, goods, and lifestyles as well as technology and procedures. As a result, inequalities in society can be reduced and social inclusion can be encouraged, both of which are crucial elements of sustainable development. Collaboration and engagement with a variety of stakeholders are typical components of social innovation, which can also support sustainable development in terms of assisting in creating stronger, more resilient communities. With society becoming more involved in innovation processes, businesses, technical institutions, and research, organizations are no longer the only relevant agents. Citizens' empowerment becomes an important component of the innovation process. Customers and citizens are no longer just sources of information about needs; they also contribute more to the process of creating new products to address issues that already exist[20].

Moreover, social innovation helps to combat social isolation and advance more environmentally friendly developments at the local level by encouraging collective well-being[21]Bak15lg. This is made possible by satisfying the human need of connection with citizens involvement in social innovation projects. Each human need (Table 1) can be activated by positive or negative triggers. For instance, the need of connection can be positively activated by the contact with nature, healthy relationships, being part of a team, sharing common projects with long term vision. It is negatively activated by unhealthy relationships, loneliness, social anxiety and isolation[22]. Social innovation is among the positive triggers of the need of connection and can therefore give a strong contribution in the creation of a heathier society. Steffens *et al.* demonstrated that a strong identification with a team is crucial for the health and can protect citizens from stress and burn-out[23].

Social innovation can therefore give a strong contribution in generating a healthier society by involving citizens in collective projects, such as energy communities, stimulating therefore their sense of connection and contribution[24].

Social innovation aims to overcome social problems in a way that fosters social well-being and positive social change. It brings up societal transformation that cannot be built on the basis of already established practices[25]. Extensive cutbacks in public investment, criticism of dominant business structures, and limited economic outlooks on development are some of the themes driving social innovation, which is not just about utilizing cutting-edge technology but also mainly about resolving societal issues[26].

Table 1. The human needs.

Egocentric needs	Essential needs	Evolutionary needs
Comparison	Knowledge	Awareness
Consideration	Connection	Contribution
Control	Change	Growth

Social innovation for rural bioeconomies

In exploring the realm of social innovation within rural bioeconomies, the primary objective of this chapter is to provide a comprehensive overview of the prevailing good practices in the market. The focus extends beyond mere product or service delivery, emphasizing the transformative nature of social innovation, which not only addresses societal needs but also forges new relationships and collaborations among citizens and stakeholders. This dual impact positions social innovation as a dynamic catalyst for positive change, a characteristic that is particularly crucial within the context of rural bioeconomies.

Social innovation has garnered increasing attention as a vital force in steering sustainable development, promoting inclusive growth, and addressing global challenges such as climate change, energy scarcity, resource depletion, and food security. Within the intricate landscape of bioeconomies, social innovation finds its implementation through a multifaceted approach. This encompasses strategies such as increasing social awareness and collaboration, exchanging best practices, applying circular economy principles to minimize waste, supporting sustainable agriculture and food systems, and utilizing renewable energy and biofuels.

One pivotal aspect of social innovation in rural bioeconomies involves fostering social awareness and collaboration. This includes cultivating a sense of shared responsibility and knowledge sharing among diverse stakeholders.

Collaborative networks become instrumental in collectively addressing challenges and exploring innovative solutions that benefit both society and the bioeconomy.

The exchange of good practices emerges as another cornerstone of social innovation within bioeconomies. By sharing successful models and approaches, communities can learn from each other, accelerating the adoption of effective strategies. This knowledge-sharing ecosystem plays a crucial role in navigating the complexities of rural bioeconomies and adapting solutions to local contexts.

Circular economy principles feature prominently in the application of social innovation in bioeconomies. The emphasis here lies on minimizing waste, promoting resource efficiency, and closing material loops. This not only contributes to environmental sustainability but also fosters a more resilient and resource-conscious bioeconomy.

Furthermore, social innovation actively supports sustainable agriculture and food systems within rural areas. Initiatives may include the introduction of innovative farming practices, community-supported agriculture models, and the promotion of local and organic food production. These endeavours not only contribute to the well-being of local communities but also

align with the broader goals of sustainability and resilience. The utilization of renewable energy sources and biofuels represents a critical facet of social innovation in bioeconomies. By transitioning towards cleaner and more sustainable energy practices, rural areas can reduce their dependence on traditional energy sources, mitigate environmental impact, and contribute to a more sustainable and resilient bioeconomy.

As we delve into the chapters ahead, a detailed exploration of exemplary cases will illuminate how these good practices have been effectively applied in similar contexts. The objective is to distil insights that can inform and inspire sustainable and impactful social innovation initiatives within the specific regions under examination in the SCALE-UP project.

Stakeholders

Social innovation stakeholders cover wide range of groups who are individuals, organizations, and institutions that are involved in the creation, implementation, and support of social innovations. These stakeholders coming from a variety of sectors and backgrounds work together to create innovative solutions that address social problems and improve the well-being of individuals and communities.

Stakeholder mapping is essential for ensuring a systematic and accurate identification of relevant stakeholders needed for the identified social innovation. It provides a structured approach to categorize and analyse stakeholders, developing a solid understanding of their roles, relationships, and potential contributions.

Social innovation stakeholder groups are described in detail below. According to the authors of this handbook, their role can be categorized as shown in Table 2.

Primary production includes agriculture, forestry, fisheries, and aquaculture. The focus is on the producers of agriculture, forestry and their bioproducts in order to be in line with the scope of SCALE-UP project. Social innovation in rural bioeconomies stand for inclusive bioeconomies. Social inclusion is possible via several ways. According to Park and Grundmann, primary producers' participation to social innovation practices could be as follows: inclusion through yield improvement technologies, rural development, valorisation of ecosystem services, or through international development. When actors, such as primary producers in rural areas, perceive changes in their reality, whether due to technological advances or resource depletion, they are driven to adapt the institutional structure to better serve their interests and well-being[27]. Social innovation initiatives can be transformative to overcome this. By empowering primary producers through knowledge sharing, policy advocacy, collaborative initiatives, capacity building, better access to resources and digital solutions, we can enable them to proactively embrace change, overcome challenges and secure their interests and well-being in the evolving to an inclusive bioeconomy.

Secondary production. In the context of bio-rural economies and social innovation initiatives, secondary production refers to the creation of value-added goods or services derived from the utilization of by-products, waste materials, or resources generated in the primary production processes. Secondary production builds on primary production by finding innovative ways to maximize the use of the by-products or residual materials generated in these primary processes. The goal is to create additional economic value, generate employment opportunities, and contribute to the overall well-being of rural communities.

Governments and policy bodies. In order to create real social benefit, according to Steiner *et al.* public bodies should encourage the implementation of social innovation projects. Governmental actors should be aware that social innovation necessitates shifting power dynamics and turning hierarchical structures into more cooperative alliances[28]. This group might include local and regional governments, environmental agencies, forestry departments, agricultural departments, agri-food / circular-food clusters in the frame of SCALE-UP project. They

Table 2. Social innovation stakeholders and their roles.

Stakeholders	Their Roles
Primary Producers	Contributing to sustainable resource management, technology adoption, environmental stewardship, and knowledge sharing
Secondary Producers	Creation of value-added goods or services, additional economic value
Government and Policy Bodies	Policy development and regulation, funding and investment, infrastructure development, promotion of collaboration, monitoring and evaluation
Research and Academic Institutions	R&D, knowledge dissemination through publications, policy advocacy, entrepreneurship and start-up support
Industry Associations	Member representation, market development, certification, setting standards, networking and collaboration
Environmental Organizations	Regulation and compliance, technical assistance, education and outreach, monitoring and evaluation
Community Representatives	Voice, community engagement, conflict resolution, local entrepreneurship

have significant role in fostering collaborations within rural bioeconomies. Their importance lies in creating an environment where diverse stakeholders, including farmers, businesses, research institutions, and local communities, can come together to collectively drive social innovations. Policies that encourage collaboration facilitate the sharing of knowledge, resources, and best practices, leading to more effective and sustainable solutions in rural bioeconomic activities. Creating interface structures and fostering self-reflection in governmental practice and institutions, governance networking and communication between varied actors boost actors' interactions and improve the quality of actions[29,30].

Research and academic institutions are other stakeholders of social innovation practices. Cunha and Benneworth explained the role of those establishments. Research and academic institutions create a framework that serves multiple purposes for social innovations. Firstly, it aids universities in identifying and supporting worthwhile social innovation initiatives through a robust measurement approach. Secondly, it enables the measurement of micro-practices and their alignment with higher-level decision-making and policies, facilitating the identification of successful components. Lastly, as universities increasingly recognize their social engagement, they should demonstrate their social performance, considering the perspectives and expectations of both internal and external stakeholders. This necessitates a dialogue between universities and stakeholders, ensuring the effective implementation and scalability of social innovation efforts. In summary, research and academic institutions can use this adaptable framework to effectively measure and manage their involvement in social innovation, fostering collaboration with diverse stakeholders and adaptability to evolving contexts[31].

Industry associations work to expand markets for bio-based products and services. They can help rural businesses access new customers and distribution channels, promoting economic growth in these areas. They help rural businesses access funding opportunities, grants, and resources for research, development, and infrastructure improvement projects. Moreover, those associations create a network environment that can lead to cross-sector partnerships and the creation of innovative solutions that address rural development challenges. Industry associations are important for driving social innovations because they act as influential intermediaries between businesses, their members, and government bodies by representing the interest of their members.

Environmental organizations do research that promotes policy formation, institutional capacity building, and create independent engagement with civil society to help people living more sustainable lives. They stand for and support regulations that promote responsible resource management, provide technical expertise to improve sustainable practices, educate and engage communities and businesses in the concept of environmental conservation. Moreover, they can monitor and evaluate various projects based on their know-how. Environmental organizations, through these functions, help to the creation of innovative and sustainable solutions that balance economic growth with environmental responsibility in rural areas.

Community representatives play an important role in fostering social innovations because they act as the true voice of their communities, expressing issues and needs and ensuring that solutions are relevant with citizens at the centre. They encourage community involvement, motivate individuals to join in activities, and develop a feeling of collective responsibility. Furthermore, community representatives navigate and resolve problems within the society, setting the path for the successful implementation of creative ideas. Additionally, their capacity to discover local economic opportunities and encourage entrepreneurship brings economic growth, self-sufficiency, and sustainability. Their diverse contributions are critical in fostering social innovations by linking local projects with the specific needs and ambitions of the communities they represent.

Good practices of social innovation for rural bioeconomies

Guided by the social innovation definition outlined in this work, which underscores the provision of valuable and sustainable products or services meeting societal needs while fostering new relationships and collaborations, this subchapter seeks to shed light on effective strategies and successful social innovation initiatives within rural bioeconomies. In doing so, the objective is not only to inspire and educate readers but also to provide actionable insights, problem-solving approaches, and tangible models for implementation.

Social innovation within rural bioeconomies often takes the form of community-driven initiatives that directly respond to local needs. One prevalent example involves the establishment of collaborative networks, such as community-supported agriculture or circular economy initiatives. These fosters direct connections between producers and consumers, minimize waste, and promote resource efficiency, thereby contributing to both societal well-being and environmental sustainability.

Renewable energy cooperatives serve as another illustrative example of social innovation in rural settings. By enabling collective investment in and benefits from renewable energy projects, these cooperatives address local energy needs while nurturing a sense of community and collaboration among residents. Such initiatives underscore the dual impact of social innovation in meeting societal needs and forging new relationships within the community[7].

Community-led initiatives, such as forest management programs, exemplify social innovation by actively involving local communities in sustainable practices. By ensuring responsible resource use and conservation efforts, these initiatives meet societal needs while engendering a sense of shared responsibility and environmental stewardship.

In the forthcoming chapters, these general examples will be thoughtfully adapted for each SCALE-UP region, considering the unique characteristics of each local aspect. This approach ensures that social innovation proposals are not only

contextually relevant but also exemplary for the specific needs and challenges of each region. The overarching goal is to cultivate a culture of continuous improvement, enabling the adaptation and replication of successful social innovation models to address the evolving dynamics of rural bioeconomies.

Local bioeconomy and forest management cooperatives

In many situations, private forest ownership is divided into small parts by inheritance and profitable management of that area is no longer possible; many forest heirs/owners are looking for prospective buyers as a way out and some of the potential investors have explicit deforestation ambitions. Cooperatives are useful tools for preventing deforestation managing the forest responsibly. The Remscheid Forest Cooperative is a best practice forest cooperative that has been operating successfully for several years[32].

Cooperatives bring together all local stakeholders to enhance the sustainable utilization of local resources, stimulate economic growth, and strengthen communities. Cooperatives play an essential role in rural development as means of job creation, food security, more equitable revenue distribution, and maybe poverty alleviation[33]. Cooperatives are typically more concerned with local issues than national, regional, or international issues, because their primary priority is to address the individual and communal needs of its members[34].

Cooperatives help to ensure that natural resources remain available by providing a forum for local people to find solutions to environmental change by defining their property and user rights, managing natural resources, and diversifying their economic activities to embrace green economic ventures. A good example comes from Indonesia, where forestry cooperatives promote sustainable usage of tropical hardwood and have gained Forest Stewardship Council (FSC) accreditation for the furniture industry, overcoming monopolies of wood purchasers and earning a sustainable life[33].

Forest education centres

The primary focus of forest education is to develop the knowledge, skills, and shared values necessary for sustainable forest management and its contributions to environmental, social, and economic development on local and global scales. For nearly two decades, forest education has been largely absent from the global forest policy agenda. However recently, there has been a renewed interest in forest education, evidenced by increased activities from research organizations and non-governmental organizations (NGOs).

Notably, forest education was included in the agenda of the 14th session of the United Nations Forum on Forests in May 2019. This indicates a growing recognition that forest education is a crucial part of the solution to various challenges, including deforestation, forest degradation, ecosystem protection, livelihood enhancement, biodiversity conservation, and climate change mitigation and adaptation[35].

Forest education centers allow people to learn about sustainable forestry practices, forest ecosystems, and bioeconomy. These centres could also offer workshops on woodworking and other forest-related skills. Forest education can be delivered to all members of society, including children, adults, farmers, teachers, public servants, and other professions.

Furthermore, in its report on forest education, the Food and Agriculture Organization of the United Nation (FAO)[35] recommended concrete steps as:

- ✓ Forest education should begin before primary school.
- ✓ Forest-related issues should be covered in primary and secondary school curricula as separate subjects as well as integrated with other subjects.
- ✓ Teachers should be given additional training in forest-related issues as well as instructional abilities.
- ✓ Outdoor learning and the use of forests as learning spaces should be given systematic support.

A relevant initiative is the Forest Schools project, funded by the European Union (EU). In the frame of the project several forest schools will be established[36].

Forest innovation grants

The financial dimension of innovation has practical value, and as a result, there is a need to incorporate the financial sector and its link with the entrepreneurial process into the theorization of innovation and entrepreneurship in the forestry sector[37]. In their research, D'Amato *et al.* highlights the importance of financial support and mentions citing a scarcity of investors and limited availability of private funds for ventures related to bio-based products in the forestry sector[38].

Innovation grants encourage local entrepreneurs, researchers, and community groups to develop innovative products and technologies using forest byproducts. European Commission funding opportunities on forest research and innovation. However local grants, administered by organizations familiar with local challenges, provide targeted, context-specific support, more flexibility and adaptability to regional conditions. With reduced bureaucracy, quicker decision-making, and an emphasis on collaboration, local grants encourage community ownership and the development of tailored solutions. By investing in capacity building and considering cultural nuances, these grants contribute to sustainable initiatives that align closely with the needs and values of the local forest ecosystem. As an example, Global Forest Watch (GFW) is an online platform that provides data and tools for monitoring forests. Moreover, they provide grants and opportunities for the realization of relevant projects[39].

Wood fuel network

Wood fuel network can be a stimulator to SCALE-UP rural bioeconomies. However, underutilization of logging residues, such as branches and tops, which represent a valuable biomass resource stands against scaling-up. By creating a network that connects buyers and sellers, this social innovation enables the efficient utilization of these logging residues, contributing to diversified and sustainable wood fuel sources. Moreover, it

helps to mobilize all actors within the whole value chain and to communicate and exchange best practices for cost-effective deliveries of logging residues with high quality. The network serves as a collaborative platform, allowing stakeholders to make informed decisions, share best practices, and collectively work towards optimizing resource utilization. Additionally, it ensures the delivery of high-quality wood fuels through standardized practices, aligning with the broader goal of advancing bio-based products beyond traditional energy generation. The economic growth stimulated by such networks in rural areas creates opportunities for businesses involved in wood fuel production, transportation, and sales, fostering a resilient and advanced bioeconomy on the regional scale[40].

InnovaWood is a network of forest and wood science and technology in European scale. It consists of 60 organisations in 28 countries, including research institutes, universities, and regional cluster organisations throughout the value chain from forestry and wood processing to construction, furniture and the circular economy[41]. Establishing a network in regional scale offers localized benefits for specific needs. It allows for optimized logistics, cultural fit and faster adaptation to changes.

Collaborative platform

Bringing together primary producers, research institutions, and industry associations facilitates the knowledge exchange and foster cross-sectoral partnerships. This kind of a platform would serve as a hub for sharing insights on efficient agricultural practices, innovative processing techniques, and sustainable bioeconomy technologies. During the establishment of collaborative platform some points need to be taken into account, such as the importance of considering initiative goals, adjusting methods over time, and recognizing the engagement power of small-scale events. Additionally, practitioners are advised to invest time and resources in extensive communication efforts to describe collaborative platforms accurately, engage the community, and involve relevant actors from both local and governmental sides[42].

In the frame of SCALE-UP, collaborative platforms will be established for each region of the project. Within the platforms, specialized steering groups will be formed with the responsibility of interacting with all regional bioeconomy stakeholders, guaranteeing efficient information sharing, arranging introductions between regional players, and supervising the execution of focused innovation support services. Each platform will have formal terms of reference that outline its goals and organizational structure[40].

Besides the collaborative platforms developed in the framework of the SCALE-UP project, another relevant example is OpenTEAM a collaborative platform that focuses on regenerative agriculture. It integrates data from various sources, including farmers, researchers, and technology providers, to improve soil health and promote sustainable practices. It involves collaboration between farmers, scientists, and technology developers to enhance agricultural productivity while minimizing environmental impact[43].

Another example is SmartAgriHubs, that is a European project that aims to foster digital innovation in agriculture. It involves a network of digital innovation hubs that collaborate to support the development and implementation of digital solutions in farming practices. The project encourages collaboration among farmers, technology developers, and researchers to enhance the digital transformation of rural agriculture[44].

Bio-based packaging incentives

Local government and policy bodies could introduce initiatives to encourage the adoption of bio-based packaging among agri-food producers, as shown in the partnerships for Climate-Smart Commodities developed by OpenTEAM[43]. This could involve providing financial support for local businesses that transition to more environmentally friendly packaging solutions, thereby reducing plastic waste and promoting a circular economy.

Potential incentives could be 45:

- ✓ Formation of a trade association of bioplastics processors (and/or compostable packaging manufacturers).
- ✓ Education for all generations of society is founded on consensus and coherent communication.
- ✓ The development of a high-quality law.
- ✓ Increasing the awareness and qualifications of specialists who formulate legal restrictions in order to influence the increase in the share of biodegradable packaging in the food packaging market.
- ✓ When creating legal regulations, take into account the views of business practitioners.
- ✓ Open dialogue across the worlds of science, industry, and government.
- ✓ Research and development initiatives carried out in collaboration between scientific and business units.
- ✓ Optional solutions development as part of bottom-up actions of biodegradable packaging supply chain stakeholders (e.g., certification).

An example is from Novamont, an Italian bioplastics company, produces Mater-Bi compostable bags made from agricultural byproducts, such as corn starch and plant oils. These bags are designed to be used for waste collection and composted in municipal composting facilities[46].

Educational campaigns and workshops

Environmental education is a critical component in combating climate change[47]. In order to foster a sense of environmental consciousness and engagement among farmers, campaigns and workshops could be organized in collaboration with academic institutions and NGOs. These efforts would raise awareness about sustainable agricultural practices and encourage local communities to actively participate in the region's bioeconomic development. Workshops provide spaces for community engagement, encouraging collaboration and the co-creation of solutions. Also, the aim of this initiatives is to bring about

behavioral change by raising awareness about the environmental impact of individual and collective actions.

European Commission regularly organizes events: workshops, online conferences, forums to increase awareness. One example is "Network to innovate: Social innovation" to create the opportunity to meet other actors in the field, exchange knowledge and possibly even form new partnerships[48].

Living labs

Living Labs serve as open innovation intermediaries, providing structure and governance for citizen involvement. These labs are instrumental in social innovation, generating new socially negotiated meanings for products and services. The "social" aspect of the innovation process extends beyond end-user involvement, encompassing the collaborative and participatory nature of Living Lab operations, real or virtual meetings, direct engagement of end users in ideation, and the use of methodologies that maximize interaction with various stakeholders[49].

Additionally, living lab facilitates the experimentation and testing of new agricultural products, encouraging diversification and niche crop production. This real-world testing contributes to refining and optimizing products before their introduction to the market, ensuring their viability and sustainability in the rural context. Community engagement, local empowerment, and educational initiatives further enhance the living lab's role in creating a resilient and sustainable rural bioeconomy.

Collaborative supply chains

To connect primary producers, including farmers and producers, seamlessly with the construction and agri-food industries to increase efficiency and promote sustainable practices, collaboration is a key approach. The development of collaboration among local individuals must involve supply chain actors who, by experiencing the region and understanding its history and values, can assist establish a united image of the territory[50]. Understanding the history and values of a region empowers supply chain actors to adopt sustainable and responsible practices. This can include environmentally friendly production methods, ethical sourcing of materials, and a commitment to social responsibility. Such practices contribute to the long-term well-being of the community and its natural environment. Those collaborations could play a significant role in connecting producers to markets and consumers.

By understanding the local context and needs, they can develop effective strategies for fostering bio-based products, assisting market access for rural producers and contributing to the overall growth of the bioeconomy. Unique Mānuka Factor exemplifies the successful implementation of collaborative supply chain. Mānuka honey producers, marketers, and academics in New Zealand collaborated to pioneer the science of Mānuka honey. They attempted to further understand the chemicals, advantages, and mechanisms that make our Mānuka honey truly extraordinary by enlisting professional scientists and establishing a global network of partners[51].

Another example is from France, The Leggo Association. It brings together 4 regions (Brittany, Centre Val-de-Loire, Pays de Loire and Normandy), whose aim is to support the development of a legume industry (peas, field beans, lupins, lentils, chickpeas, soya and beans), from both a commercial and technical point of view. This approach is the result of a desire on the part of the farming community in Western France to develop plant protein production tailored to market needs: "*Rather than going from farm to fork, our ambition is to start from the plate and work our way back to the field*". Leggo centralises the commercial expectations of professional customers and passes them on to the member distribution and processing companies that serve these customers. Leggo channels the information and alerts its members, who can then, for example, speed up the development of new ranges of adapted products[52].

Community based research

Community-based research approach perceives communities as co-investigators or co-authors not only subjects for research activities[53]. Community-based research involves community members in the decision-making process, ensuring that their perspectives and priorities are considered. This participatory approach not only leads to more inclusive and sustainable solutions but also fosters a sense of ownership and commitment among community members. Community-based participatory research is viewed as an equitable research method that is implemented within a social justice perspective[54]. It helps to engage local communities in participatory research projects to teach them systematic uses of bio-based materials. This engagement not only empowers the local population but also builds their capacity to take charge of their own development initiatives. Also, community-based research creates linkages between bio rural communities and external networks to resource usage, knowledge sharing, and opportunities that can contribute to the sustainable development and scalability of rural economies.

A real-life example is the Agroecology Europe Initiative. They conduct research based on sustainable use of local renewable resources, local farmers' knowledge and priorities, wise use of biodiversity to provide ecosystem services and resilience, and solutions that provide multiple benefits (environmental, economic, social) from local to global[55].

Green building certifications

When growing concerns about global warming and resource depletion became more visible and validated by research in the twenty-first century, the number and variety of green product standards and certifications increased[56]. Olubunmi *et al.* conducts a methodical examination of research on incentives for green building, identifying two main types: external and internal. External incentives, categorized as financial or non-financial, are extrinsic and impose specific conditions on beneficiaries. In contrast, internal incentives, encompassing factors like human well-being, market demand, satisfaction. The analysis also reveals critiques, primarily directed at external incentives. Criticisms include the absence of an enforceability mechanism, and a lack of a mechanism to determine the optimal level of incentives needed[57].

It can be concluded that certification initiatives have positive impact on promoting green buildings. There are several certifications available worldwide[58]. Considering regional specifics and characteristics, new certification programs can be implemented.

Food waste awareness campaigns
Various tools can be used to disseminate campaigns to increase environmental responsibility and reduce food waste. Websites, newsletters, e-newsletters, social media, flyers, radio broadcasts, TV commercials etc. The correct approach would differ based on the country, or even on the region. Education campaigns with hands-on practice and incentives may be useful in developing nations, but they are not good for longer periods of time since society might be spoiled. Food waste program delivery mechanisms (e.g., mass media, social media, newspapers) are also important. Food waste should be discussed frequently because it occurs every minute. Furthermore, because today's younger generations spend a lot of time on social media, a program that communicates with social media may assist promote awareness. The content of these campaigns would also be different, some focusing on environmental consequences, some focusing on resource utilization[59].

Circular economy education
This social innovation involves curriculum revision in response to current challenges, promoting knowledge, skills, capacities, and values that assure the circular economy's proper performance and promoting circular economy behaviors and individual acts[60]. Patwa *et al.* argues that education has a significant role to adopt circular economy practices, especially in developed countries. According to this study, governments play a critical role in seeding the adoption of circular economy concepts. They start educational initiatives, offer platforms for design thinking, and assist in the building of infrastructure for long-term, sustainable development. This study also emphasizes that none of the above can be accomplished without the participation of citizens who should adjust their attitudes and behaviors. A widespread behavioral shift brought about by communication, education, and economic advancement would eventually result in the adoption of circular economy culture in society[61].

It encourages inclusive participation in waste reduction initiatives and contributes to a more resilient and environmentally conscious society, aligning with the broader goals of social innovation. It can bring various stakeholders together and create a space where communities share ideas and create new opportunities. There are many online courses available with various specifications. Two examples of circular economy education programs are the Ellen MacArthur Foundation's "Circular Economy in Education"[62] and the "Circular Classroom"[63] initiative. The Ellen MacArthur Foundation's program focuses on integrating circular economy principles into various educational levels, offering toolkits, case studies, and resources for educators globally. The "Circular Classroom" initiative specifically targets students and educators, providing lesson plans and activities to teach students about the circular economy. To derive region-specific training based on these programs, educators can adapt content to reflect local contexts, industries, and challenges. For instance, incorporating examples relevant to the region's predominant economic activities and emphasizing solutions applicable to local waste management systems.

Trust building intentions
Transparency in project outcomes and collaborative decision-making processes, discussion platforms, stakeholder exchanges can be considered as trust building intentions. The cooperative nature of social innovation requires open communication, transparency, and a willingness to take calculated risks, all of which are facilitated by trust. Establishing trust fosters an environment where stakeholders can navigate challenges resiliently, engage communities effectively, and mobilize resources for initiatives. Trust is a prerequisite for meaningful participation, as individuals and groups need to believe that their contributions are valued and that decision-making processes are inclusive and transparent. When trust is established, participatory governance becomes more effective, leading to more informed and representative decisions.

Initiatives like Open Data Berlin allow residents to access and analyze public data, promoting transparency and trust by making government information readily available for scrutiny and analysis[64]. These examples illustrate how citizen trust-building initiatives can take various forms, from direct involvement in decision-making to the use of technology to enhance transparency and accountability in public services. Each of these initiatives aims to strengthen the relationship between citizens and stakeholders.

Food sharing ecosystem
Partnership could be developed to foster a sense of community and shared responsibility and to ensure surplus food is redirected to those in need. Partnership comes into life as an online platform or social media groups where residents can share tips, recipes, and success stories related to reducing food waste. Moreover, regional farms, restaurants can use this platform to effectively exchange information on wastes. Waste that is still in good condition and usable is delivered to those who need it, benefiting society. This mitigates poverty and its negative consequences and at the same time ensures that food waste is efficiently utilized.

OLIO is a real-world example. It's a food-sharing app that connects neighbours with each other and local businesses to share surplus food. Users can share items they have too much of, whether home-cooked or store-bought, with others in their community[65]. Too Good To Go is another example, with more focus on reducing food waste from restaurants and cafes. The app allows users to purchase surplus food at a discounted price from local eateries, thus preventing it from being discarded[66].

Another example is a start-up from Linz that saves food from waste. They send out thousands of „Saviour-Boxes"with fresh fruits and vegetables that would have been gone to waste otherwise[67].

Training programs
Training programs are useful tools to foster knowledge sharing. SCALE-UP project offers training programs for cross-sectoral and cross-regional capacity building and knowledge transfer has been developed, which reflects the needs and priorities of key stakeholder groups. The aim of these programs is to build cross-sectoral and cross-regional capacity among regional stakeholders, identify and promote innovative bio-based solutions, contribute to discussions on inclusive rural development pathways and share experiences and good practices across Europe. Various work streams are being covered on the training programs[68].

These work streams are:

a) Improved nutrient recycling

b) Integrating primary producers into bio-based value chains

c) Digitalisation in the bioeconomy

d) Efficient regional infrastructures and biomass logistics

e) Practices of social innovation in rural bioeconomies

f) Governance of regional biobased systems

g) Strategies to address social, ecological and economic trade-offs in regional bioeconomy development.

These programs engage local communities, ensuring that participants gain a good understanding of the dynamics of the region. By fostering networking and collaboration among diverse stakeholders, regional training initiatives create a supportive ecosystem for the exchange of ideas, resources, and expertise. Moreover, participants have the opportunity to express their needs, challenges that they face and provide feedback.

Female seminar farmers is another example that aims to support women engagement. They are farmers who are trained in giving cooking lessons, doing public awareness work at events or in schools. The aim is to teach people about using regional products and learning about food and agriculture[69].

Targeted communication activities
The awareness and comprehension of the various actors involved in bioeconomy value chains (including producers, consumers, project developers, local, regional, and national decision-makers) determines the barriers to change and the ability to change. Raising awareness and inform citizens about environmental impact of open burning and the benefits of sustainable waste management should be a horizontal priority in all rural bioeconomy promotion strategies, and it is possible with targeted communication. The bioeconomy is centred on added value, innovation, and sustainable development; thus, demand drivers are frequently knowledge-based, i.e. to demonstrate added value and benefits to society to reach new markets, particularly through green public procurement and financial support. Understanding the bioeconomy and then educating others about it needs to be done in stages. Following the conceptualization of a circular, sustainable bioeconomy, support criteria can be set, and instruments built to specify the desired environmental, social, and economic objectives[70].

An example of a project that aims to raise awareness by organising communication campaigns in this regard is Valuewaste. The aim is to carry out two communication campaigns in order to improve the perception of citizens on urban biowaste as a local source of valuable materials[71].

Policy advocacy movements
Trust in institutions and in the society are essential for social innovation to develop. Trust allows individual self-expression, civic activity, and community empowerment. Thus, institutional policies, such as constitutional laws on basic rights or legislation on cooperatives, public-private partnerships, and governance structures in general, are fundamental to create the framework for civic activity, entrepreneurship, and public initiatives[72].

For the rural areas as well as SCALE-UP project regions, the formal implementation of national strategies related to biowaste management and sustainability is important. Without the necessary frameworks and guidelines, it is more difficult to move forward and develop. If local people are aware of the importance of policies for sustainable development of their region, they will advocate for policy, carry out measures to get the authorities to take action. Clear and supportive policies can facilitate the development, implementation, and scalability of innovative solutions by providing a regulatory foundation and defining roles and responsibilities. Moreover, policies help to legitimize and institutionalize social innovations, contributing to their long-term impact.

A successful example is the Susquehanna Valley citizens' community opposition against fossil fuel power plant[73]. This example belongs to a broader concept, The Climate Reality Project[74]. They provide training and networks to develop leadership and actions against climate change, projects that will adversely affect global warming, and movements that will cause excess GHG emissions.

The success of the above-mentioned movements exemplifies the importance of policies for sustainable development and the impact of movements to advocate these policies. Clear and supportive policies not only facilitate innovative solutions but also contribute to their sustainability by providing regulatory foundations.

Financial support mechanisms
In the rural context, financial support mechanisms could involve local, national, and international funds or cooperatives that provides low-interest loans or grants to farmers and businesses willing to invest in sustainable agricultural practices or biowaste utilization. The majority of creative projects in rural areas are not self-sustaining. These projects are being partially or entirely supported by outside sources. This money can be public, including direct, indirect, and supplementary funds related to EU programs, as well as support from other public sources,

primarily regional governments[75]. Financial support mechanisms are recognised as social innovation because they create an environment for the creation of new products and services for regional development and environmental services through monetary funds.

In this sense, various funds can be established to promote community well-being and encourage innovative solutions by taking regional characteristics into consideration. A range of stakeholders need to come together to establish these funds, including government authorities, financial institutions, businesses, non-profits, educational institutions, community groups, investors, and residents. This collaborative effort aims to drive economic development by providing funding, expertise, and support to businesses and initiatives in the region. Financial actors play an important role in the development and implementation of innovative projects, which is why many projects rely on public funding even throughout and beyond the final stages of development. Additionally, the success of these mechanisms relies on effective engagement and alignment with the diverse needs and aspirations of the local community.

There are many national, international, and EU funds available in various topics. European Social Fund +, Cohesion Fund and Just Transition Fund are examples of EU funds[76].

Crowdfunding is a relevant tool to finance social innovation due to its versatility of application and its aim of giving the opportunity to citizens to support a project in their field of interest. Crowdfunding can be used to finance projects for:

- Renewable energy production from photovoltaic systems[77]
- Biomass heating systems[78]
- Ocean power[79]
- Sustainable tourism concept[80]
- Sustainable food tech concept[80]
- Removal of plastic from the oceans and rivers[81]
- Construction of schools for disadvantaged children[82]

There are two types of investment opportunity in crowdfunding: lending and equity crowdfunding. In the lending crowdfunding the investors lend money for the financing of a project, receiving, in addition to the return of the capital, also an interest on the sums with which they decide to join the initiative. In the equity crowdfunding the investors acquire a stake in a company, becoming a shareholder and having administrative rights over it 77.

Circular bioeconomy awards

The circular economy presents an idea that is opposed to the traditional linear economy, in which raw materials are taken and processed into products that are discarded after use[83]. Both the bio-based economy and the circular economy concepts aspire to build a more sustainable and resource-efficient world with a lower carbon footprint. The circular economy enhances resource efficiency and the use of recycled materials to reduce the demand for extra fossil carbon, whereas the bio-based economy substitutes renewable carbon from biomass for fossil carbon[84]. The move to a more circular economy necessitates citizens' active involvement[85].

Awards or recognition programs to honour individuals, organizations, and communities that demonstrate commitment to circular bioeconomy principles are promising tools to engage locals. Circular bioeconomy awards can bring recognition to local businesses and initiatives that are contributing significantly to sustainable practices. Circularity awards are common in local and global level in different scales.

One example is from Netherlands, on the national level. Professionals organise their own event on the circular economy, named as Circular Economy Week. They show how circular business works in practice, so that visitors can learn from it. Throughout the country, good examples are given, pioneers meet each other, and entrepreneurs are given concrete tools to get started with the circular economy. Within the week, circular awards are given to the most impactful circular projects, organisations and individuals[86]. Another example on the global scale is The Circulars, a circular economy awards program, highlighting more than 1.500 cases of circular excellence across 65 geographies and creating a steady drumbeat of support for transformative action on the international circular agenda[87]. These kinds of initiatives are also applicable on the local, and regional scale.

Cross-sector collaboration

Social innovation and collaboration strengthen one another in the sense that collaborative processes and approaches influence the impact of social innovation, in turn, social innovation develops new shapes and designs for collaboration[88,89]. Cross sectoral collaborations could cover profit/non-profit collaborations as well as inter-sector interactions, such as agriculture, biotech, energy, and cosmetics, to explore synergies and develop innovative solutions. It encourages networking events and partnerships between different industry associations to drive social innovation.

However, the process of cross-sector partnerships for social action is acknowledged as challenging. The development of partnerships is often non-linear, marked by adjustments, successes, and failures. Trust is identified as a key factor influencing collaboration intensity and effectiveness. Trust, consisting of capacity, honesty, and benevolence, leads to more successful collaboration, creating a virtuous circle of collaboration and innovation[88]. Taking this statement into account, it can be said that the local collaborations are easier to form and maintain, because of less bureaucracy, local cooperation benefit from flexibility, quick decision-making, and a simpler procedure. Local stakeholders' similar interests and aspirations, together with resource sharing and circular economy concepts, contribute to the efficiency and sustainability of joint projects.

There are examples of cross-sector collaborations in Brazil. One of them is the "Portal Transparência" project that to

make private enterprises aware of socially innovative concepts supported by third-sector institutions. The concept, organizational structure, and impact of third-sector efforts are examined in order to have a quality seal on these initiatives, establishing a trusting connection with organizations interested in working together[88].

Agrotourism initiatives

Ecotourism, agrotourism, and rural tourism are forms of tourism that rose in the last century and have grown to become increasingly major sections of the global tourism business. New forms of lifestyle, dynamic tourist behavior, and constantly changing customer preferences, together with growing concern about the environment, industrial heritage, and sustainable development, have all contributed to the growth of these niche market types of tourism[90]. Those 3 types of tourism initiatives are applicable to rural areas. Based on the regional characteristics, the correct one can be selected.

Agrotourism is a rather recent term that emerged in the late twentieth century, directly related to agricultural activities, potential customers are interested in farming, crafting, folklore, natural agricultural products and gastronomy[91]. Agrotourism is a sort of rural tourism that takes place in a particularly specific environment, such as mixed livestock and tillage farms. Its significance comes from the fact that it provides the opportunity to supplement farm income with tourism income while also carrying out an activity that promotes environmental conservation. Despite the fact that rural tourism has experienced rapid growth in European nations such as Spain, agrotourism has yet to reach its full potential[91]. There are many agrotourism farms operating in Europe where tourists can visit olive farms, bio-refineries, and other eco-friendly facilities to foster environmental awareness. As an example, Casa Cerro da Correia farm in Portugal offers a two day experience to its visitors[92].

Social innovations for the SCALE-UP regions

The SCALE-UP project seeks to encourage and carry out cross-sectoral and cross-regional capacity building and knowledge exchange among stakeholders in order to strengthen interdisciplinary conversations and find novel solutions that cater to the particular needs of the project regions, namely Northern Sweden (SE), Mazovia (PL), French Atlantic Arc (FR), Upper Austria (AT), Strumica (MK) and Andalusia (ES)[93].

Uptake of the bioeconomy is only possible with rural actors' contributions. Despite a large number of regionally accessible, underutilized biomass sources and a variety of promising recognition options, regional stakeholders are unable to fully realize the potential of the bioeconomy because they lack technical know-how, competitive networks, and market knowledge. This was one of the causes of emerge of the SCALE-UP project. To address this challenge, regional platforms are being set up. In the context of these platforms, specialized steering groups are being established with the primary purpose of engaging a diverse spectrum of stakeholders, including citizens, within the bioeconomy sector of each region. Their target is to foster a dynamic exchange of knowledge, facilitate meaningful connections among each local actor.

One of the project objectives is to promote regional, rural, local/urban and consumer-based transitions towards a sustainable, regenerative, inclusive and just circular economy and bioeconomy across all regions of Europe. Citizen engagement is crucial in this transition. There are various reasons behind this view. First of all, citizen engagement empowers individuals and communities to actively participate in shaping their local economies. By involving citizens in decision-making processes, it ensures that transition strategies reflect diverse perspectives, addressing the specific needs and aspirations of various regions. This inclusivity fosters a sense of ownership, strengthening commitment to sustainable development goals. Their active involvement ensures that decisions made by policymakers and stakeholders align with the principles of sustainability, fairness, and circularity. Engaging citizens in transition processes cultivates a sense of shared purpose and cohesion, which increases the sense of belonging and trust. This collective effort enhances social capital, fostering collaboration and community-driven initiatives. Empowered citizens take active roles in driving change, elevating both their own well-being and that of their regions.

Highlighting the importance of social innovation within this framework, the regional platforms are aiming to harness citizen engagement with progressive approaches. By fostering collaborative partnerships, knowledge sharing, and innovation support, social innovation is envisioned to be included in these platforms to act as a catalyst. The overarching goal is to create an environment where regional stakeholders, including private enterprises, government bodies, civil society organizations, and researchers, actively contribute to the development and expansion of innovative and sustainable bio-based value chains with the inclusion of citizens. This environment is unique to each region as each has its own specific characteristics.

In this context, this chapter will be devoted to an examination of each region under the concept of social innovation, briefly describing and considering the characteristics of each region. Based on this review and the stakeholder mapping, assessment/impact guidelines described in the previous sections, the aspects to be developed for each region will be examined and potential social innovations -that have been explained in the previous chapter- are proposed. In the bigger picture, the aim is that other regions with similar geographical and characteristic features can also benefit from these social innovation solutions.

Northern Sweden

Northern Sweden is characterized by expansive woodland resources. The total land area for the region is 221.800 km^2 of which 67% is forest land (148.920 km^2). The total growing forest stock is 1.314 million m^3 and the annual growth is 45 million m^3. The protected productive forest amounts to

42.990 km^2, approximately 20%. Additional to this there are voluntarily set aside areas made by private forest owners. These forests are actively supervised and transformed into lumber, paper, and pulp. As a result of these endeavours, substantial amounts of timber, industrial outputs, and forestry-related byproducts are accessible, primarily utilized for producing district heating and energy.

While sawn timber, pulp and paper products have historically dominated, the use of forest biomass for energy purposes has surged. Forestry operates as a co-production system, generating various products simultaneously. Forest industry activities produce substantial by-products, like sawdust and bark, primarily used for power and heat in Combined Heat and Power (CHP) plants. Logging residues (LR) represent an untapped potential due to higher costs of harvesting, transport, and storing compared to market prices for sawdust and bark. Sawdust, with its unique qualities, is highly desirable for energy production and biorefining. Bark, a by-product of debarking logs in sawmills and pulp mills, constitutes approximately 10% of round wood input. Despite its challenging properties, including high ash content, bark is utilized for heat and electricity generation in CHPs near urban areas. Logging residues, characterized by a bulky and heterogeneous nature, pose challenges in mobilization, handling, and refinement. Pre-treatment and mixing with other assortments can enhance the acceptability of logging residues in certain applications[40].

The SCALE-UP project aims to further enhance the bioeconomy in Northern Sweden by facilitating the exchange of information, networking, study visits, and other relevant activities for the region. The initiative will strive to reinforce and broaden existing networks involving educational institutions, local areas, municipalities, and industries. A particular emphasis of the initiative is to encourage methods for adding value to byproducts of the forestry industry (such as sawdust and bark) and to mobilize the currently underused biomass resources like leftover logging materials.

Being involved in innovation cluster and coordinating the work between municipalities and other actors, SCALE-UP partner BioFuel Region has the capacity to foster collaboration in the region. By collaborative networks, reenforcing local public to involve those collaborations and raising a knowledge-share environment serve to the development of social innovation. Similarly, emphasizing the value of forestry byproducts creates ways to new job opportunities, especially in rural areas where employment opportunities might be limited. This can contribute to the social and economic well-being of local communities.

The stakeholders for Northern Sweden have been defined:

- **Primary Producers**: Forest owners, logging companies.
- **Secondary Producers**: Timber processors and manufacturers, woodchip suppliers, wood pellet manufacturers, pulp and paper mill companies.
- **Government and Policy Bodies**: Local and regional governments, environmental agencies, forestry departments.
- **Research and Academic Institutions**: Universities, research institutes, forestry research centres.
- **Industry Associations**: Bioeconomy associations, forest industry associations, renewable energy associations.
- **Environmental Organizations**: Conservation groups, sustainability NGOs.
- **Community Representatives**: Local communities, indigenous groups, rural development organizations.

One of the aims of this region is to expand the networks among stakeholders and especially include forest owners more in the processes. In Northern Sweden, most of the forests are privately owned, therefore it is not enough to coordinate only with municipalities and/or governmental organizations. More citizen inclusion is necessary because the citizens own the forests.

This initiative reflects one of the social innovation targets, target (C), of Ludvig *et al.*, named as "*participation and collective action: Engagement of civil society, forest owners, and forestry actors*". The focus of this target is collective activities of multiple stakeholders with a common goal. Participation and collective action addressing engagement of civil society, rural areas owners and actors, comprises social innovation characteristics such as new stakeholder involvement models and participation from civil society in rural bioeconomies[94].

Considering the stakeholders, resource availabilities and regional targets, the following social innovations are proposed to be implemented in Northern Sweden:

- **Local bioeconomy cooperatives**
- **Forest education centres**
- **Forest innovation grants**
- **Wood fuel network**

Mazovia (Poland)

Characterized by the production of new functional agri-food products, production of new bio-based packaging, production of fertilisers based on waste from fruits, grains and vegetables and other processing activities, Mazovia targets short and collective actions to scale up its regional development. The long-term plan for Mazovia includes its development into a region where biomass utilization is prominently integrated into a closed-loop economy framework. This development will be guided by sustainable principles, fostering innovative bioeconomy technologies and related industries to enhance overall efficiency. The region aims to achieve economic competitiveness while nurturing a society attuned to environmental consciousness[95].

In the frame of SCALE-UP project, Radom region in Mazovia is particularly under the spotlight. Radom region serves as a nice example of a fruitful harmony of agricultural prosperity and bioeconomic progress. Recognized for its abundant apple and pepper cultivation, this area has become a hub of agricultural productivity, boosted the local economy and fostering innovative social advancements. The thriving apple and pepper

production not only generates significant revenue but also promotes sustainability by diversifying crops and reducing the environmental impact caused by monoculture practices. This bioeconomic approach has encouraged the adoption of modern agricultural techniques, increasing productivity while minimizing resource usage. Reflecting the region's dedication to its agricultural heritage and its adept incorporation of bioeconomic principles, SCALE-UP partner UNIMOS creates matchmaking opportunities where brings farmers and policy bodies together.

This would not only drive economic growth but also creates an environment for meaningful social transformation.

SCALE-UP focus for this region has various aspects, including creating novel functional agri-food products, developing bio-based packaging alternatives, producing fertilizers derived from agricultural waste like fruits, grains, and vegetables, and engaging in other related processing activities.

Biocircularity is another important issue that is being addressed in the frame of the project. The Biocircular Apple Farm initiative is positioned to benefit from the SCALE-UP project's innovation support program, leveraging its interdisciplinary approach and commitment to biocircular principles. This project envisions the apple farm not just as a traditional agricultural space but as a hub for fostering innovation, particularly in the realms of bioeconomy and social innovation. Within the framework of the SCALE-UP project's innovation support program, the Biocircular Apple Farm serves as a testing ground for novel concepts and solutions across various dimensions, including technology, society, education, and culture. With that, cross-industry perspective is also underlined. This cross-industry collaboration not only enhances the farm's innovative potential but also fosters knowledge exchange and synergies between agriculture and other sectors.

According to this focus, the following stakeholders are determined:

- **Primary Producers**: Farmers, apple producers.
- **Secondary Producers**: Apple juice producers, bio-based packaging companies.
- **Government and Policy Bodies**: Local and regional governments, environmental agencies, agricultural departments.
- **Research and Academic Institutions**: Universities, research institutes, farming research centres, agricultural research centres.
- **Industry Associations**: Agricultural associations, farming industry associations, renewable energy associations.
- **Environmental Organizations**: Conservation groups, sustainability NGOs.
- **Community Representatives**: Local communities, indigenous groups, rural development organizations.

In the light of the specific characteristics and aspirations of the Radom region in Mazovia, following social innovation solutions are proposed to enhance its bioeconomic development within the framework of the SCALE-UP project:

- **Collaborative platform**
- **Bio-based packaging incentives**
- **Educational campaigns and workshops**
- **Living labs**

French Atlantic Arc (Pays de la Loire/ Normandy/ Brittany/ New-Aquitaine)

French Atlantic Arc region (Pays de la Loire/ Normandy/ Brittany/ New-Aquitaine) has expertise on the development of four fibre plants linked to the resources available in the rural areas of the Atlantic Arc: hemp, flax, straw, miscanthus. These plants have primary uses such as livestock breeding, human food or animal feed, but their uses are diversifying, particularly for industrial purposes (chemicals, textiles, construction).

Following contacts with stakeholders in the fibrous plant sector, it was agreed that the project would work on the use of these plants as bio-based construction materials, an important issue in the decarbonization of the construction sector.

Bio-based materials are materials derived entirely or partially from renewable organic matter (biomass). The nature of these bio-based materials is varied: wood, cellulose wadding, recycled textiles, cereal husks, cork, thatch, meadow grass. These fibres can be used as raw materials in bio-based building materials in varying proportions, which is one the focuses of the SCALE-UP project for the region. Part of the population shows a keen awareness of the importance of bio-based construction, prioritizing the use of environmentally friendly materials that contribute to sustainable practices. At the same time, local authorities are actively pursuing strategies to increase the integration of bio-based materials into architectural projects. More and more local authorities work to improve the share of bio-based material in construction. Large structures such as the Normandy Union for Social Housing (UHSN) and social landlords are engaged in this topic and introduce bio-based material in new building construction projects, despite the cost associated with the production and processing of the bio-based material increases the global cost of the construction project. This cohesive effort in the region underlines the harmonious combination of environmentally conscious values, proactive administrative initiatives and a committed farming community contributing to the advancement of bio-based building practices.

These strengths can be further developed through social innovation initiatives. There are initiatives in this respect in the region. The public High school of Aizenay built with straw insulation by the company PROFIBRES, under a public procurement by the Pays de la Loire regional council. PROFIBRES has a partnership with the agricultural cooperative CAVAC to make sure the supply of biomass takes place within 50 km around the location of the construction site[96].

The region is also good at diversifying market opportunities through downstream conversion stages. It capitalizes on its strengths with defibrillation industrial units and on-farm processing facilities. These capabilities are aligned with environmental strategies for water management, GHG mitigation, biodiversity enhancement and climate adaptation. Growing demand for local products and the region's commitment to non-displaced productions strengthen its bioeconomic landscape.

The project's main target for this region is to develop plant fibres for bio-based building materials (i.e. insulation) and other markets. Specified challenges are the limited network and lack of coordination of all economic players.

Based on that information the following stakeholders are determined:

- **Primary Producers**: Farmers, hemp/flax/miscanthus producers, agri-food industry, building industry.
- **Secondary Producers**: Food processing companies, biofuel producers, biobuilding material producers.
- **Government and Policy Bodies**: Local and regional governments, environmental agencies, agricultural departments, agri-food clusters.
- **Research and Academic Institutions**: Universities, research institutes, farming research centres, agricultural research centres.
- **Industry Associations**: Agricultural associations, farming industry associations, renewable energy associations.
- **Environmental Organizations**: Conservation groups, sustainability NGOs.
- **Community Representatives**: Local communities, indigenous groups, rural development organizations, cooperatives.

Awareness is high in the region and local authorities as well as local communities are open to improvements. This is understood from the farmers' undertaking approach towards bio-based buildings. Another pro is the political will to re-industrialising France, this would ease bureaucratic processes. Also, the demand for local products is increasing, which creates environment for social innovation. However, the economic crisis is increasing the cost of materials, which may slow down the development of the sector.

Considering the cost of bio-based building renovation/ construction, it is important to look at the overall cost of the building, not just the cost of the raw materials: biobased buildings are energy-efficient.

If we also take into account the building's life-cycle costs, the balance is often equivalent or even cheaper. it is important to consider this point, which reflects the target (B) of Ludvig *et al.*, named as "*Sustainable rural development: Addressing rural/regional economy*". This target focuses on economic revenue and soft values such as strengthening of social stability and identity with the income to the region. Institutional innovations are strategic key points for this type of social innovations[94].

Based on the needs, stakeholders, the backdrop and the social innovation target category, the following social innovation ideas have been found relevant to the region:

- **Collaborative supply chains**
- **Community-based research**
- **Green building certifications**

Upper Austria

Upper Austria is quite rich in terms of potential biomass products: forestry, agriculture and side streams from food processing like bakery products, dairy products, oils and oil press cakes and brewery wastes are sources for potential bioeconomy innovations. Bakery products industry in this region faces high amount of avoidable food waste. This waste primarily consists of biomass streams, including dough, bio waste, and old bakery products.To address this issue, there is a focus on utilizing these biomass streams as inputs for biogas plants to promote regional autonomy in energy production. The dairy industry generates numerous dairy products, including valuable side streams like whey protein. Efforts are ongoing to reuse dairy waste for biofuels, biogas and fermentation. The third value chain, centred in oils and oil press cakes, focuses on press cakes oil utilization and using regionally available oils in Austria. Biodegradable food packaging options are being discussed; however, there is a challenge due to oil extraction residues, reused materials are not suitable as feed. The last value chain, brewery, is utilized as a material in biogas plants due to its easily accessible sugars. Apple orchards are also perceived as a potential value chain to be utilized in the frame of the project.

Foreseen scale up options are to extract raw materials for bio-based packaging, cosmetic industry and fertiliser production; to produce novel fibres and nutraceuticals and dietary supplements. However, the need of the region is to raise public awareness against food waste. Food regulations and policies are also not effective enough.

The stakeholder groups of the region are as follows:

- **Primary Producers**: Agriculture and forestry producers.
- **Secondary Producers**: Bakeries, dairy industry, oil industry, brewery industry, feed industry.
- **Government and Policy Bodies**: Local and regional governments, environmental agencies, agricultural departments, circular food clusters.
- **Research and Academic Institutions**: Universities, research institutes, waste utilization research centres.
- **Industry Associations**: Brewery associations, bakery associations, biomass energy associations.

- ❖ **Environmental Organizations**: Conservation groups, sustainability NGOs.
- ❖ **Community Representatives**: Local communities, indigenous groups, rural development organizations.

The substructure and the needs of the region are moving towards a social innovation -target (A)- of Ludvig *et al.*, which is the "*Social benefits and needs: Addressing and fostering social inclusion"*. This target covers the need of businesses and producers which then lead to increasing trust among the different stakeholder groups (i.e., primary producers and policy bodies, or primary producers and academic institutions)[94]. This inevitably creates a sense of being part of the social economy, raising awareness and putting pressure on policy bodies.

To address the challenges and opportunities in Upper Austrian context, several social innovation solutions can be proposed:

- **Food waste awareness campaigns**
- **Circular economy training**
- T**rust building intentions**
- **Food sharing ecosystem**

Strumica (North Macedonia)

With experienced farmers who possess strong agricultural abilities, the Strumica region of North Macedonia has a solid agricultural basis. The region benefits from a large supply of feedstock resources, which are especially ideal for producing small-scale bio-based goods. The area has ideal soil and climate conditions for farming. Furthermore, development of technological and industrial zones in the Strumica region is another indication of the region's expanding industrial presence. Additionally, it boasts a strong network of organizations and stakeholders that have a history of working together, which encourages cooperation and creativity, which is crucial for social innovation.

The developed business environment in the area offers an ideal backdrop for agricultural operations. Moreover, in the region, necessary academic base is being developed, this includes high schools and a variety of agricultural study programs, which help to develop a trained workforce and enhance the region's agricultural potential. Strumica region is rich in forest biomass as well.

Compost production is the focused value chain of the region in the frame of the project. Despite reducing the waste generated and cutting the CH_4 emissions from the landfills, the compost improves soil health and lessens erosion, conserves water and reduces household food waste. At the beginning the regional focus will be on the agricultural residues from the primary producers and biodegradable waste from the food, vegetable processing and production industries. The current situation for biowaste is open burning and landfilling, which is highly undesirable. 2023 vision of the region is to utilize biowaste by producing fertilizers. This vision is supported by national strategies but not formally implemented. Existing potential barriers for the region are insufficient education on sustainability, limited interest from stakeholders, a lack of awareness and training, resistance to innovation, limited financial support, and inadequate policy frameworks. Although there are agricultural cooperatives in the region, lack of government support and policies prevents them from functioning efficiently. The current utilization of industrial waste in the surveyed area shows that 73% of industries are not benefiting from their residues. Some companies use their waste for heating, while others produce secondary products or sell it to specialized waste management companies. A few industries prioritize environmental impact, contributing to regional bioeconomy development by providing biowaste to local farmers or repurposing it for composting. However, waste management in Strumica faces challenges with on-site compliance to national and regional regulations. There is no unified approach for various industries, but some supply bio-waste to nearby farms or compost it. Larger industries collect bio-waste separately and rely on public waste management companies for removal. Paper and cardboard waste are also sorted and collected by authorized companies. Overcoming these challenges through education, awareness campaigns, policy development, and financial incentives is possible with social innovation.

A second bio-based value chain that possibly could be investigated further in the region is the mycelium-based packaging and insulation materials, an innovative model that utilizes regional agricultural residues and mycelium as bonding substance. These bio-based products could be useful for many different purposes by various sectors, such as the food and drink industry, hospitality, forestry and building sector.

Stakeholders for this region are specified as below:

- ❖ **Primary Producers**: Farmers, agricultural workers.
- ❖ **Secondary Producers**: Food processing industries, waste management companies, mycelium-based production companies.
- ❖ **Government and Policy Bodies**: Local and regional governments, environmental agencies, government's agricultural departments, policymakers.
- ❖ **Research and Academic Institutions**: Universities, research institutes, farming research centres, agricultural research centres.
- ❖ **Industry Associations**: Agricultural associations, forestry associations, renewable energy associations.
- ❖ **Environmental Organizations**: Conservation groups, sustainability NGOs.
- ❖ **Community Representatives**: Local communities, agricultural cooperatives, indigenous groups, rural development organizations.

In the light of the information described above, following social innovation actions are found relevant for Strumica:

- **Training programs**
- **Targeted communication activities**
- **Policy advocacy movements**
- **Financial support mechanisms**

Andalusia (Spain)

Andalusia region stands out with its olive and agricultural production. Agricultural sector has a strong emphasis as the primary sector as a significant source of employment. Thereby the biomass potential is quite high. In recent years, the utilization of olive biomass has seen significant advancements, with the olive industry incorporating olive to produce new products into new value chains. Innovative biomaterials are already taking place in the industries. For instance, "Alpechin" is a byproduct obtained from the olive tree and is commonly referred to as "alpeorujo" in Spanish. This substance is a waste generated during the process of olive oil production. It is the liquid waste obtained during the pressing of olives and contains various components. It turns into a main product and is used in different areas such as energy generation, composting, and agricultural fields. Another example is bioplastics which is also a by-product of alpechin. Similarly, it is used in the automotive and furniture industries, where it is valued as a main product rather than a by-product.

Andalusia has a diverse range of resources and industrial capacities that support its circular bioeconomy efforts. These resources include intensive olive-culture, algae production, fisheries byproducts, livestock byproducts, forestry biomass, biowastes, prunning wastes, and various agroindustrial byproducts. The region benefits from political support through initiatives like the Andalusian Circular Bioeconomy Strategy, rural development groups, and access to structural funds. It also possesses a strong industrial base, including biotech companies, agroindustries, biorefineries, bioenergy plants, chemical industries, and forest industries. Furthermore, Andalusia has a robust knowledge network comprising universities, research groups, RTD (Research, Technology, and Development) centers, and the International Campus of Excellence, fostering innovation and growth in the circular bioeconomy sector[97]. The region is also familiar with the energy community and cooperative concepts. These institutions can support potential social innovation practices.

The SCALE-UP project approach for this region aims to achieve two key objectives: wastewater management by repurposing alpechin, a byproduct of olive oil production, as an irrigation source for agricultural fields and the extraction of biochemical compounds from olive processing activities, such as antioxidants and other beneficial components, which is utilized in the production of biofertilizers and cosmetics. Promising opportunities exist to achieve this target in the region, such as fruitful landscape of chemical production sites and initiatives that are exploring the innovative concept of bio-refineries. Simultaneously, the region is experiencing significant growth in biological agriculture, driven by the demand for more sustainable products.

The stakeholders for Andalusia have been identified as follows:

- **Primary Producers**: Farmers, olive producers.
- **Secondary Producers**: Alpechin producers, biomaterial producers
- **Government and Policy Bodies**: Local and regional governments, environmental agencies, agricultural departments, policymakers.
- **Research and Academic Institutions**: Universities, research institutes, agricultural research centres, olive production research centres.
- **Industry Associations**: Agricultural associations, farming industry associations, olive industry, renewable energy associations.
- **Environmental Organizations**: Conservation groups, sustainability NGOs.
- **Community Representatives**: Local communities, agricultural cooperatives, indigenous groups, rural development organizations, olive cooperatives, olive oil cooperatives.

Based on the regional description and determined stakeholders, the following social innovation options are relevant for Andalusia:

- **Circular bioeconomy awards**
- **Cross-sector collaboration**
- **Agrotourism initiatives**

Discussion and conclusions

Social innovation represents a fundamental tool to boost rural bioeconomies. Being developed through a community-driven process, it considers the needs of all relevant stakeholders, including citizens and civil society. This leads to highlight barriers often overlooked by industrial stakeholders and policymakers. With society becoming more involved in innovation processes, businesses, technical institutions, and research organizations are no longer the only relevant agents. Citizens' empowerment becomes an important component. Customers and citizens are no longer just sources of information about needs; they also contribute more to the process of creating new products or services addressing their needs.

Collaboration and engagement with a variety of stakeholders are typical components of social innovation, which can also support sustainable development in terms of assisting in creating stronger, more resilient communities. Social innovation supports the development of more environmentally friendly business models, goods, and lifestyles as well as technology and procedures, promoting inclusive growth, and addressing global challenges such as climate change, energy scarcity, resource depletion, and food security. As a result, inequalities in society can be reduced and social inclusion can be encouraged, both of which are crucial elements of sustainable development. In this way, social innovation helps to combat social isolation and advance more environmentally friendly developments at the local level by encouraging collective well-being. This is made possible by satisfying the human need of connection with citizens involvement in social innovation projects. Social innovation can therefore give a strong contribution in

generating a healthier society by involving citizens in collective projects, stimulating therefore their sense of connection and contribution.

Social innovation can be seen as a dynamic catalyst for positive change, a characteristic that is particularly crucial within the context of rural bioeconomies. Its versatility makes social innovation very attractive; indeed, it can be applied to a wide and diverse range of areas as shown in the description of the various types of social innovation proposed in this handbook. Within the complex environment of bioeconomies, social innovation finds its implementation through a multifaceted approach. This encompasses strategies such as increasing social awareness and collaboration, exchanging good practices, applying circular economy principles to minimize waste, supporting sustainable agriculture and food systems, and utilizing renewable energy and biofuels. By sharing successful models and approaches, communities can learn from each other, accelerating the adoption of effective strategies.

This knowledge-sharing ecosystem plays a crucial role in navigating the complexities of rural bioeconomies and adapting solutions to local contexts. In this contest, stakeholders mapping is essential for ensuring a systematic and accurate identification of relevant needs to be covered by social innovation. Stakeholders mapping provides a structured approach to categorize and identify the relevant stakeholders, developing a solid understanding of their roles, relationships, and potential contributions. These stakeholders coming from a variety of sectors and backgrounds work together to create innovative solutions that address social problems and improve the well-being of individuals and communities.

Uptake of the bioeconomy is only possible with rural actors' contributions. Despite a large number of regionally accessible, underutilized biomass sources and a variety of promising recognition options, regional stakeholders are unable to fully realize the potential of the bioeconomy because they lack technical know-how, competitive networks, and market knowledge. Social innovation can create an environment where regional stakeholders, including private enterprises, government bodies, civil society organizations, and researchers, actively contribute to the development and expansion of innovative and sustainable bio-based value chains with the inclusion of citizens.

Ethics and consent

Ethical approval and consent were not required.

Data availability

No data associated with this article.

References

1. European Union: **Second pillar of the cap: rural development policy**. 2023.
Reference Source
2. Ludvig A, Weiss G, Sarkki S, *et al.*: **Mapping European and forest related policies supporting social innovation for rural settings.** *Forest Policy Econ.* 2018; **97**: 146–152.
Publisher Full Text
3. Nicholls A, Edmiston D: **Social innovation policy in the European Union**. *Policy design in the European Union*. 2018; 161–190.
Publisher Full Text
4. Jalonen H, Jäppinen T, Bugarszki Z: **Co-creation of social innovation**. 2019.
Reference Source
5. Polman N, Slee B, Kluvánková T, *et al.*: **Classification of social innovations for marginalized rural areas**. 2017.
Reference Source
6. Mikkonen I, Gynther L, Matschoss K, *et al.*: **Social innovations for the energy transitions**. Publications Office of the European Union, Luxembourg, 2020.
Publisher Full Text
7. Dall-Orsoletta A, Cunha J, Araújo M, *et al.*: **A systematic review of social innovation and community energy transitions.** *Energy Research & Social Science.* 2022; **88**: 102625.
Publisher Full Text
8. **CircuBED project- applying the circular economy to the design of social housing**. 2018–2021.
Reference Source
9. **SocialRES project**. 2023.
Reference Source
10. **ESF transnational cooperation platform community of practice on social innovation. Scaling-up social innovation: seven steps for using ESF+**. 2022.
Reference Source
11. Sarkki S, Parpan T, Melnykovych M, *et al.*: **Beyond participation! Social innovations facilitating movement from authoritative state to participatory forest governance in Ukraine.** *Landscape Ecol.* 2019; **34**(4): 1601–1618.
Publisher Full Text
12. Wang W: **Toward economic growth and value creation through social entrepreneurship: modelling the mediating role of innovation.** *Front Psychol.* 2022; **13**: 914700.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**
13. Hewitt RJ, Bradley N, Compagnucci AB, *et al.*: **Social innovation in community energy in Europe: a review of the evidence.** *Front Energy Res.* 2019; **7**: 31.
Publisher Full Text
14. Harnmeijer J, Slee RW, Toke D: **Community renewables in the UK - a clash of cultures?** *Int J Technol Intell Plan.* 2018; **12**(1): 99–120.
Publisher Full Text
15. Copernicus Climate Service: **European State of the Climate 2022**.
Reference Source
16. Otto IM, Donges JF, Cremades R, *et al.*: **Social tipping dynamics for stabilizing Earth's climate by 2050.** *Proc Natl Acad Sci U S A.* 2020; **117**(5): 2354–2365.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**
17. European Commission: **Empowering renewable and citizen energy communities**. 2024.
Reference Source
18. Bailey T, Dyson E, Newton M, *et al.*: **The power of people**. 2022.
Reference Source
19. Jump ACC: **The power of people**. 2021.
Reference Source
20. Howaldt J, Schröder A, Butzin A, *et al.*: **Towards a general theory and typology of social innovation**. 2017.
Reference Source
21. Baker S, Mehmood A: **Social innovation and the governance of sustainable places.** *Local Environ.* 2015; **20**(3): 321–334.
Publisher Full Text
22. Benedetti DD: **Fuori dal Fango.** Mondadori, 2020.
Reference Source
23. Steffens NK, Haslam SA, Schuh SC, *et al.*: **A meta-analytic review of social identification and health in organizational contexts.** *Pers Soc Psychol Rev.* 2016; **21**(4): 303–335.
PubMed Abstract | **Publisher Full Text**

24. The U.S. Surgeon General's Advisory on the Healing Effects of Social Connection and Community: **Our Epidemic of Loneliness and Isolation**. 2023.
Reference Source

25. Cajaiba-Santana G: **Social innovation: moving the field forward. A conceptual framework.** *Technol Forecast Soc Change.* 2014; **82**: 42–51.
Publisher Full Text

26. van der Have RP, Rubalcaba L: **Social innovation research: an emerging area of innovation studies?** *Res Policy.* 2016; **45**(9): 1923–1935.
Publisher Full Text

27. Park H, Grundmann P: **What does an inclusive bioeconomy mean for primary producers? An analysis of European bioeconomy strategies.** *J Environ Policy Plan.* 2023; **25**(3): 225–241.
Publisher Full Text

28. Steiner AA, Barraket J, Calo F, *et al.*: **The role of governments and public policies in social innovation processes.** *Educ Knowl Econ.* 2021; **17**(2): 157–164.
Publisher Full Text

29. Galego D, Moulaert F, Brans M, *et al.*: **Social innovation & governance: a scoping review.** *Innov: Eur J Soc Sci Res.* 2021; **35**(2): 265–290.
Publisher Full Text

30. Massey A, Johnston-Miller K: **Governance: public governance to social innovation.** *Policy Polit.* 2016; **44**(4): 663–675.
Publisher Full Text

31. Cunha J, Benneworth P: **How to measure the impact of social innovation initiatives?** *Int Rev Public Nonprofit Mark.* 2020; **17**: 59–75.
Publisher Full Text

32. Wolff M: **Interviewee, Forest cooperatives as a model for the future**. 2019.
Reference Source

33. Altman M: **Cooperative organizations as an engine of equitable rural economic development.** *J Co-operat Organ Manag.* 2015; **3**(1): 14–23.
Publisher Full Text

34. International Labour Organization: **Cooperatives and the Sustainable Development Goals**. 2015.
Reference Source

35. Food and Agriculture Organization of the United Nations: **Global assessment of forest education**. 2022.
Reference Source

36. **Forest schools project**. 2023.
Reference Source

37. Callegari B, Nybakk E: **Schumpeterian theory and research on forestry innovation and entrepreneurship: the state of the art, issues and an agenda.** *Forest Policy Econ.* 2022; **138**: 102720.
Publisher Full Text

38. D'Amato D, Veijonaho S, Toppinen A: **Towards sustainability? Forest-based circular bioeconomy business models in Finnish SMEs.** *Forest Policy Econ.* 2020; **110**: 101848.
Publisher Full Text

39. Global Forest Watch: **Grants & fellowships**. 2023.
Reference Source

40. **SCALE-UP Project**. 2023.
Reference Source

41. **InnovaWood Project**. 2023.
Reference Source

42. Temmerman L, Veeckman C, Ballon P: **Collaborative governance platform for social innovation in Brussels.** *Soc Enterp J.* 2021; **17**(2): 165–182.
Publisher Full Text

43. OpenTEAM: **Open technology ecosystem for agricultural management**. 2023.
Reference Source

44. Smart Agri Hubs: **Smart Agri Hubs**. 2023.
Reference Source

45. Kędzia G, Ocicka B, Pluta-Zaremba A, *et al.*: **Social innovations for improving compostable packaging waste management in CE: a multi-solution perspective.** *Energies.* 2022; **15**(23): 9119.
Publisher Full Text

46. Novamont: **Mater-Bi**. 2023.
Reference Source

47. Frantz CM, Mayer FS: **The importance of connection to nature in assessing environmental education programs.** *Stud Educ Eval.* 2014; **41**: 85–89.
Publisher Full Text

48. European Commission: **Workshop „Network to innovate: social innovation"**. 2023.
Reference Source

49. Cossetta A, Palumbo M: **The Co-production of social innovation: the case of living lab**. *Smart City.* 2014; 221–235.
Publisher Full Text

50. Monda A, Feola R, Parente R, *et al.*: **Rural development and digital technologies: a collaborative framework for policy-making.** *Transform Gov: People Process Policy.* 2023; **17**(3): 328–343.
Publisher Full Text

51. Unique Mānuka Factor: **New Zealand's Unique Mānuka Honey.** 2023.
Reference Source

52. **Leggo Association.** 2024.
Reference Source

53. Boyd MR: **Community-based research: understanding the principles, practices, challenges, and rationale.** *The Oxford Handbook of Qualitative Research.* 2014; 498–517.
Publisher Full Text

54. Wilson E: **Community-based participatory action research.** *Handbook of Research Methods in Health Social Sciences.* 2019; 285–298.
Publisher Full Text

55. Agroecology Europe: **A European association for agroecology.** 2023.
Reference Source

56. Vierra S: **Green building standards and certification systems.** *Vierra Design & Education Services.* LLC, 2016.
Reference Source

57. Olubunmi OA, Xia PB, Skitmore M: **Green building incentives: a review.** *Renew Sustain Energy Rev.* 2016; **59**: 1611–1621.
Publisher Full Text

58. World Green Building Council: **Sustainable building certifications.** 2023.
Reference Source

59. Zamri GB, Azizal NKA, Nakamura S, *et al.*: **Delivery, impact and approach of household food waste reduction campaigns.** *J Clean Prod.* 2020; **246**: 118969.
Publisher Full Text

60. Suárez-Eiroa B, Fernández E, Méndez-Martínez G, *et al.*: **Operational principles of circular economy for sustainable development: linking theory and practice.** *J Clean Prod.* 2019; **214**: 952–961.
Publisher Full Text

61. Patwa N, Sivarajah U, Seetharaman A, *et al.*: **Towards a circular economy: an emerging economies context.** *J Business Res.* 2021; **122**: 725–735.
Publisher Full Text

62. **Circular economy in education.** 2023.
Reference Source

63. **The circular classroom.** 2023.
Reference Source

64. **Berlin open data.** 2023.
Reference Source

65. **Olio app.** 2023.
Reference Source

66. **Too good to go.** 2023.
Reference Source

67. **afreshed Österreich.** 2024.
Reference Source

68. **SCALE-UP trainings.** 2024.
Reference Source

69. **Seminarbäuerinnen.** 2024.
Reference Source

70. European Network for Rural Development: **Exploring the role of awareness raising and communication in promoting the development of sustainable bioeconomy value chains.** 2023.
Reference Source

71. **Valuewaste communication campaigns.** 2023.
Reference Source

72. Lukesch R, Ludvig A, Slee B, *et al.*: **Social innovation, societal change, and the role of policies.** *Sustainability.* 2020; **12**(18): 7407.
Publisher Full Text

73. **Fighting fossil fuels and winning.** 2023.
Reference Source

74. **The climate reality project.** 2023.
Reference Source

75. Esparcia J: **Innovation and networks in rural areas. An analysis from European innovative projects.** *J Rural Stud.* 2014; **34**: 1–14.
Publisher Full Text

76. Cohesion Data: **Cohesion policy and sustainable urban development.** 2023.
Reference Source

77. **ENER2CROWD project.** 2024.
Reference Source

78. Abundance Investment: **Monnow valley biomass debenture 1.** 2024.
Reference Source

79. Abundance Investment: **Orbital marine power (Orkney) debenture 1.** 2024.
Reference Source

80. **Invesdor.** 2024.
Reference Source

81. **Ocean clean up**. 2024.
Reference Source

82. **Still i rise**. 2024.
Reference Source

83. Brandão AS, Gonçalves A, Santos JM: **Circular bioeconomy strategies: from scientific research to commercially viable products.** *J Clean Prod.* 2021; **295**: 126407.
Publisher Full Text

84. nova-Institut für politische und ökologische Innovation GmbH; BTG Biomass Technology Group B.V: **Concept of bio-based and circular economy, RoadToBio EU Project**. 2019.
Reference Source

85. European Commission: **Report on the implementation of the circular**

economy action plan. 2019.
Reference Source

86. **Week van de circulaire economie**. 2023.
Reference Source

87. **Circulars Awards Program**. 2023.
Reference Source

88. Borges MA, Soares AL, Dandolini GA: **Collaborative networks as ways to improve cross-sector collaboration in social innovation: an exploratory study**. *IFIP Advances in Information and Communication Technology*. 2016; **480**: 137–147.
Reference Source

89. Sanzo MJ, Álvarez LI, Rey M, *et al.*: **Business–nonprofit partnerships: a new form of collaboration in a corporate responsibility and social innovation context.** *Serv Bus.* 2015; **9**(4): 611–636.
Publisher Full Text

90. Maria-Irina A: **Ecotourism, agro-tourism and rural tourism in the European Union.** CACTUS 2017 - Contemporary Approaches and Challenges of Tourism Sustainability. 2017.
Reference Source

91. Leco F: **Rural tourists and their attitudes and motivations towards the practice of environmental activities such as agrotourism.** *Int J Environ Res.* 2013; **7**: 255–264.
Reference Source

92. **Casa cerro da correia**. 2024.
Reference Source

93. **SCALE-UP Regions**. 2024.
Reference Source

94. Ludvig A, Zivojinovic I, Hujala T: **Social innovation as a prospect for the forest bioeconomy: selected examples from Europe.** *Forests.* 2019; **10**(10): 878.
Publisher Full Text

95. POWER4BIO Project: **Assumptions and review of the bioeconomy development strategy for Mazovia**. 2024.
Reference Source

96. **Aizenay**. 2024.
Reference Source

97. Harvard Real Colegio Complutense: **International campuses of excellence**. 2024.
Reference Source

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The article, based on the work within a project SCALE-up, explores the potential of social innovation to boost citizen engagement in the processes of rural Bioeconomics. The article reviews some current definitions of social innovation, proposing its own, project-appropriate definition. The article follows by arguing for the relevance of applying SI concept. Later, it reviews examples of SI approaches and good practices applicable for rural bioeconomics. Finally, it analyzes the regions of interest in the SCALE-UP project, proposing which stakeholders and SI practices could be relevant for each region.

Comments and suggestions for improvement:
1. The article reviews several SI definitions, mostly from previous EU projects. However, it lacks certain depth in the overview of the definitions, mostly because it doesn't engage enough with academic work that is fundamental in elaborating and defining SI, such as works by Mulgan and Moulaert.

2. In the section SOCIAL INNOVATIONS FOR THE SCALE REGIONS, the authors analyze the needs in each regions and how they can be adressed with SI. However, describing each region the authors tend to focus mostly on the technical aspect of the challange that the region needs to adress. The article could be greatly enriched if the authors could include other characteristics which can effect the SI implementation in each region, for instance, the currently prevailing situation with citizen engagement, participatory culture and citizen led ecological initiatives; political support and/or resistence towards certain ways of socio-ecological transitions, etc. Including the key features of each region could help to make the suggestions for recommended SIs more elaborated and systematic.

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?

Partly

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?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Rural social innovation; socio-ecological transitions, social sustainability

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, however I have significant reservations, as outlined above.

Reviewer Report 02 April 2025

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?

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Åge Olav Mariussen
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The paper presents the objects and findings of the SCALE-UP project supporting rural bioeconomies with the multi-actor partnerships and with promoting social innovations. The ultimate aim is to scale innovative, sustainable, bio-based value chains utilizing regional resources. The article discusses many definitions of social innovation and combine them to be applied in the analysis of rural bioeconomy. The paper identifies good practices of social innovations in bioeconomy projects in Europe. The good practices have been used as reference for stakeholders in the case regions. The topic of the paper is highly important, since enhancing bio economy is crucial for sustainable development. The paper shows many ways to enhance bio economy in different type of regions.

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

The abstract reflects the paper disposition. However, after the abstract is text reporting what has been done in the project. It is confusing for the reader, since there is some repetition with the abstract. In addition, articles should focus more on findings, and report only on the relevant processes leading to the findings.

The definition adopted for social innovation in the framework of the SCALE-UP project is the following:
"Social innovation is an innovation that provides a valuable and sustainable product and/or service to the market and meets the needs of the society. Social innovation creates new relationships and collaborations among citizens and stakeholders, providing a sense of contribution and/or community, which improve the health and well-being of the actors implementing it".

The first part of the first sentence seems to imply that all social innovations need to provide a product or service to the market. Yet, the second part of the sentence quite rightly points out that social innovations create *new relationships and collaborations among citizens and stakeholders*. We would argue that social innovations might, in some cases, accidentally, or as side effects, provide products and services to the market. Indeed, some social innovations might create new market products, such as bio-waste from forestry used in energy production. However, as shown through several examples in the report, important social innovations are not based on or motivated by the market, but rather on the needs of communities, societies, and the well-being of citizens. These non-market-driven social innovations may for instance be driven by community-based civil-society organizations, where transactions are based on reciprocity, exchange of gifts, and not market relations involving money. In some cases, they may be based on local communities (you repair my car and I fix the roof of your house), or they may be organized as voluntary communities providing collective goods, such as organizations helping members to stop drinking alcohol, stopping smoking, promotion of healthy habits avoiding diseases, or increased physical fitness. Many of these non-market-based social innovations might also provide collective goods, such as clean air, other forms of protection of nature, such as biodiversity, or nice and green neighborhoods, with no garbage floating around. These forms of non-market-based social innovations driven by communities as actors may come close to or replace services which are usually provided by the public sector.

- *Is the study design appropriate and is the work technically sound?*

The selected cases seem in general reflect variety of rural bioeconomy. The descriptions of case areas are interesting. The case areas could be more compared, for instance by using summary tables on characteristics of the cases, what social needs the case regions have, what kind of social innovation response to the needs, what are the main stakeholders, etc. There might be regularities in the stakeholder composition and characteristics of the region, such as social needs or type of value chain.
The notion of good practice in social innovation in rural bioeconomies could also be defined more accurately. Which elements it has? For instance, should a good practice has already some achievement, and which kind? Are use of regional resources, sustainability, multi-actor partnerships and citizen involvement seen as achievement as such? Should good practices have some transferable elements from which the others can learn? How embedded they are in their present context? What kind of social needs social innovations is able to solve or is a response in rural bioeconomy?

Sometimes you write on good practices, sometimes on best practices, and use them as

synonymous. They have not necessary the same extension.

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

The authors have identified plenty of good practices of social innovation in different European regions and projects. They write that the good practices can be used as reference by stakeholders in rural bioeconomy. The authors also report which identified good practices could response to the needs of case regions. We think that the good practices are interesting and they could be analysed more. In addition, it would be interesting to know how the stakeholders can learn from them.
Good practice description can be used also by others than SCALE-UP project members, if they are easy accessible. The idea of Stakeholder mapping along value chain can be replicated by others, and it is indeed often used.

- *Are all the source data and materials underlying the results available?*
- *Are the conclusions drawn adequately supported by the results?*

The discussion and conclusion is not completely align with the analysis of the cases. Introduction section has a starting point a biobased value chain with the inclusion of citizen. The arguments for citizen engagement are convincing, but somehow self-evident. Also conclusion emphasizes the need of citizen engagement, but does not go very much further with the statement. The conclusion section consists of general statements on social innovation, which are not based enough to the findings in the earlier sections of the article. It would be better to discuss more what other researchers, developers, and actors in rural bioeconomy can learn from the efforts to integrate social innovation in enhancing rural bioeconomy.

According to the article "*regional stakeholders are unable to fully realize the potential of the bioeconomy because they lack technical know-how, competitive networks, and market knowledge.*"

To address this challenge, regional collaboration platforms were set up. However, we wonder how the rural actors evaluated the collaboration platforms as a good practice, and how it can be used in identification selecting and benchmarking the good practices, how the platforms are addressing the specific regional needs, and how the experiences of the platforms vary regarding the involvement of citizens and local communities.

Refer 1 to 3.

References

1. Learning Transnational Learning. 2013. Publisher Full Text
2. Nordberg K, Mariussen Å, Virkkala S: Community-driven social innovation and quadruple helix coordination in rural development. Case study on LEADER group Aktion Österbotten. *Journal of Rural Studies*. 2020; **79**: 157-168 Publisher Full Text
3. Nordberg K, Virkkala S, Mariussen Å: Municipalities and communities enabling social innovations in peripheral areas – case studies from Ostrobothnia, Finland. *Geografiska Annaler: Series B, Human Geography*. 2024; **106** (1): 74-95 Publisher Full Text

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

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

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?
Partly

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

Are the conclusions drawn adequately supported by the results?
No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: regional development, rural development, innovation studies, economic geography, sociology

We confirm that we have read this submission and believe that we have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however we have significant reservations, as outlined above.