RIBES

REGIONAL INCLUSIVE BIOBASED ENTREPRENEURSHIP SOLUTIONS

DELIVERABLE D2.1

Literature review and conceptual framework; The role of social innovation in transitioning the bioeconomy for sustainable rural development

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ABBREVIATIONS

MTF	Multi-actor Transformative Forum
WP	Work package
MLP	Multi-Level Perspective
CBE	Circular Bio Economy
T2.1	Task 2.1
D2.1	Deliverable 2.1

EXECUTIVE SUMMARY

This deliverable examines the intersection of **bioeconomy** and **social innovation**, revealing that while these fields remain largely separate in the literature, they share common theoretical foundations and sustainability goals.

The findings of the bibliographic analysis and the results of the workshops supported the bottom-up, contextualised development of a conceptual framework that serves to steer other project activities, such as the case studies in the 10 regions (Task 2.4) and a synthesis at the end of the project (Task 2.5).

Social innovation plays a crucial role in enabling participatory, community-driven approaches in the bioeconomy that integrate local knowledge, stakeholder engagement, and inclusive governance. It fosters cross-sectoral collaboration and adaptive governance, supporting the scaling of sustainable, bio-based innovations. However, a lack of universally accepted definitions for both concepts underscores their highly contextual nature, with meanings shaped by local interests, ambitions, and socio-economic conditions.

Findings from the Multi-actor Transformative Forum (MTF) workshops confirm that bioeconomy and social innovation are **deeply place-based**, requiring localized governance models and co-designed innovation pathways. The Multi-Level Perspective (Geels, 2002) is extended to integrate ecological dimensions alongside technological and social co-evolution. This approach recognizes the **complex interdependencies** within rural bioeconomies, where **trade-offs and synergies** between economic gains, social well-being, and environmental sustainability **shape transformative processes**.

The deliverable emphasizes the role of **multi-actor partnerships**, including technological, social, and institutional innovators, in fostering a socio-ecological regime shift. Platforms like MTFs enable collaborative exploration and experimentation of **socio-technical, socio-institutional, and socio-ecological innovations**, ensuring sustainable bioeconomy transformations. The inclusion of **Social Life Cycle Assessment (S-LCA)** enhances impact evaluation, integrating social and ecological considerations into bio-based value chains.

A **multi-actor partnership lens** is essential for identifying asymmetries, governance dynamics, and opportunities within rural bioeconomies. The framework recognizes that social innovation expands beyond biomass value chains, linking and including actors from education, tourism, public services, health, agriculture, industry and energy sector, to enable **multiple value creation**. Through co-designed, **place-based solutions**, these partnerships facilitate regional transformation, ensuring fair benefit distribution and resilience in bio-based economies.

1. Introduction

This is the first deliverable of **Work Package 2: Towards a Social-Ecological Transformative Innovation Framework**. The objective of this work package is to advance knowledge at the nexus of circular bioeconomy (CBE) and social sciences, specifically focusing on social economy[1] as an asset for revitalising rural areas.

This Deliverable (D2.1) summarises the findings of an extensive literature review and results of MTFs workshops to support the elaboration of a shared conceptual framework to structure further project activities. Interaction with **local Multi-actor Transformative Forums (MTFs)** plays an important role in advancing the knowledge, contextualisation and developing a shared understanding.

The deliverable is related to the activities of **Task 2.1 – Conceptual Framework Development for Sustainable, Circular, Inclusive, Bio-based Ecosystems in Rural Areas**. Lead by UM/UNU-MERIT, with the contribution of all project partners in the first year. RIBES partners have engaged in a participatory co-development process and workshops to set the grounds of a shared conceptual framework. This will allow for a comprehensive understanding of how social innovation and social entrepreneurship can advance the CBE and generate sustainable rural development in ten RIBES pilot regions.

The collaborative desk research on the evolution of scientific knowledge involved an extensive **literature review** that started with a large-scale systematic analysis of scientific publications at the nexus of bioeconomy and social innovation. Also included are linkages between the literature referring to various 'economies' concepts: such as bioeconomy, social economy and circular economy (see **Section 2** and **Annex I**).

Starting from the basic concepts of bioeconomy and social innovation identified through the collaborative desk research, three online workshops (June-July 2024) addressed good practices and the regional ecosystem, from which **local specificities in the ten RIBES regions** emerged. The first Inter-regional MTF meeting resulted in a validation of conceptual definitions. The results are described in Section 3 (see **Section 3**).

Considering these results in the sections above was the start for developing **RIBES conceptual framework.** This initial framework links and structures a broader set of concepts and literature, on topics such as: rural development, sustainability, transformation, circularity, social entrepreneurship, eco-system, value chain, multi-actor, place-based, innovation system, co-evolution, and Life Cycle

[1] "The social economy covers entities sharing the following main common principles and features: the primacy of people as well as social and/or environmental purpose over profit, the reinvestment of most of the profits and surpluses to carry out activities in the interest of members/users ("collective interest") or society at large ("general interest") and democratic and/or participatory governance." Source: https://social-economy-gateway.ec.europa.eu/about-social-economy/social-economy-definitions-and-glossary_en

Assessment (see **Section 4**). This living framework will evolve and be synthesized in the final delivery when the results of other tasks will be integrated.

In **Section 5 conclusions** are provided and possible **implications for other tasks** will be addressed, notably ideas on the design of the qualitative case studies.

2. Literature Review

2.1 Evolving Perspectives on a Bioeconomy

The use and understanding of the term **bioeconomy** (and bio-based economy) has emphasized different aspects and evolved in its scope over time. As a result, it is hard to pinpoint what exactly a bioeconomy is (or should be). In fact, many authors use the term bioeconomy as an umbrella concept or as Levidow et al. (2012) state as a master narrative with its meaning still in flux (see also Bugge et al., 2016; Pülzl et al., 2014; Staffas et al., 2013). Within this narrative, we find often overlapping but also diverging and even at times contradictory understandings which build upon the rich history of the underlying concepts and reflect the diverse academic backgrounds of the authors (Bugge et al., 2016; Vivien et al., 2019).

The origins of the concept of a *bioeconomy* can be traced back as early as the beginning of the 19th century, when the term ***bioeconomics*** was first introduced to describe fishery economics and quickly extended to include all renewable resource economics (Allain et al., 2022; Gordon, 1954; Vivien et al., 2019). A first strict normative meaning was introduced by Nicholas Georgescu-Roegen, an intellectual scholar of Joseph Schumpeter (Georgescu-Roegen, 1975; see also Gowdy & Mesner, 1998; Vogelpohl & Töller, 2021). Georgescu-Roegen used the term "*bioeconomics"*' to acknowledge the biological bases of all economic activity and the incompatibility of unlimited growth and the basic laws of nature. He explicitly addressed the need for degrowth structured around new societal values, new social organization, as well as low-tech innovations. Driven by breakthrough innovations for example in the field of recombinant DNA technology in the late 1970th and 1980th, the so-called ***biotechnology*** received much attention which led to the development of designated biotechnology policies such as the German “Biotechnology 2000” program or the Dutch "Program Committee Biotechnology" which aimed to stimulate economic growth and improve the international competitiveness of the German and Dutch biotechnology sector (Allain et al., 2022; Buchholz & Collins, 2013; Rip & Nederhof, 1986; Warmuth, 1991). Such advancements in **biological sciences and biotechnology** inspired scholars and scientist such as geneticists Juan Enriquez Cabot and Rodrigo Martinez to describe its potential to transform commercial and industrial processes and in doing so helped further define the root of the concept of bioeconomy (Birner, 2018, p. 19).

The roots of the contemporary momentum of the concept of a bioeconomy can be traced back to the efforts of the EU and OECD, and other political institutions, which began the formalization of the concept of a bioeconomy in their policy framework in the early 2000s (McCormick & Kautto, 2013). While the term was first introduced by scientists concerned with the industrial consequences of advancements in biology, it only become a key policy concept in Europe after the European Commission pushed the concept of a **“knowledge-based bioeconomy”** based on advances in the life sciences in 2005. Under the German EU Presidency, the 'Cologne Paper' (EU, 2007) first outlined the concept at the conference 'En Route to the Knowledge-Based Bio-Economy' in 2007 (Lang, 2022). This politically motivated (re-)interpretation of the bioeconomy concept was triggered by the increasingly depleting reserves, rising fossil fuel prices and the growing significance of using **biological resources** as primary feedstock and biorefineries as production facilities, and resulted in an conceptualization of the

bioeconomy as a **biomass-based economy** which highlights the use of **biomass** and efficient **bioprocesses** to achieve sustainable production (OECD, 2009).

The substitution of **non-renewable resources with renewable biological alternatives** alone, however, has proven to be problematic, and trade-offs and negative impacts of an unsustainable bioeconomy focused on input substitution have become more apparent over the years (McCormick & Kautto, 2013; Pedersen et al., 2020; Pfau et al., 2014; Stegmann et al., 2020; Zander et al., 2022). Consequently, both the political as well as the academic landscape developed more comprehensive definitions and understandings of the bioeconomy concept, e.g. ***circular* bioeconomy** and ***sustainable* bioeconomy** (see e.g. the updated bioeconomy strategy Council of the European Union, 2023; see also Kardung et al., 2021) where the term bioeconomy has been reinterpreted and extended to not only focus on replacing the unsustainable resources with sustainable ones, but also to contribute to a **socially, economically and environmentally sustainable future** (Geels, 2011; Losacker et al., 2023; Pfau et al., 2014; see also Quental et al., 2011 for a discussion on sustainability).

While a substitutive interpretation of the bioeconomy may be best addressed by **technological innovations** that enable the efficient use of biological resources (Friedrich et al., 2022; Lühmann & Vogelpohl, 2023), a sustainable or circular bioeconomy requires a more profound transformation. This transformation **goes beyond technological advancements** to encompass **systemic changes in economic mechanisms, social organization and inclusivity, and consumer behavior**. In other words, what is needed is **social entrepreneurship that leads to social innovation**, *i.e. new ways of thinking, organizing, and interacting as a society,* which drives sustainable practices and reshapes societal norms.

2.2 Diverging Meanings of Social Innovation

The literature on **social innovation** shows conceptual diversity and several authors have described it as a *contested* concept (Ayob et al., 2016; see also Gallie, 1956; Marques et al., 2018; Slee et al., 2021). Despite far reaching historical roots, the concept has gained increasing momentum in academia and policy circles, particularly in the last two decades, leading to a broad but also to some extent fragmented field which is characterized by diverse interpretations, theoretical approaches, and practical applications.

When trying to define what social innovation means, one stumbles across a **multitude of definitions**, some of the main definitions are provided in the following table:

Table 1 Definitions of Social Innovation

Nr.	Definition	Source
1	"A process encompassing the emergence and adoption of socially creative strategies, which reconfigure social relations in order to actualize a given social goal"	(Pue et al., 2015)
2	"Social innovation refers to new ideas that work in meeting social goals"	(Mulgan et al., 2007)
3	"Social innovation refers to the design and implementation of new solutions that imply conceptual, process, product, or	(OECD, 2025)

	organisational change, which ultimately aim to improve the welfare and wellbeing of individuals and communities."	
4	"Social innovation is a process of change emerging from the creative re-combination of existing assets (from social capital to historical heritage, from traditional craftsmanship to accessible advanced technology), the aim of which is to achieve socially recognized goals in a new way."	(Manzini, 2014)
5	"A process of change, social collaboration, and interaction, aiming at organizing ideas and inventions to tackle social problems and to improve quality of life and collective wellbeing through mechanisms of community governance"	(Martins et al., 2022)
6	"Social innovation […] refers to the generation and implementation of new ideas about how people should organize interpersonal activities, or social interactions, to meet one or more common goals"	(Mumford, 2002)
7	"The application of innovative, practical, sustainable, market-based approaches to benefit society in general, and low-income or underserved populations in particular"	(Blanke & Milligan, 2016)
8	"Social innovations are changes in the cultural, normative or regulative structures […] of society which enhance its collective power resources and improve its economic and social performance"	(Hämäläinen & Heiskala, 2007)
9	"Social innovations are new solutions (products, services, models, markets, processes, etc.) that simultaneously meet a social need (more effectively than existing solutions) and lead to new or improved capabilities and relationships and better use of assets and resources"	(Caulier-Grice et al., 2012)
10	"New ways of achieving goals, especially new forms of organisation, new regulations, new lifestyles, which alter the direction of social change, solve problems better than earlier practices, and which are therefore worth imitating and institutionalizing"	(Zapf, 1994)

Leaving aside, potentially problematic normative or tautological elements in the definitions, there is no single, universally accepted definition of social innovation, as it is always subject to subjective and/or research domain specific interpretation shaped by academic backgrounds and perspectives. Consequently, there exists a rich body of literature aiming to grasp and categorize the scope of this still evolving concept (Maldonado-Mariscal & Alijew, 2023; Mumford, 2002; Nicholls & Murdock, 2012; Phillips et al., 2024). For example, Ayob et al. (2016) use three themes to cluster publications on social innovation: **(1) societal impact** – 'societal' consequences of the innovation, **(2) social relations** – 'social' processes leading to the innovation and **(3) technological innovation** – focus on innovations that leverage technology to address social issues. Bautista-Gómez and van Niekerk (2022) identify the **(1) instrumental / technocratic - social innovations** as developing more effective, efficient or sustainable solutions, **(2) institutional/structural - social innovation** as institutional change or transformation in complex adaptive systems or **(3) democratic paradigms - social innovation** as a way to meet human needs by focusing on increasing the participation and empowerment of communities,

creating more access to resources, and increasing social and political capacities (see also Phillips et al., 2024 for a related categorization). However, there is also the differentiation in *technocratic* and *democratic* by Montgomery (2016), who does not seek to explain *what* social innovation is but rather *how it is structured and implemented* (see also Bruin & Read, 2018). Other than generic definitions, social innovation can only be defined in a context in relation to the ideas, interests, institutions and the issues at the locality, since **local interests and context situations** are both triggers of (potentially transformative) social innovations. These triggers are transformative constituents of **bottom-linked governance,** which is essential for **adaptive governance**, hence the **adaptive definition, implementation and contextualization of social innovation** in the locality occurs (Castro-Arce and Vanclay, 2020).

2.3 Bibliometric Analysis

In recent years, the field of bibliometrics has gained considerable momentum in the research community (Donthu et al., 2021). It can be used to visualize, explore, and analyze large amounts of scientific metadata to identify the structure, patterns, dynamics, and knowledge gaps of a field of study (Donthu et al., 2021; Small, 1999), or to scope a body of literature (see also Munn et al., 2018).

We conducted an initial large-scale bibliometric analysis at the economy level, e.g. the literature on bioeconomy and social economy, and detected that social innovation and entrepreneurship have high degrees of membership in the set of most important potential interaction domains between bioeconomy and social economy (See Annex 1). In the following analysis, we concentrate on bioeconomy, social innovation and social entrepreneurship.

We are not the first to conduct a bibliometric analysis within the field of bioeconomy (see for example Gould et al., 2023; Mougenot & Doussoulin, 2022) or social innovation (see for example Ayob et al., 2016; Martins et al., 2022). However, to the best of our knowledge we are the first to do an analysis of both fields.

For the analysis, we employ the following approach: First, for data retrieval and analysis, we use an adapted version of the PyblioNet software tool (Müller, 2023), which combines a Python-based data collection tool (accessing the Scopus database) with a browser-based visualization and analysis tool. The Scopus database was chosen as it is a curated database (Baas et al., 2020) which provides unique identifiers for authors and documents, avoiding the need for complex data cleaning and manual assignments.

As main query we combined the keywords **"bioeconom*", "social entrepreneur*", "bio-based econom*", "bio-econom*" and "social innov*"** and applied it on titles, abstracts and keywords without any further restrictions. This results in a set of **26.227 publications in total with 13.135 publications on bioeconomy and 13.098 publications on social innovation**.

Only 11 publications have references to both fields of research. Out of the 11 publications provided by Scopus, nine were considered relevant and were accessible by the authors of this report. Below the main arguments of these publications are scrutinized:

The paper by **Schmid et al. (2012**) critiques the conventional approaches to the bioeconomy, arguing for a broader inclusion of public goods and social interests. It emphasizes the need for integrating farmer perspectives and public interests to ensure the bioeconomy supports broader societal goals, such as sustainability and social justice (Schmid, Padel, & Levidow, 2012) **Sasson & Malpica (2018)**,

for instance, highlight the importance of participatory and social innovation initiatives as essential to connecting local communities with bioeconomic initiatives in Latin America through participatory practices, sustainable resource management, and equitable benefit-sharing. By integrating local knowledge and ecosystem services into technological advancements, social innovation ensures scalable, community-driven, and sustainable bioeconomic growth. **Ludvig et al. (2019)** explain that social innovation unfolds in two possible stages: first, as a process involving collaboration and negotiation among stakeholders, and second, as an outcome generating new services, economic benefits, and community engagement. They further identify three key areas where social innovation is relevant: fulfilling social needs (e.g., supporting vulnerable groups through social enterprises), driving sustainable rural development (e.g., regional initiatives like bioenergy and non-timber forest products), and fostering participation and collective action (e.g., community forestry and stakeholder cooperation). **Falcone et al. (2019)** explore how transitioning towards a bioeconomy involves complex stakeholder interactions that need to consider social dimensions. They stress the importance of social innovation in creating stakeholder engagement and participatory approaches that include diverse groups in the decision-making processes, thus promoting a more inclusive and sustainable bioeconomy. Drawing on Ludvig et al. (2019), **Lawrence et al. (2020)** emphasize that social innovation in woodland social enterprises is rooted in reconfigured social relations, participatory engagement, and meeting community needs. It involves integrating diverse actors, business models, and governance structures while balancing financial, environmental, and social goals. Achieving this balance requires flexible, context-specific policy support, including advisory services, peer networks, and adaptive partnerships. These elements help woodland social enterprises overcome barriers to innovation and contribute to a sustainable, community-driven bioeconomy. **Weiss et al. (2021)** explains that social innovation in the forest sector plays a transformative role by involving diverse stakeholders through participatory governance, addressing regional development, and supporting the transition to a sustainable bioeconomy. Social innovation is framed as essential for overcoming structural challenges, enhancing rural development, and integrating non-market forest goods and services, which require governance innovations beyond traditional market mechanisms. In a similar vein, **Weiss et al. (2023)** argue that social innovation plays a significant role in unlocking the potential of non-wood forest products within the bioeconomy by addressing barriers and creating new opportunities through innovation systems. They specifically highlight barriers such as weak institutional frameworks and limited market recognition of non-wood forest products and explore how collaborative networks, innovation systems, and policy adjustments can overcome these challenges.

An example outside the field of forestry can be found in **Souza Piao et al. (2023)** who identify social innovation as a key mechanism for incorporating social inclusion into circular economy. By reshaping governance structures and supporting inclusive business models such as cooperatives and reverse logistics systems, their paper underscores that circular economy strategies must move beyond technical solutions and address socio-economic barriers to foster equitable and scalable sustainability. Finally, **Laverde and Szarka (2024)** highlight that social innovation is a key enabler within regional bioeconomy innovation ecosystems, facilitating collaboration among diverse actors, institutions, and sectors. The authors emphasize that social innovation fosters knowledge transfer, adaptive management, and cross-sectoral interactions necessary for scaling sustainable bio-based innovations.

2.3 Identifying Hidden Links

Given the large conceptual overlaps between both strands of literature, it is surprising that there is **little research that deliberately explores the potential of a combined and interlinked perspective**. Consequently, we use a bibliometric perspective that highlights how intertwined and interdependent these concepts are (or should be). More specifically, our bibliometric analysis aims to identify so-called **hidden links between the two strands of research** (Müller et al., 2024). Our analysis is based on the idea that when exploring the links and overlaps between two research strands, it is not sufficient to restrict the relevant literature to the publications that explicitly use keywords from both research strands. By doing so, we neglect the vast number of contributions which, despite not containing the relevant keywords, still show a strong association with the literature from the other strand. Examples for this are situations where authors cite research from the other field, use the same references or keywords etc.

We start by describing how the two strands of literature have evolved over time. Figure 1 shows the number of publications published per year from 1956 to 2024. The roots of both research strands on sustainability as well as digitalization can be traced back to the late 1980s and early 1990s, with a short and small peak for bioeconomy at the end of the 1990s. Following this period, the growth in publications related to both topics remained relatively slow until the early 2000s, when a noticeable acceleration for both fields began. Bioeconomy research saw a particularly rapid increase over the last years, surpassing social innovation in publication volume by the end-2010s.

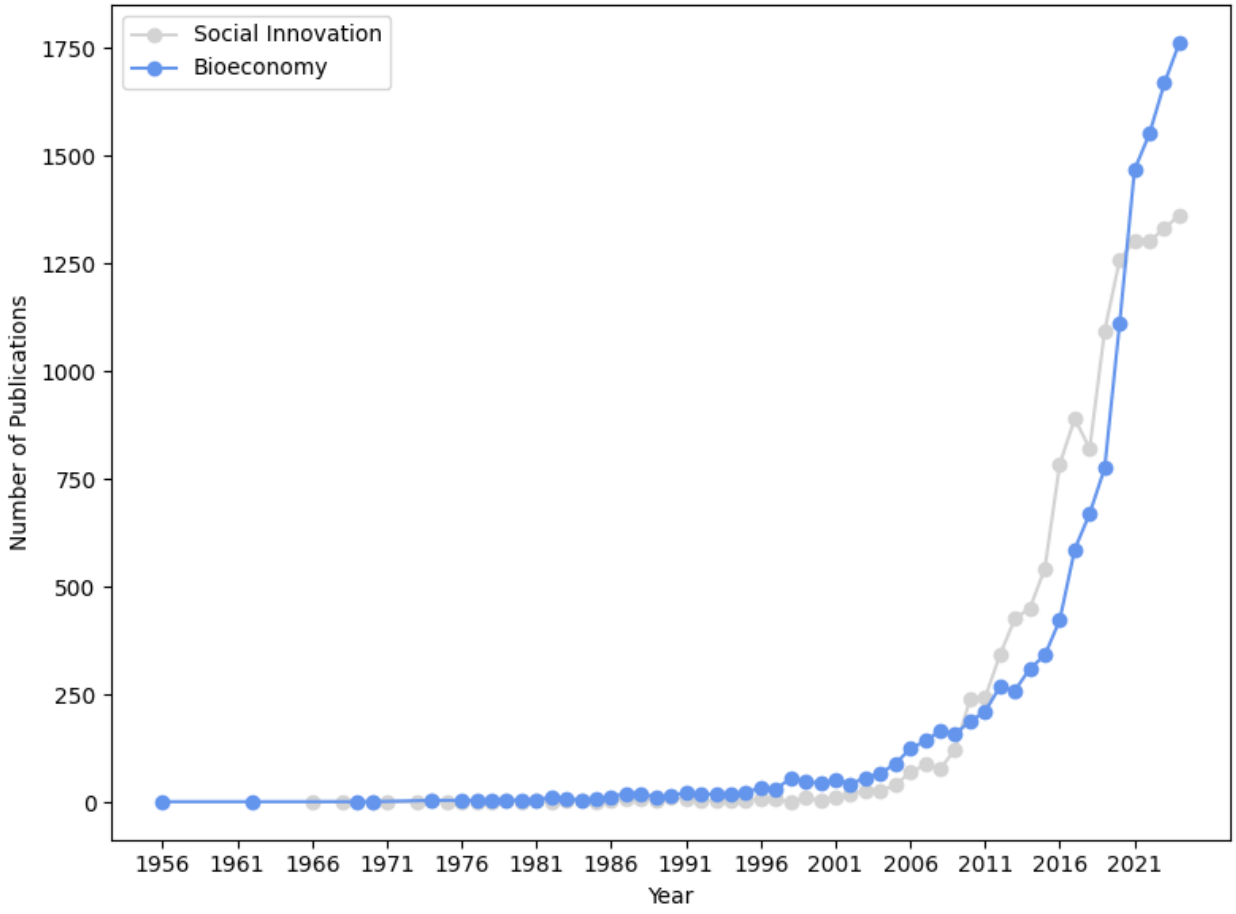


Figure 1 Publication Frequencies over time

To get an in-depth understanding of the main topics and research foci of both scientific fields, we show in Figure 2 and Figure 3 the most common keywords used in the publications. Not surprisingly, the top two keywords used by articles on social innovation reflect the keywords used in the search query (*e.g.*, **"social innovation" and "social entrepreneurship"**). Additional keywords used within this set of publications include, for instance, **"social enterprises", "innovation", "entrepreneurship", or "sustainability"**. Publications on bioeconomy primarily use keywords such as "**bioeconomy", "circular bioeconomy", "sustainability", "circular economy", "biorefinery" or biomass".**

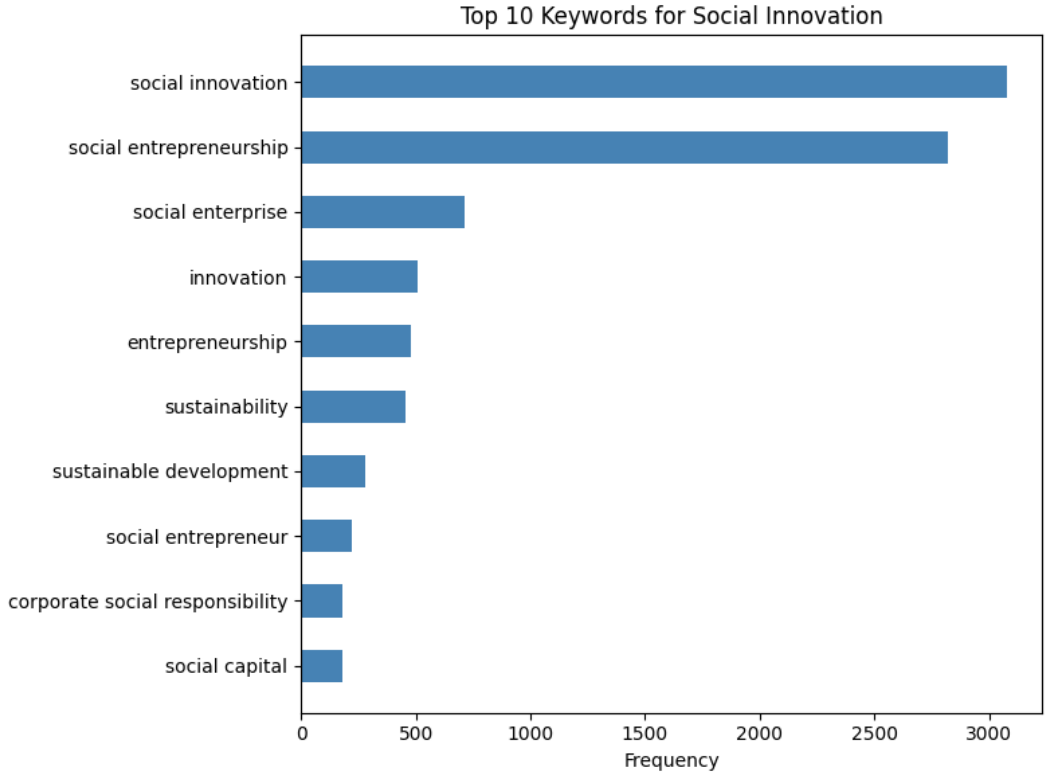


Figure 2: Most frequent Keywords used with the social innovation literature

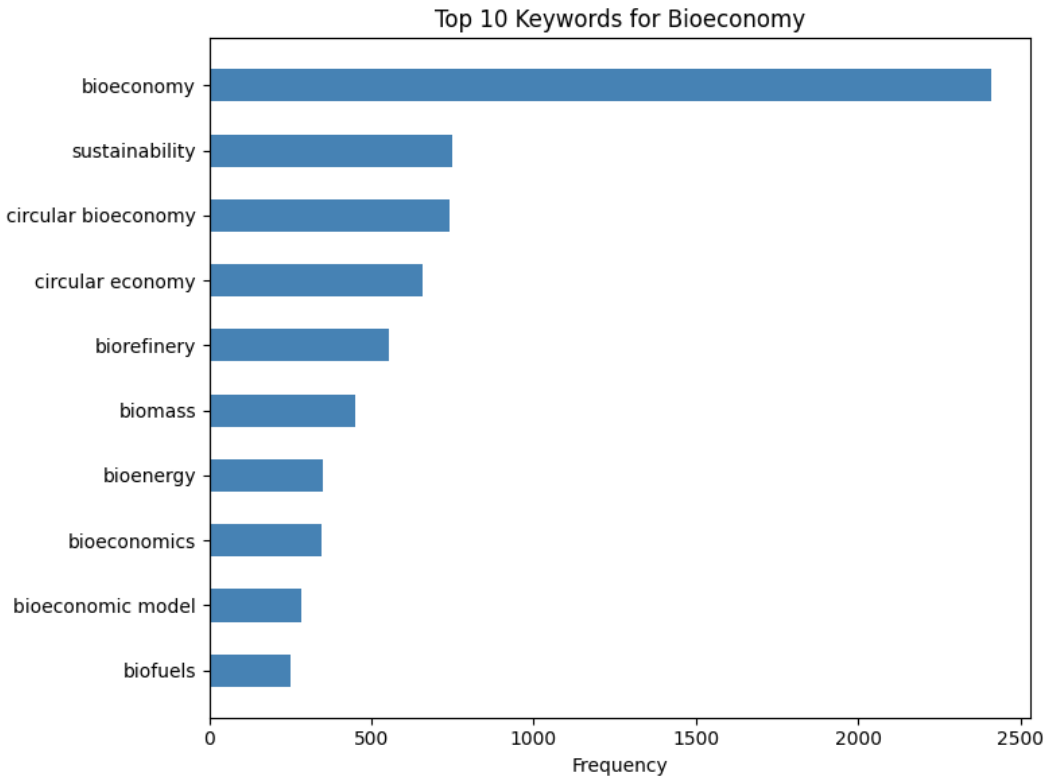


Figure 3: Most frequent Keywords used with the Bioeconomy literature

However, there are also **interesting overlaps**. To identify **joint research foci** within both fields, we present in Figure 4 the ten most common keywords. Here, it becomes clear that topics like **"sustainability", "sustainable development"; "climate change"** or simply the **"environment",** are pressing matters for both research strands. At the same time, we see that also the issue of **"governance"** and **"policy"** are relevant topics in both fields.

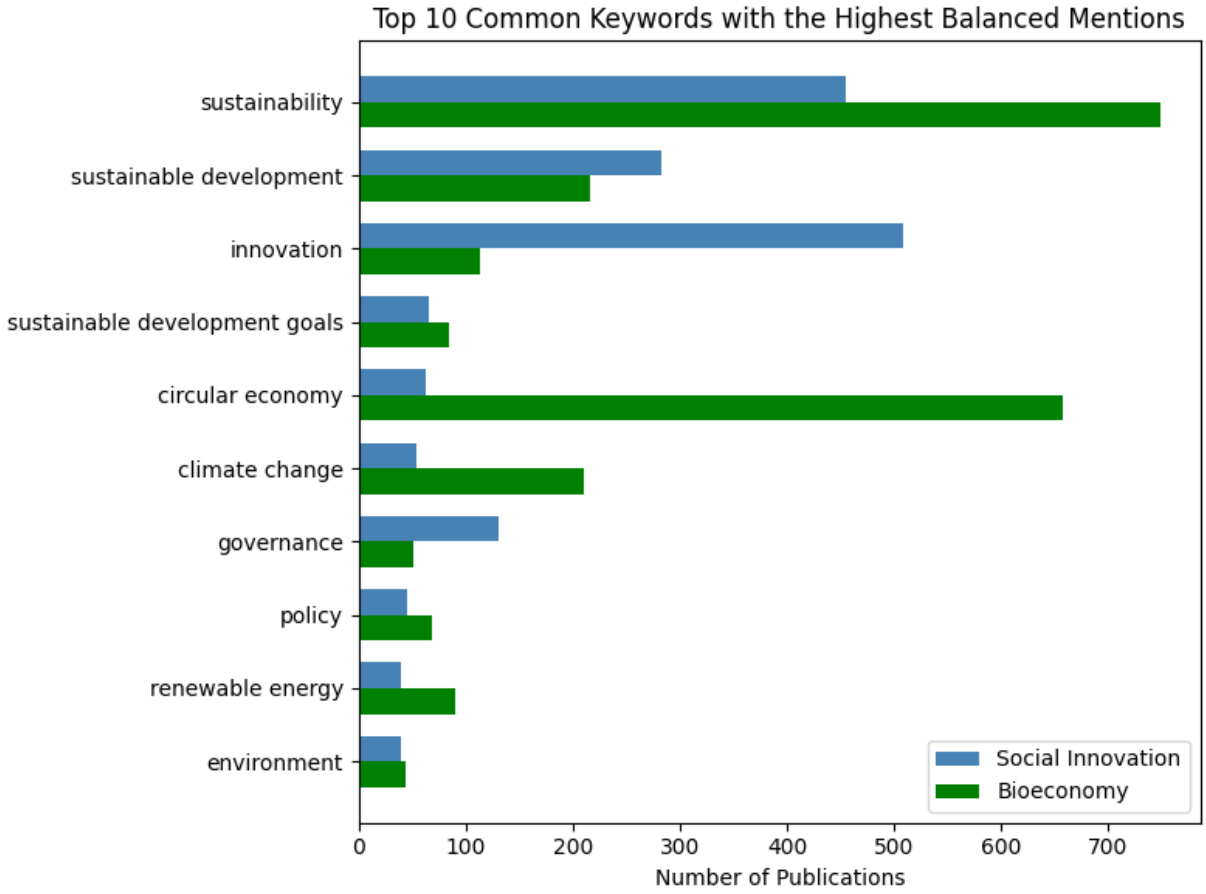


Figure 4: Most frequent common Keywords

Citation Network Analysis:

Next, we explore **the citation network patterns** within and across the literature on **social innovation and bioeconomy**. In this analysis, a directed link is established from one node to another if the respective node cites the other node. **The resulting network, consisting of 98,642 edges and 26,227 nodes (including 7,345 isolated nodes)** is shown in Figure 5. The network reveals relatively distinct and separated research strands, however, also within both the social innovation and bioeconomy literature separated clusters emerge. Additionally, we see that **118 publications from the social innovation literature cite works within the field of bioeconomy**, while **207 publications from the bioeconomy literature reference studies on social innovation**. This imbalance in cross-citations suggests a **pronounced asymmetry in the relationship between the two research fields**. In other words, **bioeconomy scholars are more actively drawing on ideas, theories, or methods from the field of social innovation than vice versa**.

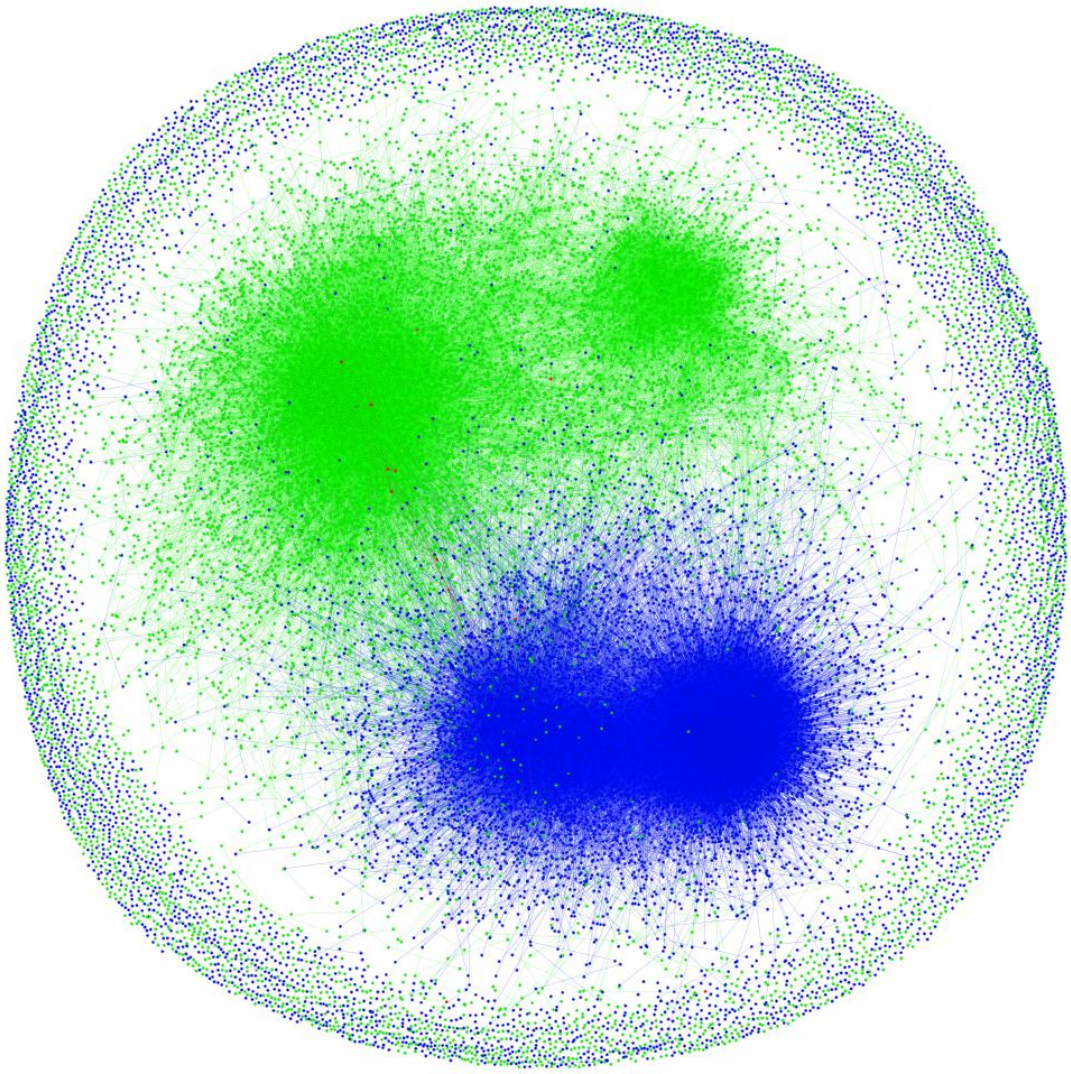


Figure 5: Citation network (green: Bioeconomy; blue: social innovation)

To further analyse the fields inherent topic clusters and links between the research strands, we divide the citation network into communities using a Louvain community algorithm (Blondel et al., 2008), which identifies communities of nodes based on the connectivity patterns of the network. The algorithm iteratively optimizes a quality function to maximize the modularity of the network. It can be applied to large networks as compared to other community detection algorithms such as the Girvan-Newman algorithm (Girvan, Newman, 2002; see also Šubelj *et al.*, 2016 for a comparison). Figure 6 shows the resulting community structure (see also table 2 for further details). It is noteworthy that there are several possible explanations for the formation of citation network communities, such as the underlying co-authorship networks (Newman, 2004), geographic or institutional proximity (Pan et al., 2012), or journal bias (Urlings et al., 2021). However, we find no evidence for any of the above in our data. Therefore, we assume in the following that **the community structure in our citation network is the result of thematic coherence**, as evidenced by commonly used keywords.

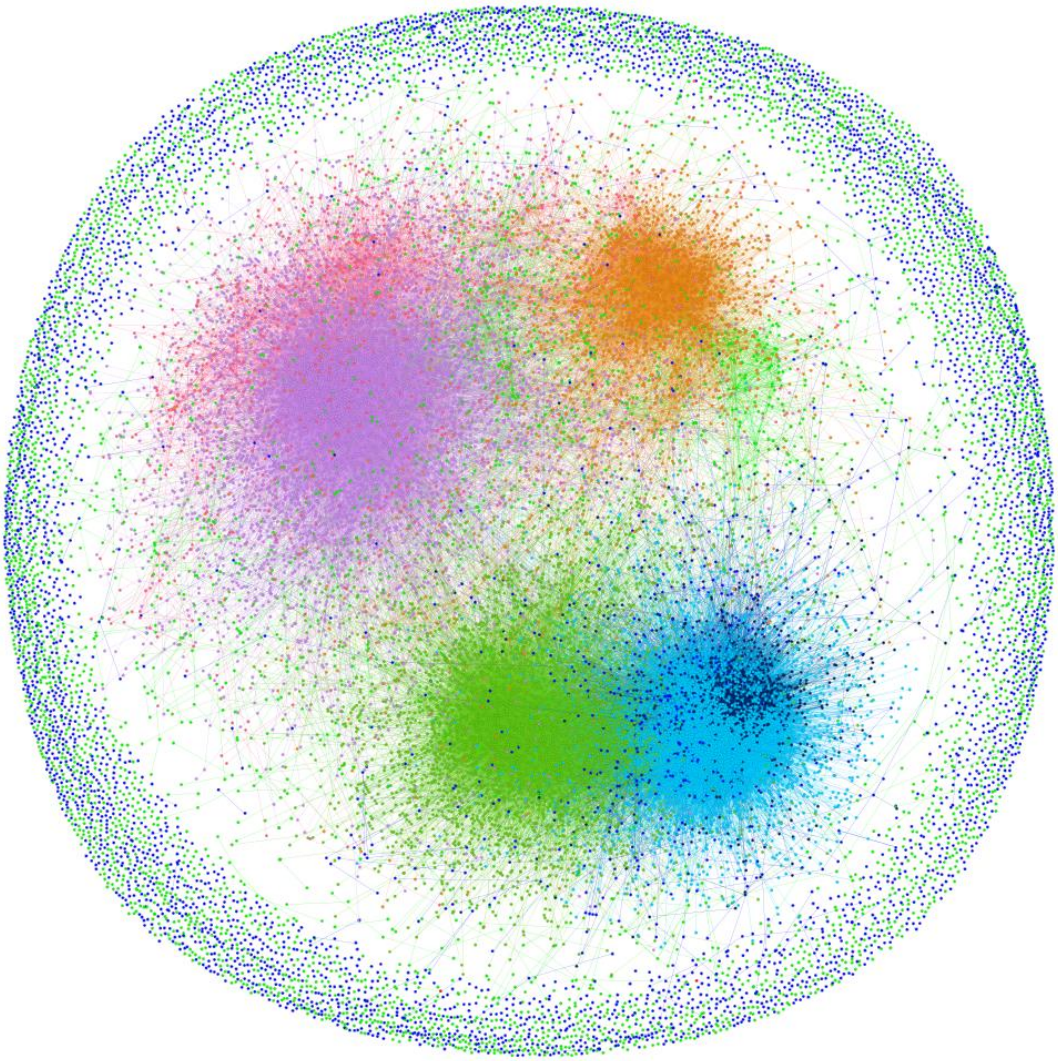
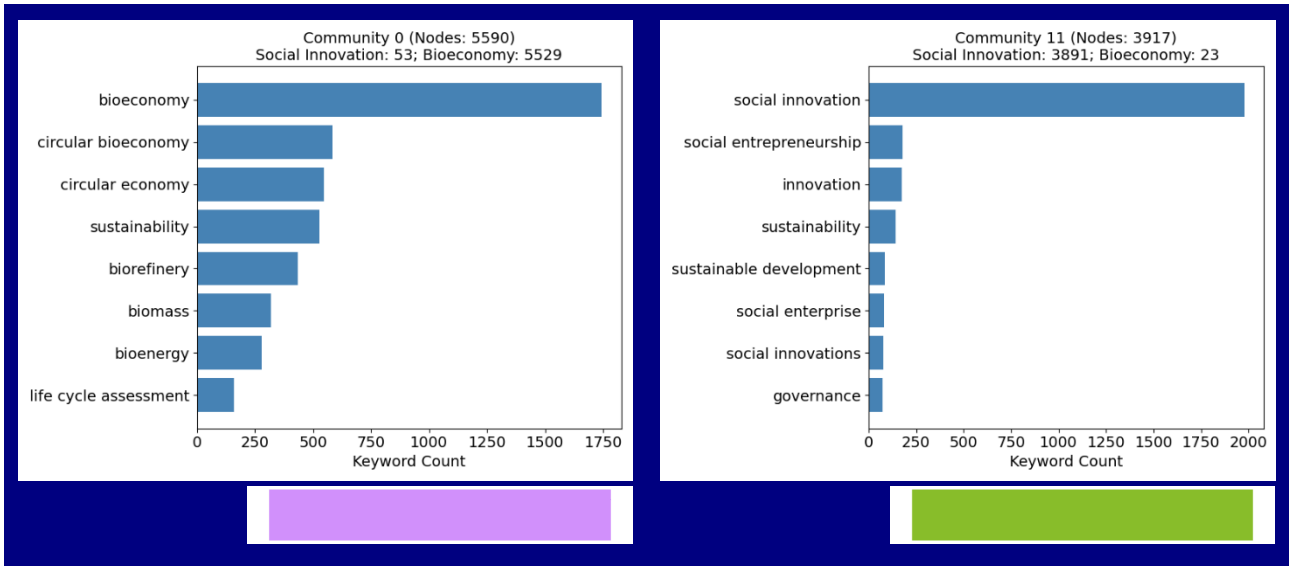
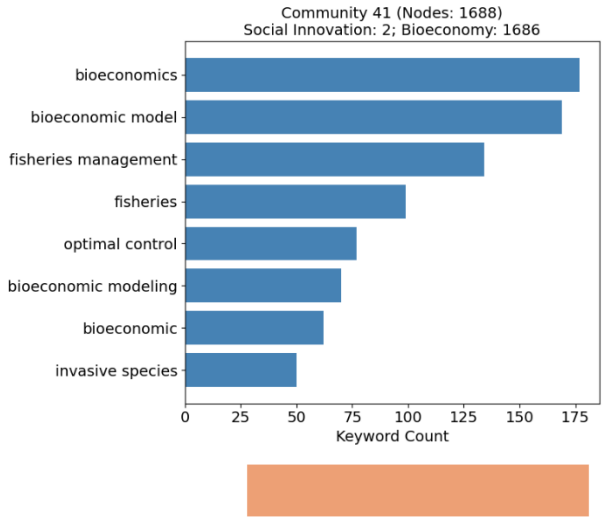


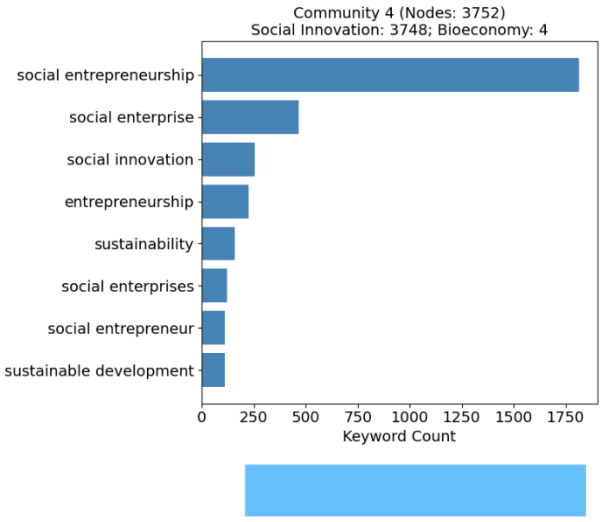
Figure 6: Citation network with highlighted community structure

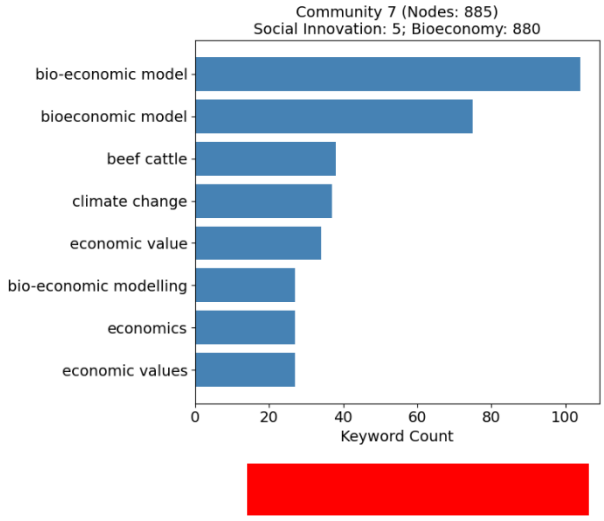
In Table 2 below, we, thus, show **the most common keywords for the six biggest communities**. Starting with the field of bioeconomy, the biggest community in the network (community 0) appears to have a **technological focus** with keywords **such as biomass, biorefinery** etc. The second bioeconomy community (community 41), in contrast, shows **fisheries** background and interestingly, has **"bioeconomics"** as most used keyword (see also the discussion in section 2.1). Finally, community 7 is in close proximity to community 0 and exhibits a **modelling and economics focus**. For social innovation, we see two major components, i.e. community 11 and community 4. While community 11 displays the keywords we see dominant for the whole **social innovation** literature; community 4, has a clear focus on **social entrepreneurship**. Closely located to community 4 is community 1 where **education** is a central topic. When looking at the cross-literature links between the fields, it becomes evident that the main area of overlap exists between community 0 and community 11.

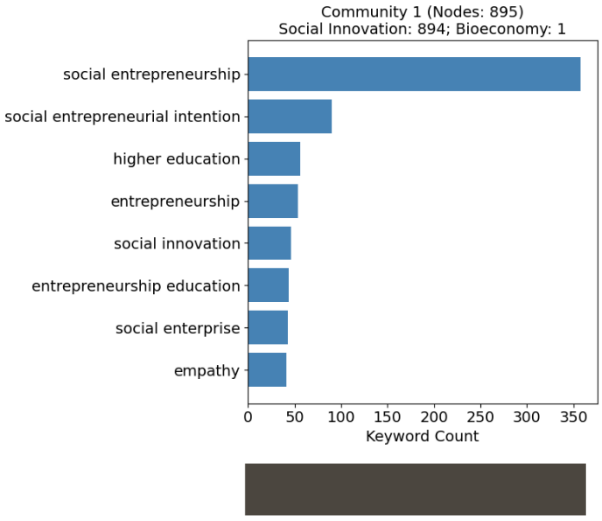
Table 2: Most mentioned keywords per community











Analysis of Bibliographic Coupling:

Another potential layer of relatedness can be found when looking at **joint references between publications from bioeconomy and social innovation literature**. Here, we assume a bibliographic coupling between two publications if they share at least 3 common references. The resulting network of coupled publications allows for determining whether literature on social innovation and bioeconomy show common foundational research, theories, or methods, hereby suggesting a similar intellectual background or knowledge base. In total, the literature on social innovation uses 306.846 different references, while publications addressing the bioeconomy uses 361.389. **They share a surprising amount of 10.976 references as a common knowledge base.**

When analysing the resulting network (see Figure 7), we first observe that the previously defined communities still hold, displaying dense communities of not only direct citations but also common references. However, we also see **925 bibliographic coupling links between the two research fields,** which are again located mainly between community 0 and community 11 and connect 378 publications on bioeconomy and 547 publications on social innovation.

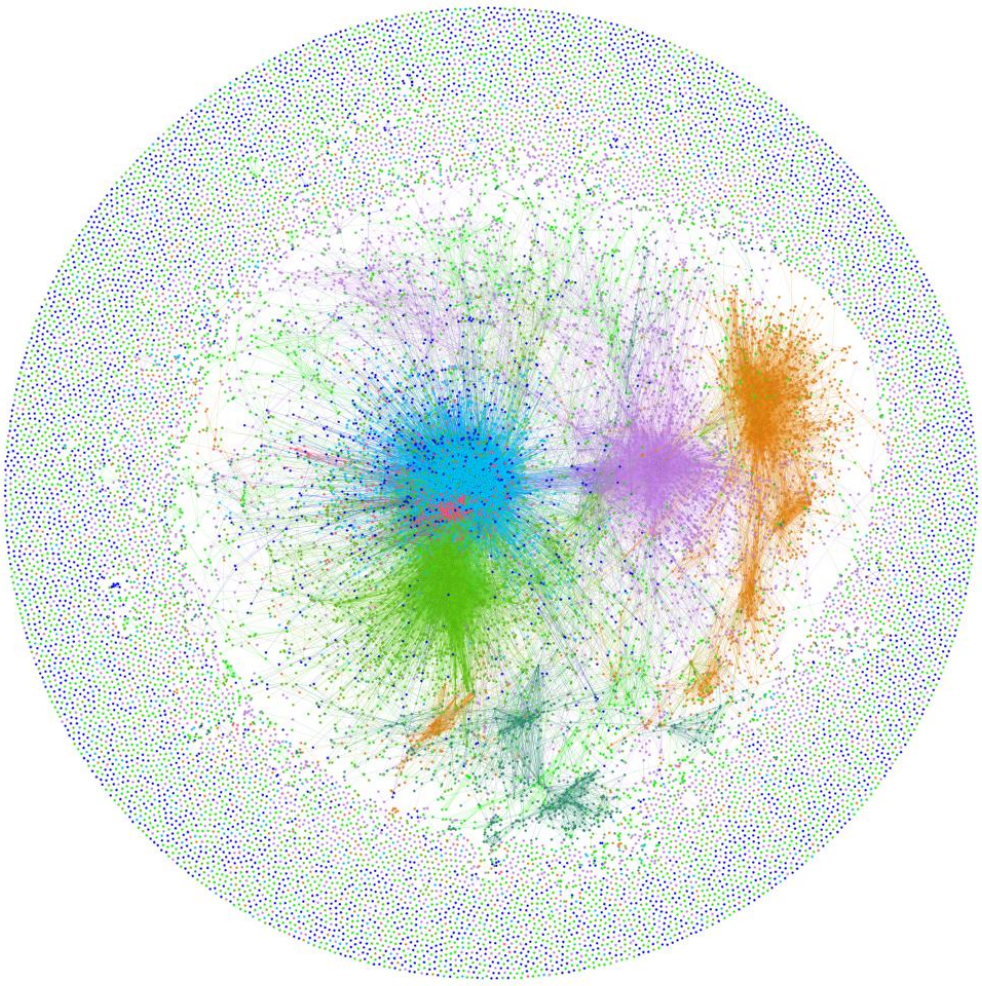


Figure 7: Bibliographic Coupling Network

Finally, to get an understanding which literature is **bridging literature on social innovation and bioeconomy**, we show in Table 3 the most common references. Here, the work by Geels (2002) on the **multilevel perspective** are strongly represented. Another central and more sustainable-related theme appears through the work of Meadows et al. (2018), and the reports by EU (2011) and the UN (2015). The work by Bocken et al. (2014), on the other hand, reveals a joint interest in potential **sustainable business models.**

Table 3: Most common references

Reference	Social Innovation	Bioeconomy
Geels (2002)	87	62
UN General Assembly (2015)	85	55
World Commission on Environment and Development (1987)	102	54
Ostrom (2015)	90	52
Geels & Schot (2007)	100	43
Hardin (1968)	39	101
Bocken et al. (2014)	56	38
Geels (2004)	37	33
European Commission (2011)	33	32
Meadows et al. (2018)	28	32

Section and the subsections shed light into most frequent keywords, common keywords, citation network analysis and analysis of bibliographic coupling between bioeconomy and social innovation. These analyses help framing the relatedness of two domains and set the starting scientific foundations of RIBES theoretical and conceptual framework, with main concepts such as **sustainability, sustainable development, climate change, technological focus (biomass, biorefinery), fisheries (bioeconomics), modelling and economics focus, social entrepreneurship and social innovation, education, governance and policy, multi-level perspective, international organisations, sustainable business models.**

3. Workshop Results: Specificities in RIBES regions

3.1 Workshop topics

From the results of the literature review it becomes apparent that there is no commonly agreed definition of the concepts of "Bioeconomy" and "Social Innovation". To allow for a bottom-up development of a shared working definition, we started the collective work on the conceptual framework with raising the following two open-ended questions to RIBES regions in the first workshop (June 13, 2024):

- What do the **concepts of 'social innovation' and 'bioeconomy'** mean in your region?
- What kind of **transformation** is most relevant for your Region and your Multi-actor Transformative Forum? (e.g. economic, ecological circular, social transformation, challenges of governance).

Different views per region emerged, not only for the two central concepts of social innovation and bioeconomy, but also regarding the challenges and most relevant transformations.

The questions raised at the second workshop (June 19th, 2024) were more concrete, asking for examples with the following questions:

- What is the dominant **bioeconomy conception** in the region?
- What **social innovations** (if any!) can be identified (especially those that contribute directly or indirectly to the regional bioeconomy)?
- What (portfolio of) **bio-based products** and supply/value chains can be identified?
- Are there specific **policy** instruments or initiatives in your region?

The questions raised at the workshop on 4th July 2024 concerned the ecosystem, namely:

- How active or inactive are the **sectors** in your region in the case of bioeconomy?
- Are there specific **barriers, needs, linkages**?

The answers on these questions also clearly differed per region. For example on the active stakeholders in the concerning regions (Table 4)

Table 4: Active/Inactive Sectors/Stakeholders in RIBES Regions

Region	*Public Sector (e.g. governmental, ministry, municipality, agency, etc.)*	*Private Sector (e.g. incumbent firms, startups, banks, investors, etc.)*	*University (e.g. knowledge institutes, research centers, labs, education centers, etc.)*	*Social Sector (e.g. CSOs, NGOs, Advocacy Groups, Social Entrepreneurs, etc.)*	*Other (e.g. independent consultants, experts, intermediary, individual, etc.)*
Western Balkans	0	+	+	++	++
North Aegean	--	+	++	+	--
Panno-nian	+	+	++	+	+
Central Region Romania	+	+	++	+	+
Podkar-packie	++	+++	+	+	++
Vojvodina	+	+++	+	++	++
Nitra	++	++	++	+	0
Campania	+	++	+++	++	+
Plovdiv	+	++	++	+	0
Carpa-thian	**+**	**0**	**++**	**+**	**++**

Note: Present/Active (+, ++, +++), Neutral (0), Passive/Absent (-, --, ---)

3.2 Summary per RIBES region

Based on the input from the workshops brief summaries are provided per region.

- **Nitra Region, Slovakia**

The Nitra region has a strong agricultural tradition, but the bioeconomy is evolving to integrate digitalization and technological advancements. The focus is on knowledge-sharing and training young entrepreneurs in innovative farming techniques, such as vertical and indoor farming. Social innovation in the region includes integrating marginalized groups into labor-intensive agricultural sectors. A combination of traditional farming methods and advanced technological solutions is being explored to ensure sustainability and resilience in the agricultural sector.

Relevant Transformation: Leveraging investments to support circular bioeconomy development while ensuring digitalization does not lead to job losses. Incorporating precision agriculture and smart farming techniques.

Biobased Products and Value Chains: High-value crops such as saffron; biochar production from biowaste; organic fertilizers; food processing byproducts repurposed for animal feed.

Policy Initiatives: National bioeconomy roadmap under development; RIS3 domain Healthy Food and Environment; investment in digital agriculture.

Strong Actors: Slovak University of Agriculture, Bioeconomy Cluster, Ministry of Agriculture, local start-ups.

Active Sectors: Agriculture, renewable energy, waste management, biotechnology.

Barriers: Lack of private investments and awareness of bioeconomy potential; bureaucratic challenges in obtaining funding.

Needs: Education and training, policy frameworks, financial incentives, improved infrastructure.

Linkages: Strengthening R&D collaborations between academia and industries; fostering partnerships with European bioeconomy initiatives; improved knowledge exchange between farmers and tech developers.

- **North Aegean Region, Greece**

This insular region remains only partially affected by tourism compared to other Greek islands. Social entrepreneurship is underdeveloped, but new initiatives are emerging, particularly in intangible cultural/ heritage and food-related innovations. The region's bioeconomy is primarily focused on small-scale farming, and the University of the Aegean has been instrumental in advancing circular bioeconomy research. Sustainable tourism and agroecology have also gained importance in recent years.

Relevant Transformation: Strengthening governance frameworks and fostering collective entrepreneurial action to support sustainable food entrepreneurship.

Biobased Products and Value Chains: Olive oil, essential oils from oregano waste, biogas from olive mill waste, seed-to-table agribusiness models.

Policy Initiatives: No dedicated policy framework; the University of the Aegean is leading bioeconomy discussions; ongoing research projects in sustainable food systems.

Strong Actors: University of the Aegean, agricultural cooperatives, Terra Nativa initiative.

Active Sectors: Agriculture, food processing, waste valorization, eco-tourism, agroecology.

Barriers: Lack of regional governance for innovation, small-scale production constraints, high logistics costs due to island geography.

Needs: Entrepreneurial education, funding, business model innovation, better access to distribution networks.

Linkages: Expanding cooperation between academia, industry, and cooperatives; integrating food production with tourism experiences; fostering local networks to increase resilience.

- **Campania Region, Italy**

Campania has significant potential in the bioeconomy due to its strong agricultural base. The region aims to integrate technological advancements with industrial sectors to develop sustainable agricultural practices and bio-based products. Social innovation plays a key role in combating environmental degradation caused by organized crime (ecomafia). Food and beverage industries, alongside marine bioeconomy, are also developing rapidly.

Relevant Transformation: Circular economic principles applied to waste management and sustainable food production. Strengthening environmental regulations to combat illegal activities harming ecosystems.

Biobased Products and Value Chains: Agri-food, bioplastics, marine biotechnology, organic fertilizers, nutraceuticals, sustainable fisheries.

Policy Initiatives: Campania RIS3 Strategy, acceleration programs, national bioeconomy strategy, local government initiatives to support SMEs.

Strong Actors: Universities, Terra Next incubator, local cooperatives, innovation hubs.

Active Sectors: Agriculture, food processing, environmental protection, marine biotechnology, sustainable fisheries.

Barriers: High competition from fossil-based industries, underdeveloped infrastructure, regulatory complexity, organized crime interference.

Needs: Private sector investment, incentives for bio-based startups, improved waste management systems, stronger enforcement of environmental policies.

Linkages: Public-private partnerships for biobased technology scaling; cross-border collaborations with Mediterranean regions.

- **Pannonian Region, Croatia**

The Pannonian bioeconomy is centered on agriculture and forestry, with a focus on renewable biological resources for food, feed, and bioenergy. The region is advancing innovative agricultural practices like precision farming and organic agriculture. Social innovation efforts include cooperative farming models, rural development projects, and digitalization of agriculture. There is a strong focus on soil preservation and biodiversity.

Relevant Transformation: Transitioning to more sustainable agricultural practices that enhance productivity and protect natural resources.

Biobased Products and Value Chains: Biomass pellets, biofuels, bio-based plastics, essential oils, organic and specialty foods, regenerative agriculture initiatives.

Policy Initiatives: National Rural Development Program, Croatian Bioeconomy Strategy (draft), EU-funded programs.

Strong Actors: Universities, cooperative networks, government agencies, regenerative farming alliances.

Active Sectors: Agriculture, forestry, bioenergy, food processing, sustainable land management.

Barriers: Limited infrastructure, funding constraints, outdated regulatory frameworks, lack of consumer awareness of sustainable products.

Needs: Increased funding for research, better waste management policies, market development, education programs on sustainable agriculture.

Linkages: Expanding collaboration between research institutions, industry, and policymakers; developing educational networks on regenerative farming practices.

- **Vojvodina Region, Serbia**

Vojvodina has a strong agricultural foundation and is increasingly exploring bioeconomy innovations. The region seeks to enhance rural development through sustainable agriculture and participatory decision-making. Social innovation in Vojvodina is seen as a means to mobilize relevant stakeholders and address socio-economic challenges. The bioeconomy here revolves around biomass production, with a strong emphasis on agriculture, food production, and renewable energy. Sustainable agricultural practices and the production of "healthy food" are focal points. A significant transformation involves utilizing agricultural byproducts and integrating marginalized rural populations into sustainable economic activities.

Relevant Transformation: Supporting sustainable agriculture and rural development through participatory decision-making and value chain mobilization.

Biobased Products and Value Chains: Healthy food production, biofuels, and organic fertilizers.

Policy Initiatives: National bioeconomy initiatives and integration into sustainable development goals.

Strong Actors: Universities, agricultural cooperatives, Ministry of Environmental Protection.

Active Sectors: Agriculture, food and beverage production, renewable energy.

Barriers: Lack of financial incentives, low awareness of bioeconomy practices.

Needs: Improved funding mechanisms, better collaboration between government and industry.

Linkages: Encouraging cross-border bioeconomy collaborations with EU partners.

- **Plovdiv Region, Bulgaria**

Plovdiv has a well-established agricultural sector with strong traditions in food production and winemaking. However, social entrepreneurship is underdeveloped. Initiatives exist to employ marginalized groups in agribusiness and tourism, but they require better coordination and educational support. Bioeconomy is largely unknown among rural populations, though the Agricultural University of Plovdiv is actively promoting circular bioeconomy principles. Future efforts should focus on expanding biorefineries and valorizing agricultural waste for bioenergy and bioproducts.

Relevant Transformation: Developing sustainable bio-based business models for SMEs and fostering investments in circular economy practices.

Biobased Products and Value Chains: Agri-food production, winemaking, organic waste recycling, bioenergy solutions.

Policy Initiatives: Regional Innovation Strategy, National Bioeconomy Integration Plan.

Strong Actors: Agricultural University of Plovdiv, municipal authorities, regional business clusters.

Active Sectors: Agriculture, food production, renewable energy.

Barriers: Lack of awareness and investment in bio-based technologies.

Needs: Business development support, training programs, access to financing.

Linkages: Enhancing collaboration between research institutions, local enterprises, and policymakers.

- **Western Balkans**

This region is leveraging agricultural biodiversity to tackle unemployment, migration, and environmental sustainability. Social innovation initiatives focus on agro-tourism and circular economy practices to create job opportunities and enhance environmental resilience. Bioeconomy is rooted in biomass production, with an emphasis on biogas, biodegradable materials, and renewable energy solutions. Policy and legislative reforms are necessary to facilitate broader adoption of bioeconomic practices.

Relevant Transformation: Strengthening policy frameworks to support social innovation and bioeconomy development.

Biobased Products and Value Chains: Biogas, biofuels, biodegradable materials, forestry-based bio-products.

Policy Initiatives: Green Agenda for the Western Balkans, EU-backed sustainability programs.

Strong Actors: Regional development networks, international partnerships, policy-making bodies.

Active Sectors: Agriculture, forestry, renewable energy.

Barriers: Fragmented regulations, limited investment in bioeconomy initiatives.

Needs: Capacity building, harmonized policy frameworks, cross-border collaboration.

Linkages: Strengthening regional cooperation and integration into European bioeconomy frameworks.

- **Central Romania, Sibiu county, Romania**

Sibiu is focusing on integrating circular bioeconomy approaches to support environmental sustainability, healthy food production, and rural revitalization. The bioeconomy is linked to biotechnological advancements and industrial applications, where waste products are repurposed into new bio-based solutions. The region emphasizes the need for governance support, legal frameworks, and financial incentives to make bio-based innovations economically viable. Moreover, as Sibiu County is covered for more than 52% with protected areas, it is focusing on finding solutions to integrate bio-based solutions with nature based – solutions and natural landscape preservation.

Relevant Transformation: Integrating circular bioeconomy approaches into the "One Health" concept, enhancing environmental health, food security, rural economy, and natural landscape preservation..

Biobased Products and Value Chains: Biotechnological innovations in agriculture, food processing waste valorization, organic fertilizers, biorefineries.

Policy Initiatives: National Strategy for Circular Economy, European partnerships for sustainability.

Strong Actors: Lucian Blaga University of Sibiu, regional government, local agricultural enterprises.

Active Sectors: Biotechnology, agriculture, environmental management.

Barriers: Limited infrastructure, high investment costs for bio-based technologies, and over 52% protected areas.

Needs: Financial incentives, improved governance structures, technology transfer initiatives.

Linkages: Strengthening cooperation with European research and industry networks.

- **Carpathian Region, Ukraine**

The Carpathian region is rich in natural resources and has significant potential for developing its bioeconomy, mostly based on forest and non-timber forest resources, and less on agriculture. The region is working to integrate bio-based innovations to strengthen sustainability and economic development. Existing initiatives are limited, and there is a strong need for policy frameworks and financial support to drive transformation. The bioeconomy here could benefit from sustainable forestry practices, biomass production, and integration with local agricultural systems. Social innovation efforts could prioritize stakeholder engagement and cross-sector collaboration.

Relevant Transformation: Strengthening forestry and agricultural bioeconomy sectors with a focus on innovations, sustainability and job creation.

Biobased Products and Value Chains: Timber, non-timber forest resources, timber harvesting residues, biomass-based energy solutions, Small-scale agriculture farming, agricultural residues, eco-tourism-related bio-based products.

Policy Initiatives: National forestry and bioeconomy strategies, cooperation with European initiatives.

Strong Actors: government agencies, associations, research and academia actors, business support agencies, and environmental NGOs.

Active Sectors: Forestry, wood processing, bioenergy, eco-tourism, beekeeping.

Barriers: Outdated infrastructure, political and economic instability affecting investments, lack of financial incentives and mechanisms to support business development, a priority of war and country defence-related issues over development issues.

Needs: Policy harmonization with European standards, financial investment, capacity building, awareness raising, education, and training.

Linkages: Enhancing cooperation with EU bioeconomy networks and sustainable forestry initiatives, enhancing national linkages, information and knowledge exchange of business with applied research, development, and innovation actors, as well as business support sectors.

- **Podkarpackie Region, Poland**

Podkarpackie is a dynamically developing region with strong potential for integrating bioeconomy principles into its existing industrial and agricultural sectors. The region has a history of forestry and agricultural production, creating opportunities for sustainable bio-based industries. Innovation in biodegradable packaging and renewable materials is also a focus. Agricultural production is carried out based on small, family-run farms, which helps preserve biodiversity (low intensity of monocultural production, e.g., corn, support programs such as the Podkarpacki Regional Grazing initiative, funded by the budget of the Podkarpackie Voivodeship Marshal's Office).

Relevant Transformation: Strengthening industrial bioeconomy applications, leveraging forestry and agricultural waste for bio-based solutions, and advancing eco-friendly manufacturing processes and environmentally friendly (without eco certification), reducing the carbon footprint and greenhouse gas emissions (NO_2, NH_3), as well as conserving water resources in production processes.

Biobased Products and Value Chains: Biogas, biofuels, wood pellets, biodegradable packaging, organic fertilizers from agricultural waste, renewable construction materials, low-impact (traditional) agricultural production.

Policy Initiatives: Regional Development Strategy promoting circular bioeconomy, integration into Poland's national sustainability programs, and participation in EU-funded initiatives.

Strong Actors: University of Rzeszów, Rzeszów University of Technology, regional agricultural cooperatives, Polish Biomass Chamber, Podkarpackie Agricultural Advisory Center, Marshal's Office, local clean-tech startups.

Active Sectors: Agriculture, forestry, renewable energy, advanced manufacturing, clean-tech, natural environment – tourism, wood industry.

Barriers: Limited financial incentives for sustainable practices, underdeveloped waste valorization infrastructure, high competition from conventional industries, slow regulatory adaptation, lack of a platform for collecting and moderating development ideas and initiatives, a traditionalist approach to innovation (lack of trust in trends promoting the bioeconomy), and conservatism in the views of both society and decision-makers (hence, for example, issues with the location of biogas plants).

Needs: Increased funding for green innovation, better policy alignment with EU bioeconomy strategies, enhanced education and training programs, faster permit processes, creating a database on the potential, needs, and possibilities for applying innovations in the bioeconomy, also selecting and supporting the most interesting and effective solutions, and identifying direct relationships between a clean environment (tourism, agricultural, and related sectors) and the circular economy.

Linkages: Expanding cross-sector partnerships, facilitating knowledge exchange between academia, industry, and government to scale bio-based solutions, developing regional incubators for green businesses, promoting solutions that implement elements of the circular economy (including financial aspects), as well as scientific and research initiatives.

3.3 Validation of concepts and conceptual statements

At the RIBES inter-MTF meeting on 1 October 2024 participants were asked to indicate their agreement with the 15 statements below using a likert scale. The lack of agreement that is apparent in scientific literature also emerged among the RIBES regions. The meaning of these concepts differs for participants of the different regions. Taking the average of the likert scores does not solve the lack of agreement, but we highlight some statements with an average score of 6, and we label this as 'average agreement' (bold in the below table).

For social innovation there is on 'average agreement' on two definitions. Statement 8: 'Social innovation is defined as creating new configurations in value chains through collaboration between different stakeholders', is close to the practice of RIBES and can be regarded as an example of social innovation in the bioeconomy. The more general definition (nr. 12) is from (Caulier-Grice et al., 2012); without text between brackets: *"Social innovations are new solutions that simultaneously meet a social need and lead to new or improved capabilities and relationships and better use of assets and resources"*. It builds on an earlier definition (Murray, Caulier-Grice & Mulgan 2010, p.3) stressing that the innovations are social both in their means and end.

For bioeconomy we are lacking agreement on a working definition. There are three statements on bioeconomy with average agreement (Table 5):

- A bioeconomy is circular;
- We need a bioeconomy to face environmental challenges;
- A sustainable bioeconomy involves new combinations of environmental-, economic- and social-resources.

We feel that these three statements are not enough as elements for constructing a joint working definition. Further co-designing efforts will be made at the next project meeting or inter-MTF meeting.

Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree
1	2	3	4	5	6	7

Table 5: Bioeconomy statements and the level of agreement by RIBES Regions

		Level of agreement
Bioeconomy		
1)	A bioeconomy is the use of biological resources, particularly biomass from agriculture, & forestry for producing food, beverages, bio-based products, and renewable energy.	Average= 4.9 3 3 4 4 4 5 6 6 6 6 7
2)	**A bioeconomy is circular.**	**Average=6.4** 2 3 3 7 7 7 7 7 7 7 7

3)	A bioeconomy is an economy that is based on the application of biotechnologies.	Average=4.8 2 3 3 5 5 5 5 5 6 7 7
4)	A bioeconomy is a fundamentally new way how economic systems are organized.	Average 4.9 3 3 4 5 5 5 6 6 6 6
5)	We need a bioeconomy to face economic challenges.	Average 5.4 4 4 5 5 5 6 6 6 6 6 6
6)	We need a bioeconomy to face social challenges.	Average 5.5 4 4 5 6 6 6 6 6 6 6 6
7)	**We need a bioeconomy to face environmental challenges.**	**Average 6.2** 5 5 6 6 6 6 6 7 7 7 7
Social innovation		
8)	**Social innovation is defined as creating new configurations in value chains through collaboration between different stakeholders.**	**Average 6.1** 6 6 6 6 6 6 6 6 6 7
9)	Social innovation involves integrating cultural dimensions, promoting of community development, cultural preservation, and civil society.	Average=5.8 5 5 6 6 6 6 6 6 6 6
10)	Social innovation is about addressing specific local challenges through new, collaborative approaches, often leveraging existing cultural and economic structures to improve societal well-being.	Average=5.6 4 5 5 5 6 6 6 6 6 7
11)	Social Innovation is the generation and implementation of new ideas about social relationships and social organization.	Average=5.5 5 5 5 5 5 6 6 6 6 6
12)	**Social innovations are new solutions (products, services, models, markets, processes, etc.) that simultaneously meet a social need (more effectively than existing solutions) and lead to new or improved capabilities and relationships and better use of assets and resources.**	**Average 6.5** 5 5 6 7 7 7 7 7 7 7
Social innovation for the bioeconomy		
13)	For a successful transformation towards a bioeconomy we need new technological innovations.	Average=5.4 4 4 5 5 5 6 6 6 6 6 7

14)	**A sustainable bioeconomy involves new combinations of environmental-, economic- and social- resources.**	**Average=6.1** 5 5 6 6 6 6 6 6 7 7 7
15)	For a successful transformation towards a bioeconomy we need social innovation.	Average=5.8 5 5 5 5 6 6 6 6 6 6 7

4. Conceptual Framework: Social innovation for transitioning the bioeconomy towards sustainable rural development

4.1 Introduction

In this section we propose an initial framework that collects and structures insights from literature that meets the needs of the RIBES project and supports its implementation. The main topic to explore is about the role of social innovation for transitioning the bioeconomy towards sustainable rural development. The initial framework of insights will support the implementation of following tasks, such as the case studies (T2.4).

We highlight in 4.2 a few results of the previous sections which guide us in the search for relevant literature. Especially the workshops with regional participants served as an **inclusive and participatory process of developing a conceptual framework** that is relevant for our RIBES project and regions. As such, we are not defining a top-down formal theory which will be tested, but a more flexible, explorative, and loose framework of appreciated insights and conceptual elements from the literature that respond to the discussions among workshop participants. As Kemp (2024) notes: *"the literature on transformations is diverse, lacking coherence, and necessitating better theorisation and cross-fertilisation."* With inputs from various strands of literature, we develop an initial structure of insights which seem relevant for our applied research in the RIBES project and regions. By doing this, we may contribute to what is lacking in literature: **transdisciplinary knowledge co-creation with local stakeholders** which is open to local knowledge. The framework, thus, will be refined and mature during the RIBES project. Finalising the framework will be done towards the end of the project in a synthesis report (D2.5 Comprehensive RIBES framework: Synthesis report) by integrating and confronting the insights following the empirical Tasks, 2.2 to 2.5 and the associated activities in other work packages.

In the next section (paragraph 4.2) we discuss a number of results from the literature review and the workshops which will form the branches of the evolving framework.

4.2 Results of section 2 and 3: branches of the framework

One of the interesting findings from the bibliometric analysis (Section 2) is that there are limited scientific publications that address both concepts of bioeconomy and social innovation, but the most important common keywords are sustainability and sustainable development, suggesting this could be their common outcome. Moreover, there is a potential for interactions, such as via circular economy, and potentially digital economy. These results make our research a more explorative search for possible **roles that social innovation could have for transitioning the bioeconomy towards sustainable rural development**, and how these processes and interactions may evolve.

Secondly, we have learned from the bibliometric analysis that a main conceptual framework that is referred to in the literature that covers both bioeconomy and social innovation is the **Multi-Level Perspective** on sustainability transitions developed by Geels (2002) in which socio-technical systems are based on a sociological perception on technology, in which technology itself "has no power, does nothing. Only in association with human agency, social structures and organisations does technology fulfil functions." (Geels 2002, p. 1257). This paper which presents the MLP framework, we take as our starting point for setting up the initial conceptual framework (Section 4.3).

Thirdly, in transitional socio-technical systems, **technology and society co-evolve**, but ecology is not specifically included. Regarding the transitioning of the bioeconomy, various material and immaterial ecological aspects matter for transitioning to a more sustainable bioeconomy: ecological assets such as soil, and climate, available biomass, behavioural norms of farmers and customers, and values regarding **environmental and ecological objectives**, e.g. biodiversity. This call for a framework that includes environmental resources is supported by the RIBES project participants as they overall agree that a sustainable bioeconomy involves new combinations of environmental-, economic- and social-resources. Possibilities to **create multiple value, rather than merely aiming to reveal a single value** (e.g. in terms of either profit, people, or planet) do exist, since with the ambitions of new social business and governance models, synergies between social economy and bioeconomy emerge. In section 4.4 we therefore bring the ecological system into the framework.

Fourth, we learned from the workshops with RIBES partners from the 10 rural regions that the situation in **the RIBES regions differ in many ways**, e.g. in terms of transformative needs, bioeconomy value chains, and eco-system characteristics. As Coenen et al. (2012) state the spatial perspective on sustainability transitions have often been neglected, however it has recently been taken up in mainstream regional innovation policy[1] in Europe. **A place-based perspective in innovation and transition towards sustainability** therefore seems very relevant, and this direction in our search for relevant conceptual framework elements is in line with EU regional policy. In section 4.5 we therefore propose to adopt such a place-based perspective.

Fifth, regarding **social innovation** we have seen that the literature does not provide one consolidated definition. The participatory workshops revealed that it also has a different meaning in the RIBES regions involved, but there is an overall agreement that social innovation is needed for a successful transformation of the bioeconomy in the RIBES regions. Thus, this finding steers our conceptual framework towards including **a broad and multi-level view on social innovation** (e.g. beyond serving marginalised people), but also to adopt a view on social innovation and social entrepreneurship that can transform regional bio-economies towards sustainable development. Such a **transformative social**

[1] https://place-based-innovation.ec.europa.eu/index_en; https://publications.jrc.ec.europa.eu/repository/handle/JRC135826

innovation concept has specific attention to **agency in social innovation**, and its role in **institutional change** and **emergence of new organisations and value chains**. This branch of the framework is discussed in section 4.6.

Finally, the final framework should provide insights towards **co-designing of bioeconomy value chains** and serve to better monitoring, evaluation and **assessment** of sustainable rural development in RIBES regions. A selection of relevant literature for this branch of the framework is discussed in section 4.7

4.3 The multi-level perspective on socio-technical transitions to sustainability

In the growing sustainability transitions literature of the past two decades (Köhler et al. 2019), the socio-technical systems approach has been very influential. This **multi-level perspective (Geels 2002)** has also been identified as the number 1 common reference between bioeconomy literature and social innovation literature (See Section 2). This suggests that the multilevel perspective as presented in Geels (2002) would be a good **starting-point** for our framework. In this paragraph we critically discuss the multi-level perspective and validate which aspects are useful or what is lacking for our purposes in RIBES.

The multi-level perspective on socio-technical transition to sustainability is an evolutionary framework which has become more relevant over the years, since innovation and innovation policy no longer are only aimed at economic outcomes, but also at addressing a wider range of sustainability and societal challenges. Traditional research and innovation (R&I) policies were based on market failures. A later frame of innovation policy was in the national, regional and sectoral systems of innovation with system failure rationales (Woolthuis et al., 2005). The innovation systems literature emphasized the interaction between multiple actors in a system, but the focus was mostly on interactions between just two types of actors: science and industry. Schot & Steinmuller (2018) refer to a third framing: innovation for transformative change (next to the R&D framing, and the system of innovations frame). Weber & Rohracher (2012) support the mainstreaming of the MPL framework by describing the innovation policy rationale for this third frame as addressing transformational failures.

The highly cited paper of Geels (2002) elaborates on the multi-level perspective of which the basis was developed by Kemp (1994) and Rip & Kemp (1998). The technological regime as described by Nelson and Winter (1984) was based on the cognitive routines of engineers. Because engineers search for solutions in the same direction, cognitive routines go in a shared direction: technological regimes and trajectories develop. Rip and Kemp (1998) have widened the concept of technological regime:

"A technological regime is the rule-set or grammar embedded in a complex of engineering practices, production process technologies, product characteristics, skills and procedures, ways of handling relevant artefacts and persons, ways of defining problems; all of them embedded in institutions and infrastructures" (Rip and Kemp, 1998, p. 340).

This broader configuration of technological regimes also includes the routines and practices of other actors, but also material infrastructures. Referring to the embedded rule-set is a more sociological approach. Dopfer et al. (2004) also refer to rules in a broad sense, as evolutionary economic agents

are rule making and using animals, and they refer to systems as broad meso-level complexity of rules and rule structures.

The stability of established sociotechnical regimes comes from the interactions between heterogeneous actors (Figure 8) and other elements of the dominant, mainstream configuration. Many kinds of interdependencies and lock-ins are keeping everything in place. This is why the innovation systems literature is sometimes regarded as lacking a dynamic perspective. Radical innovations emerge in niches. In socio-technical regimes there is only incremental innovation. In landscapes, at the macro-level, only slow changes occur.

Geels (2004) explains where a sectoral system of innovation (Malerba 2004) was lacking, and where a socio-technical system can contribute. We briefly discuss these **contributions**.

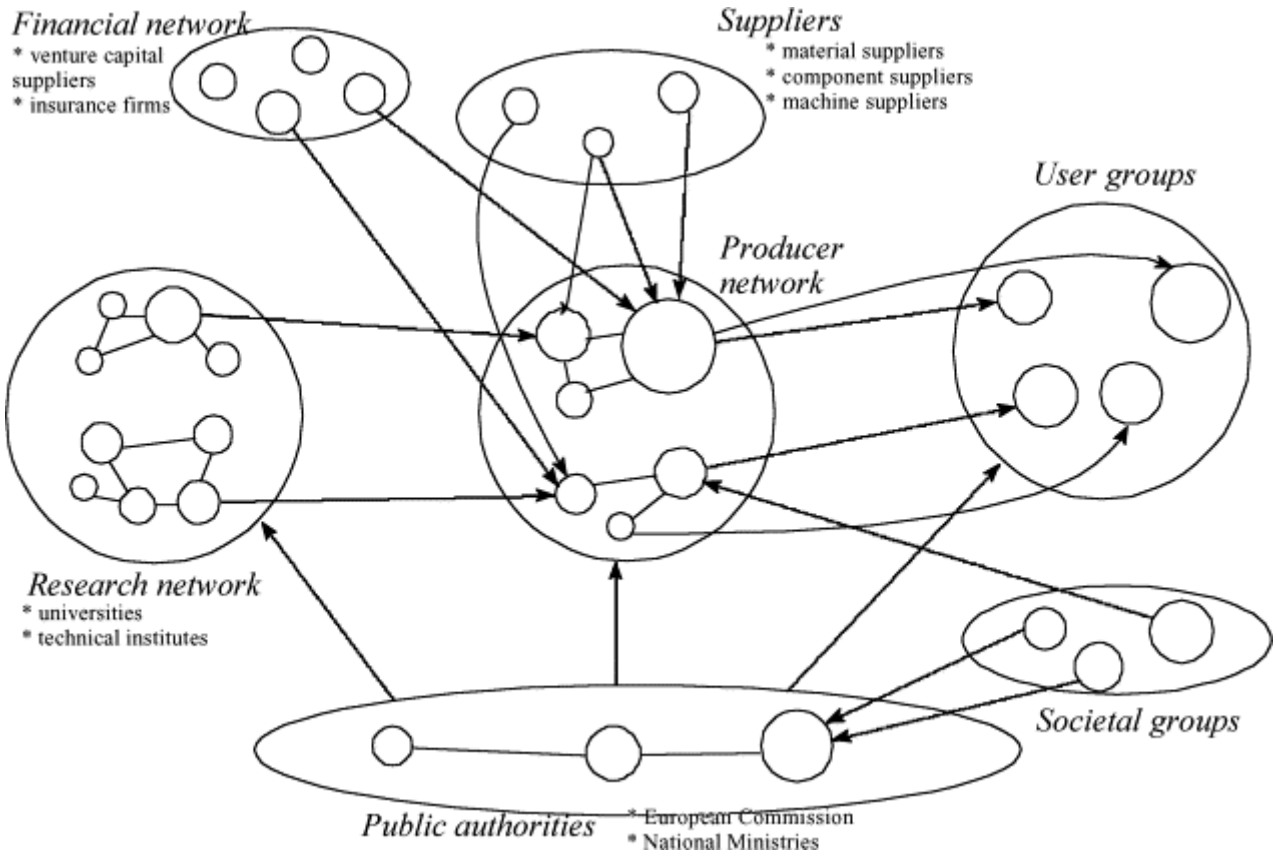


Figure 8: The multi-actor network involved in sociotechnical regimes

Source: Geels (2002, p.1260)

The first contribution is to **incorporate the user side** in the definition of systems. Whereas in innovation systems literature this aspect is rather limited, namely, to for instance firms as users and producers in the supply chain (Lundvall et al. 1988). It is important to include a wider set of actors on both the innovation supply-side and innovation demand-side, including end-users and societal groups (see Figure 8) so it becomes a socio-technical system. It also makes it a less simple system, a more complex system (Pyka et al. 2022).

Technology only becomes an innovation, only has meaning, value and impact for society, when it is used. Of major relevance is the implication that this framework becomes relevant to address functions of the system (reference is made to societal functions such as transport and housing), and therefore not only appropriate to address economic, but also other societal challenges. Since both social innovation and the bioeconomy has a role in multiple societal functions, it is not clear how to define the socio-technical system boundaries. We note that the socio-side of the socio-technical systems is still mostly seen as the consumer-side, representing the selection function, the use of artefacts; whereas the technology side is seen as the side that generates technological variety and radical changes in technology. In case we apply it to the bioeconomy, the relevant socio-technical systems and societal functions, could be e.g. food-system and energy system. In the traditional sectoral view, the producers in the bioeconomy would be representing the technology supply-side, while the socio-side would in a traditional sector-view be limited to consumers; linked to producers via market relations. Social innovation might be located on the user-side, e.g. in the case of a social movement among local customers that call for certain innovative food products, but social enterprise may also be located on the innovation supply-side, and for instance used by local farmers as a service. For questioning the role of social innovation and social enterprise in transforming the bioeconomy towards sustainability the socio-side also needs to be seen as generating variety and radical changes, and social enterprise might be located at the (non-technological) innovation-supply-side. Does social innovation empower and have a transformative potential? (See 4.6)

The second contribution according to Geels (2004) is the distinction between systems (material, technological artefacts, supply-chains and infrastructure), actors involved in building and maintaining the system, and the institutions which guide actor's perceptions and activities. In the national and regional systems of innovation literature (Freeman 1995; Cooke et al. 1997) the material aspect of technology is not included. Nature and ecological aspects are not directly included in the MLP framework since landscape pressures only cover exogenous/external effects (We address this inclusion in 4.4).

The third contribution mentioned by Geels (2004) is that it: *"opens up the black box of institutions, making them an integral part of the analysis" (*p.905). To avoid confusion between institutions and organisations Geels (2004) looks at rule-like institutions because they also coordinate and structure activities. Institutions that mediate between human activities and nature/ecology may call for more specific attention. But the distinction that Geels (2004) makes (based on Scott 1995, p. 35 and 52) between **regulative rules/institutions**, and normative and cognitive, seems very relevant, as they provide stability to the system and barriers to transformation, but they also can be drivers of change. Regulative include: formal rules, laws, sanctions, incentive structures, governance systems, power systems, protocols, standards, procedures. **Normative rules/institutions** include: values, norms, role expectation, authority systems, duty, codes of conduct. With sustainability as goal, the normative has to be taken more seriously (Schlaile 2017). **Cognitive rules/institutions** include: priorities, problem agendas, beliefs, bodies of knowledge (paradigms), models of reality, categories, classifications, jargon/language, search heuristics (Geels 2004, p. 905). The cognitive version was according to Fagerberg (2003) also referred to by Schumpeter regarding the resistance to new ideas, since: *"knowledge and habit once acquired becomes as firmly rooted in ourselves as a railway embankment in the earth […] becomes automatic"* (Schumpeter 1934, p.84). Moreover, knowledge is not a pure public good but rather something individual, local, tacit, firm specific and complex (Müller & Pyka 2022).

Adapting the MLP framework to the bioeconomy could call for adding socio-ecological systems into the dimensions (Figure 9), or **as a separate yet interacting regime** (Figure 10).

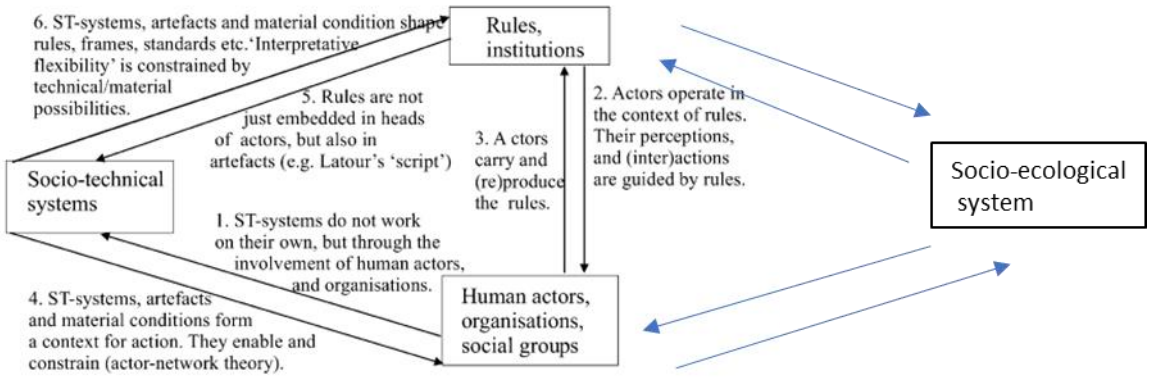


Figure 9: Interrelated analytic dimensions (Geels 2004), socio-ecological system inclusion

Source: Geels (2004); our adaptation: socio-ecological system added

The socio-ecological system enables and constrains action, and societal actions change the ecological system. The rules, norms and knowledge regarding the relation with physical nature in the region seems very relevant.

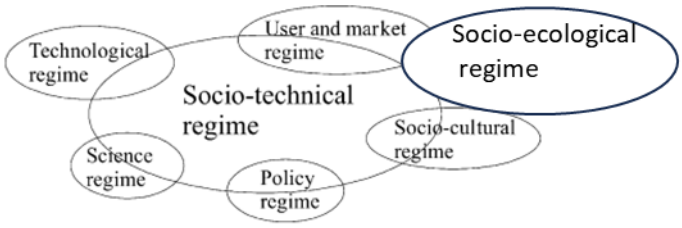


Figure 10: Meta-coordination through socio-technical regimes

Source: Geels (2004); our adaptation: socio-ecological regime added

As Geels (2004) writes "Institutions should not just be used to explain inertia and stability. They can also be used to conceptualise the dynamic interplay between actors and structures". But not only to conceptualise the dynamics at the regime level, but also at the niche level. Therefore, we emphasise the possibility of social innovation as transformative agency and institutional entrepreneurship (See 4.6).

The fourth contribution of the multi-level perspective on socio-technological systems according to Geels (2004) is to address issues of change from one system to another. The perspective is said to be relevant to analyse how shifts from one socio-technical system to another evolves as co-evolution of technology and society. For our purposes, we note that an ecological transition is however not specifically included. Social innovation is also not specifically included, but maybe there is no need to specify the location of social enterprises and social innovation on either the innovation supply- or

innovation demand-side, as it could be on both sides (and serve in generating innovation variety, as well as in innovation selection by beneficiaries).

Social innovation may be empowering in the form of co-designing value chains with other stakeholders, bridging systems, creating crossovers and linkages between previously unrelated actors, knowledge bases and sub-systems. Learning in transformation processes is served by monitoring and assessing sustainability, e.g. with Life Cycle Assessment. (See section 4.7)

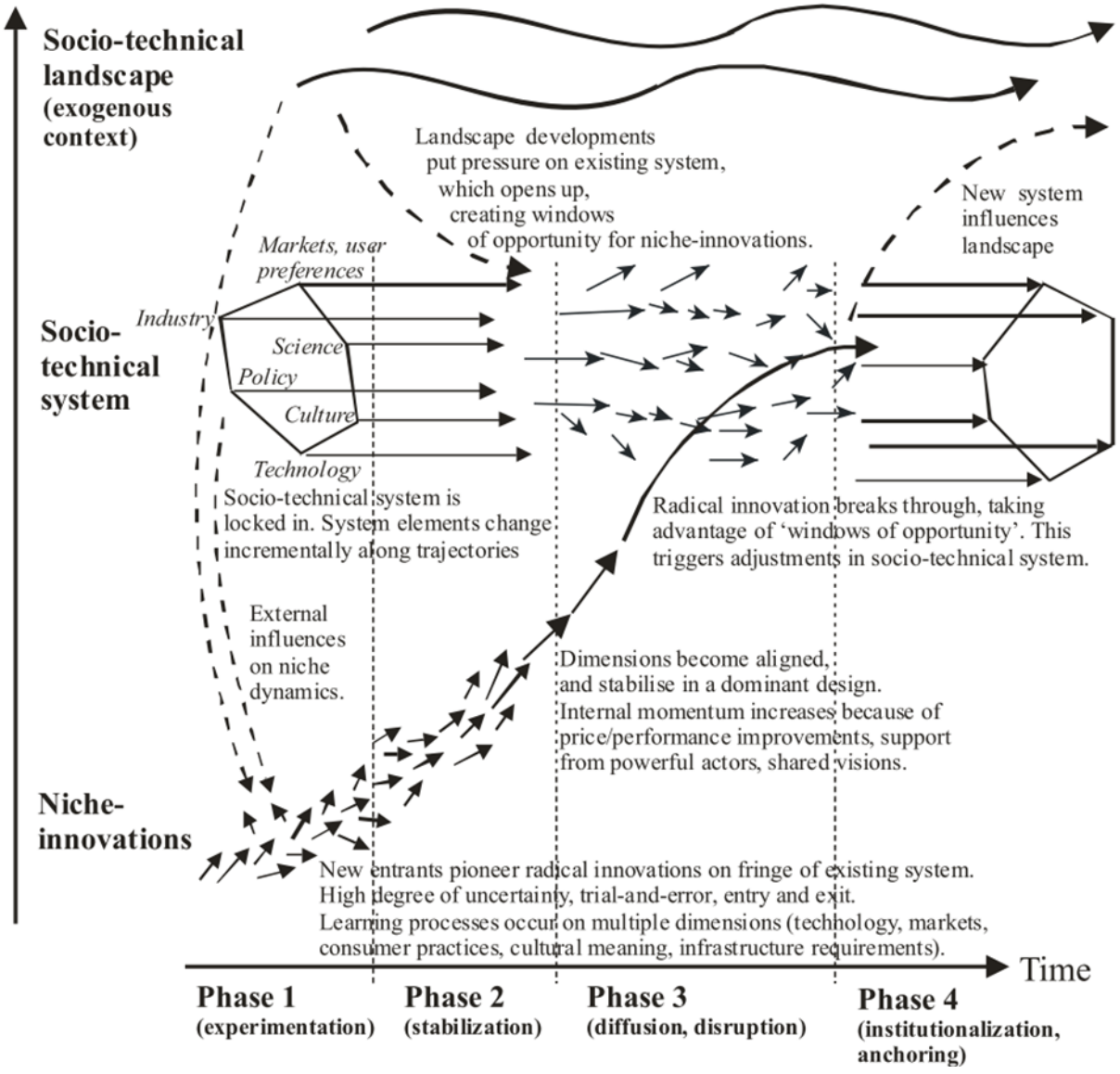


Figure 11 Multi-level perspective on socio-technical transitions

Source: Geels 2024, p.5 (substantially adapted from Geels, 2002).

The above scheme is taken from a recent (Geels 2024), revised version of the scheme from 2002. The 4 phases mentioned at the bottom of the scheme, are: **1: experimentation, 2: stabilization, 3: diffusion, disruption, and 4: institutionalization, anchoring.** Each of these phases is relevant for analysing bioeconomy innovation and social innovation. Tomai, Papachristos & Ramani (2024) point for instance at "niche innovations and experiments that are often non-technological".

Hekkert et al. (2007) also want to identify sources of dynamism in innovation systems (e.g. Carlsson & Stankiewicz 1991) and do this by analysing several co-evolving system functions or processes, namely: entrepreneurial activities; knowledge development; knowledge diffusion through networks; guidance of the search; market formation; resources mobilization; creation of legitimacy/counteract resistance to change. It is a helpful recommendation to gain insights in these processes. However, as Weber and Rohracher (2012) state, it seems fit for a specific technological change, while for our purposes a broader framework is needed. With the processes: 'guidance of the search' and 'creation of legitimacy', Hekkert et al. (2007) had a function in coming to a **transformative view on innovation policy and governance**. Weber & Rohracher (2012) aimed and succeeded in promoting the MLP model on sustainable transitioning and legitimize its use by complementing the old mainstream innovation policy rationale (of market-failure and system-failure based on the innovation systems literature) with the new, transformative rationales for innovation policy interventions regarding:

- Directionality failure relates to *"failing to contribute to a particular direction of transformative change"*.
- Demand articulation failure: lack of market uptake may reflect *"a deficit in anticipating and learning about user needs"*.
- Policy coordination failure refers to problems of *"interaction of different levels and areas of policies relevant to transformative change"*.
- Reflexivity failure: *"Insufficient ability of the system to monitor, anticipate and involve actors in processes of self-governance, experimentation and learning"* (Weber & Rohracher 2012, p.1042).

The transformative failures point at the importance of various forms of **interactive learning in policy making,** and **co-design regarding transformation.**

Regarding the reflexivity failure Voss et al. (2006) point out that rationalist planning and linear implementation towards pre-defined sustainability goals can create problems along the way. They promote reflexivity, as it: *"interrupts the automatization of executing problem-solving routines" […] "by creating interaction between various rationalities, they take account of the complexity of interlinked social, technological and ecological development" (Voss et al. 2006).* The ability to monitor and assess also relies on interaction between stakeholders and co-design of assessment procedures.

Keller et al. (2022) draw some lessons from connecting the MLP to a social practice approach to discover opportunities for social change as part of sustainable transitions, e.g. they propose to zoom-in and -out to relate the levels and do joined vertical and horizontal analysis to find intersections and frictions between practices, niches, regimes and landscapes.

4.4 Integrating the ecological system into our framework

We questioned if the MLP (Multi-Level Perspective) on sustainability transitions is adequate for analyzing transformation of the bioeconomy towards sustainability, or whether the ecological dimension should specifically be integrated. In this paragraph we discuss literature on this question.

Vivien et al. (2019) identify three main narratives for the bioeconomy: sustainability-oriented, science-oriented, and biomass-oriented. Regarding the sustainability-oriented narrative ecological

transition/transformation is central, but this is not analyzed with the MLP specifically. A variety of ecological qualities, quantities, and norms and knowledge on how to use it, matter as input for innovation and transition processes, and as output ecological changes are referring to one of the three pillars of sustainability (people planet, profit).

According to Vivian et al. (2019) the MLP model is relevant to the bio-mass-oriented narrative of the bioeconomy (See Figure 12), which is the dominant current narrative according to Vivien et al. (2019) but has a rather weak environmental sustainability impact. As they note, the **ecological transition** is not included in the analysis. The bio-mass oriented narrative of the bioeconomy in Vivien et al. (2019) is focused on technology to transform biomass. In the application of the framework to what they call the 'biomass narrative' (Figure 12) there does not seem to be room for **social innovations** at the niche level of experimentation, or even for other **non-technological innovations**. Organizing new value chains without technological breakthroughs may not be seen as radical change, but only incremental.

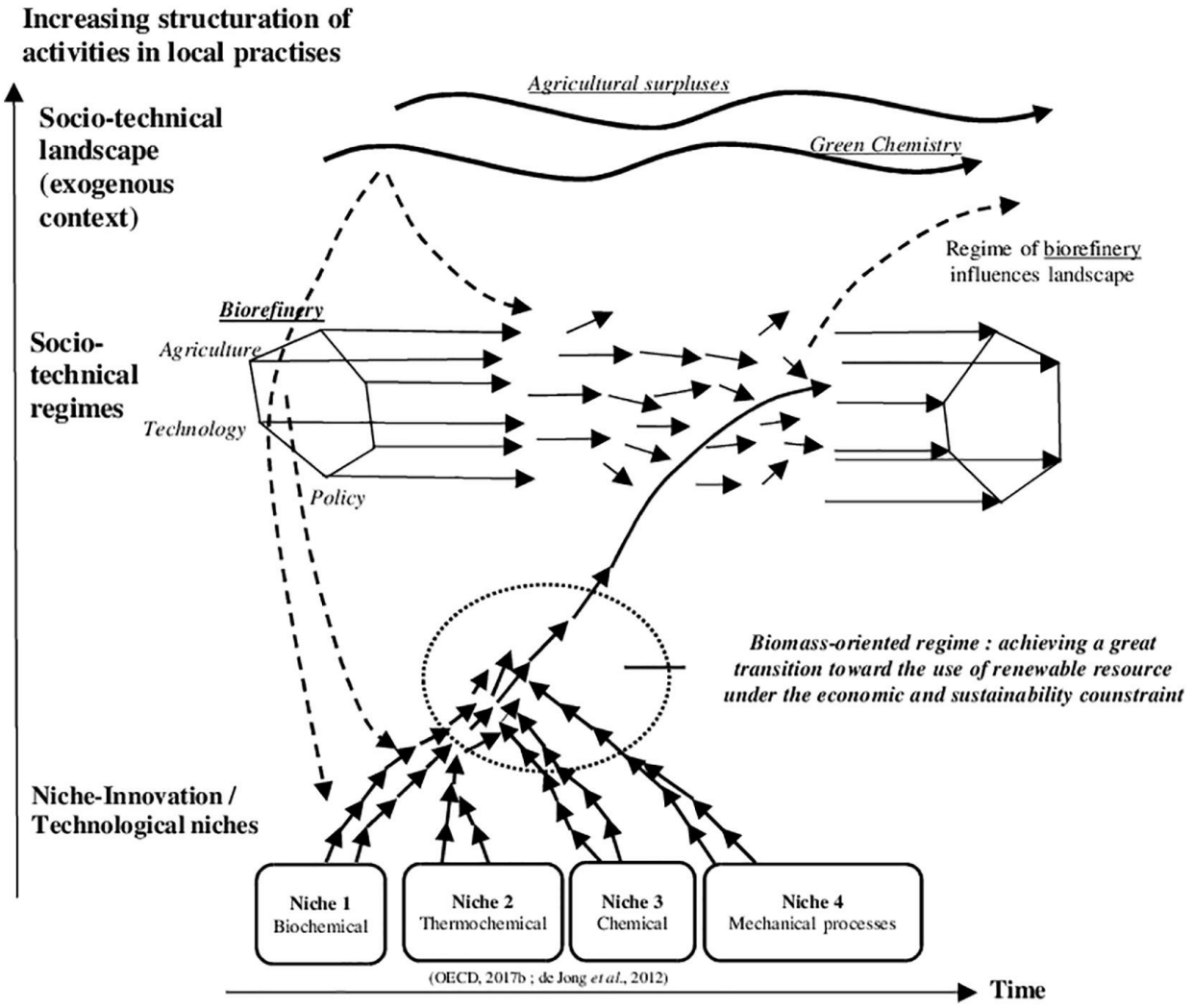


Figure 12 Bio-mass-oriented frame of bioeconomy (Vivien et al. 2019)

Source: Vivien et al. 2019

We propose to apply this framework also to **non-technological innovations**, notably social innovations. In this respect, we suggest a broader application of the framework and suggest that also non-

technological changes can develop as niches and transform any of the interconnected regimes. The formation of a MTF as done in RIBES regions can lead to experiments with new value chains, innovative business- and governance models, which can support transformation at the level of interacting regimes in the region.

Loorbach et al. (2017) distinguish in this respect three separate perspectives on transitions: **socio-technical, socio-institutional, and socio-ecological**. They conclude that: *"commonalities can be characterized in notions such as path dependencies, regimes, niches, experiments, and governance"*. Socio-institutional sounds very relevant for studying the contribution of social innovation and entrepreneurship. Whereas our focus on bioeconomy and sustainable development calls for integration socio-ecological transition, our interest in the role of social innovation makes it relevant to include socio-institutional transition. Several definitions of social innovation indeed refer to the implicit aim of institutionalization and mainstreaming of social solutions (Rehfeld et al. 2015; Pel et al. 2020).

Kemp and Pel (2023) conclude that **social innovation is in various ways connected to socio-technical, socio-ecological, as well as socio-economic transformations**. Social innovation provides crossovers between these coupled systems innovation perspectives.

Coupling these systems may indeed be one way to integrate the ecological dimension. Promoting crossovers between sectors and domains may have an advantage in terms of diffusion and scaling, and it may have the advantages of promoting un-related variety in innovation, which is more likely to concern radical innovations than the incremental innovation in the case of related variety with one sector or system (Frenken, 2017). Crossing these coupled systems in a societal challenge-driven approach may similarly involve **creating multiple values** (in a previously un-related variety of values), that provide a rationale for innovation policy (which goes beyond the market-failure and system-failure rationale). RIBES MTFs may serve in linking previously unrelated actors with heterogeneous capabilities, rationales and values.

Dopfer et al. (2004) also emphasize rules and write about an even broader rule-set: *"economic rules are, necessarily, embedded in a broader environment of rules – variously physical, biological, cognitive, behavioural, social, ecological, legal, political, and so forth."* So, biological and ecological rules should indeed be seen as part of the rule-set. They also state that it is difficult to disentangle the economic rule-system from its broader context of rule-systems. Our attempt should not be to try to be complete with this list for every type of rule relevant for social innovation, bioeconomy and sustainable rural development. But in case-studies we can question which **formal, normative and cognitive rules** are at play and can help to understand the dynamics.

Huntjens et al. (2021) specifically address **transformative social-ecological innovation** for a sustainable, healthy and just society. The intertwined existential challenges affecting the security, fairness and sustainability of our societies require according to Huntjens et al. (2021) a fundamental shift from our current anthropocentric and economic growth-oriented approach to a more ecocentric and regenerative approach.

Melnykovych et al. (2018) study a **socio-ecological system** and conclude that: "mountain forests can assist in reducing societal vulnerability of forest dependent communities". This study questioned how constantly changing human-environment interactions could be better organized to respond to current challenges. It involves a case study example in one of the 10 RIBES regions as a social-ecological

system. They outline "how people and nature are linked and interact" in the system. The framework also looks at the preferences of stakeholders for ecosystem services; maps key threats to well-being of the system; and identify potential responses to local challenges (Melnykovych et al., 2018). Technology is not specifically mentioned in the below scheme of this framework, but social innovation is included among the responses (Figure 13).

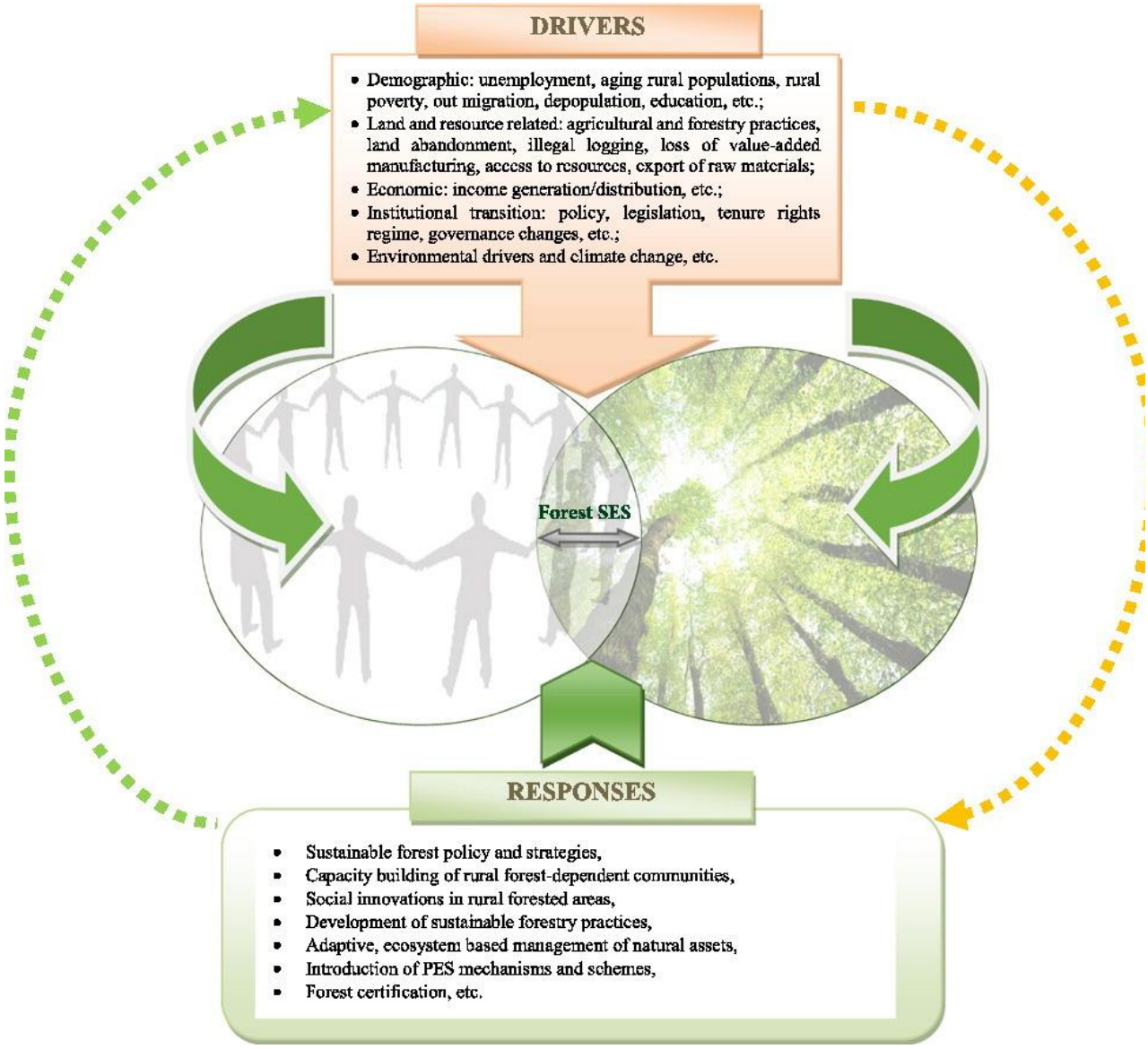


Figure 13 A Forest Socio-Ecological System

Source: Melnykovych et al. (2018)

For studying the motivations, shaping factors and impacts, the following conceptual scheme (Kemp, unpublished) inspired by the institutional analysis and development framework of Ostrom (2011) seems useful to guide our case studies (Figure 14). It gives explicit attention to strategic action fields (action arenas), biophysical conditions as a shaping factor and institutional work activities (e.g. inclusive bioeconomy value chain development) for achieving institutional change in a world of regimes and

multilevel governance. A distinction is made between outcomes for participants, non-participants in action arenas, ecology and collective action frames which inform institutional work.

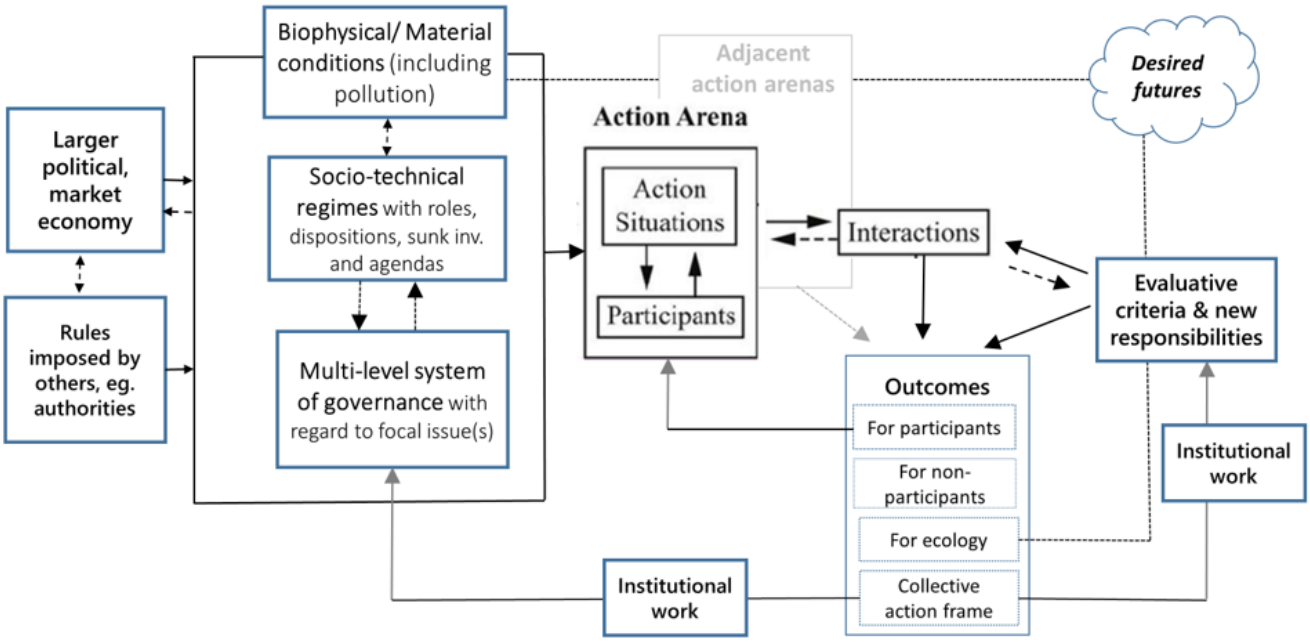


Figure 14 Integrating ecological, socio-technical and institutional analysis

Source: René Kemp (unpublished)

We conclude that the socio-ecological system should be integrated into our RIBES approach, at niche, regime and landscape level.

4.5 Innovation for place-based transformations

In Section 3, we revealed that the **10 RIBES regions differ in many ways** regarding many aspects of the study. The needs for transformation, the urgent societal challenges, the good examples in bioeconomy value chains, the ecosystem characteristics, regional drivers and barriers; and the social innovation aspects, all point to **local specificities and localised transformative pathways**. The regional varieties thus make the **place-based perspective on transformation to sustainability** a relevant perspective for RIBES projects and partners. The challenges, solutions and transformations seem localized, rooted in the concerning regions. We therefore suggest to integrate this branch of literature into our framework.

Regarding innovation for regional development, many have stressed that “there is no 'one-size-fits-all' policy portfolio. Regional differences in innovation capabilities call for a "tailored mix of policy instruments” (Nauwelaers & Wintjes 2002, p.201; Tödtling & Trippl 2005; Cooke 2011). Regarding the sustainability transition literature, Coenen, Benneworth and Truffer (2012) have addressed the fact that a spatial perspective was often lacking. Although innovation was increasingly being seen as serving a broader set of ‘grand’ societal challenges, and not merely economic growth. The focus was often on addressing global challenges, e.g. as SDGs. Addressing these societal challenges have also been picked up at regional level, although the attention was mostly on innovation in urban regions (Turkeli &

Wintjes 2014). In a spatially blind approach, the developed solutions may not work in another country, or regional socio-technical system. Transformations are complex, and the many regional and local tangible and intangible differences make it difficult to simply transfer a technological, non-technological or policy solutions to a 'wicked societal problem' to another regional context.

The knowledge inputs for social innovation and the outputs of social innovation are not of a pure public good nature, but they function more like a social good or commons (Ostrom 1990, 2015; Hardin 1968), accessible within a network but not universally open. The knowledge input is highly local, tacit, non-technological and context-dependent and to a degree socially constructed. Social innovations, such as new community-based solutions, social enterprises, or participatory governance models, often produce benefits that are not purely public goods. Their outcomes can be partially excludable (e.g. cooperative membership), rivalrous under some conditions (e.g. community resources may deplete), and locally embedded (e.g. solutions that only work, or are only valued, in a specific context). So, social innovations produce social goods which exist on a spectrum between public and private goods, and interact with technological innovations (Alijani & Wintjes 2017).

A regional problem driven approach, contrasted to previous technology driven approaches. In a linear view on technological change, the so called 'valley of death' was often a technological solution in search for a problem. Addressing main regional specific societal challenge may also have competitive advantages, as the region may develop as the lead market for the solutions and be ahead in experimenting with standards and regulations.

Uyarra et al. (2019) refer to a normative turn in regional innovation policy with the attention for "responsibility and the quest for public value". Regional innovation policy increasingly became challenge driven, starting with identifying and analysing the main societal challenges. As Frenken (2017) states: *"To trigger unrelated diversification into activities that contribute to solving societal challenges, government's main task is to organize the process of demand articulation."*

Mccann & Soete (2020) point at the importance of **place-based innovation for sustainability,** which added an additional S from sustainability to the original S3 referring to smart specialization strategies as the EU regional development policy. They point at many regional characteristics that lead to different regional green deal situations, e.g. difference in locational costs in the production of renewable energy. This place-based transformation approach is an EU approach which has been further developed in the past few years (see Schwaag Serger & Soete 2024), which has led to a practical 'action-book' developed by JRC/EC in Bianchi et al. (2024) who define:

"Transformations are place-based as local stakeholders and citizens, with their knowledge and skillsets, navigate place specificities to shape socio-technical systems through transformative activities" … "imply the co-creation of changes in cultural, social and environmental processes beyond technological ones".

With this place-based approach local stakeholders and citizens purposefully shape the socio-technological system, and they do this by '**navigating place specificities'**. By performing transformative activities, local stakeholders develop a sort of (search heuristic, cognitive routine, culture) **collective understanding and action** on the local specific needs and transformative capabilities.

A **place-based transformation to sustainability** seems especially relevant in the case of social innovation and bioeconomy, since both are strongly rooted in local resources and institutions (Moulaert 2016). In the new industrial policy of the EU, one of the transition pathways for a more resilient, green

and digital Europe concerns what is labelled as "the Proximity and social economy ecosystem". The Commission states that: "The proximity economy consists of local and short value chains, local production and consumption, human-centric city models and social economy business models"[1]. The fact that this statement in the concerning transition pathway for the EU is referring to city models, shows that social innovation in rural communities is still often neglected, while the needs for inclusion and revitalization are in several ways larger in rural areas. And so are the impacts to be gained.

This **place-based application** of socio-technical systems seems very relevant for our purpose in RIBES and for instance fits with the results of the workshops with representatives of the MTFs (Multi-stakeholder Transformative Forum's (Section 3). Figure 14 shows the chapters of this action-book with guidelines, good practices and tools, referring to the following activities: engaging, envisioning, orchestrating, designing, implementing, learning. It is stated that all these types of transformative activities must run in parallel due to the non-linear, complexity of the transformations.

Tomai, Papachristos & Ramani (2024) looked at initiatives in developing countries and point at "niche innovations and experiments that are often non-technological and are driven by urgent local needs". This finding may be relevant for the rural context of the 10 RIBES regions.

For addressing global grand challenges, innovative urban centers have been framed as the core source of solutions. Regarding innovation, the periphery received less attention and peripheral and rural areas are mostly associated with disadvantages. Glückler, Shearmur & Martinus (2023) list the opportunities; the benefits for innovation of a peripheral situation. One benefit relates to organizing a **place-based discovery**, since local stakeholders in rural regions need each other, while stakeholders in a more urban central position likely have more alternatives. In the search for synergies benefits in terms of cross-fertilization is mentioned, which related to the benefits of crossing previously un-related knowledge and capabilities, while in a metropolitan region actors are more likely to turn to similar (and like-minded) actors, sectors and industries or more narrowly defined user- and more homogeneous social groups. A third advantage mentioned by Glückler et al. (2023) is that in a peripheral region innovation can more easily develop while keeping 'under the radar'. Drawing attention is not always favorable.

Place-based transformation promotes a 'whole-of-the-government' approach, as one does not want each department of a government to work like a silo; and does not interact or agree or work against other departments. In the small-world characteristics of local government in a rural region, departments are likely to be located close to each other and share a lot of tacit knowledge and **local buzz** (Bathelt et al. 2004).

Relevant in rural regions is the factor of local community. Strong local communities (an institutional quality that interacts with society-level institutions) has positive impact on territorial development

[1] Source: https://single-market-economy.ec.europa.eu/sectors/proximity-and-social-economy/social-economy-eu_en

(Rodríguez-Pose & Storper 2006), social innovation initiatives may have positive impact on social community and social capital.

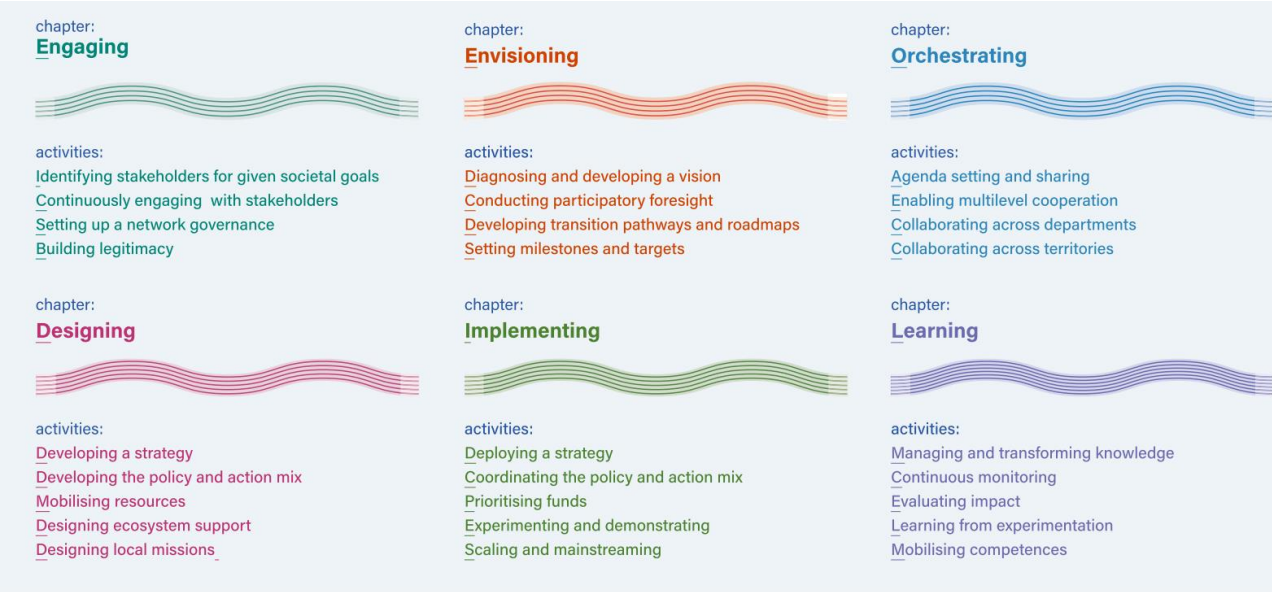


Figure 15 Chapters in action-book innovation for place-based transformations

Source: Bianchi et al. (2024)

Pike, Rodríguez-Pose & Tomaney (2018) question "what kind of regional development and for whom" and show how local and regional development has become a global challenge. Besides pointing at the geography of 'discontent' and 'left-behindness' Rodriguez-Pose et al. (2024) also show that with **place-based or place-sensitive policies,** one can move beyond the traditional efficiency versus equity debate in territorial development (Rodríguez-Pose et al. 2024b). Next to place-based or **place-sensitive investments**, there are also good arguments for certain **people-based investments,** e.g. improving the working conditions of young scientist can help regarding brain-drain. Depopulation and brain-drain are among the key societal challenges, as was mentioned during the workshops (See Section 3).

These rural issues are also mentioned in a report by the OECD where they address the topics of social innovation in relation to local ecosystems (OECD 2021) and in relation to rural development (OECD 2024). Social innovation *"seeks new answers to social and environmental problems, using new solutions that improve the quality of life for individuals and communities […] Social innovation goes hand-in-hand with local development"*. Compared to social innovation in urban areas, they find that rural social innovation is distinctive in its dependence on local actors, civil society and social enterprises for starting social innovation initiatives. *"Land use is an important and relatively more abundant resource that can be utilised for experimentation in a rural context. **Rural social innovation** is also distinctive due to barriers that may be territory-specific". (OECD 2024, p.6).*

The bioeconomy is an important sector in the 10 RIBES regions, and they host an important potential to generate regional sustainable development. In the past most attention regarding this potential was devoted to technological innovation. Studied as sectoral innovation systems growth of the sector was linked to R&D investments. With the shifted attention towards transition to sustainability the roles of

governments have extended (Borrás & Edler 2020). This is interesting to keep in mind, since distinguishing the variety of roles brings more clarity in the agency of the transformations. The triple-helix notion is in this regard too limited for understanding how innovations, transitions and transformations evolve. Social transformative roles are lacking in helix approaches.

Adopting a place-based approach also has the advantage that ideas might lead to applications for project funding from National and EU structural funds. At EU level **three transitions are evolving and converging: just, digital and green**. Competitiveness has remained an important aim of the new EU government. Regarding 'just' transition concepts such as inclusion, social innovation and responsible research and innovation have an important place.

Green and digital transition are pervasive in society and have often been described as twin transition. With the intertwining 'just transition', a triple transition perspective may emerge (Table 6). Nordberg (2020) talks about spatial justice regarding the local capabilities in rural areas and the freedom to organise development bottom up, rather than top down. Schutter et al. (2019) refers to place-based responsibility.

Clark and Harley (2020) synthesize diverse approaches (Figure 16) to study sustainability science, constituting a complex adaptive system, which can be applied to different contexts.

Table 6: Triple Transitions and RIBES

Triple transition	
Just	institutionalisation/MTFs/Social innovation/inclusivity/responsbility
Digital	tech transfer/invention/clustering/chain formation/infrastructure/innnovation
Green	land use/fertile soil/ biological advantages/ ecosystem services/bionatural resources/ biomass/valorization/circularity

We conclude that it is helpful for our project and RIBES regions to adopt a place-based transformative approach.

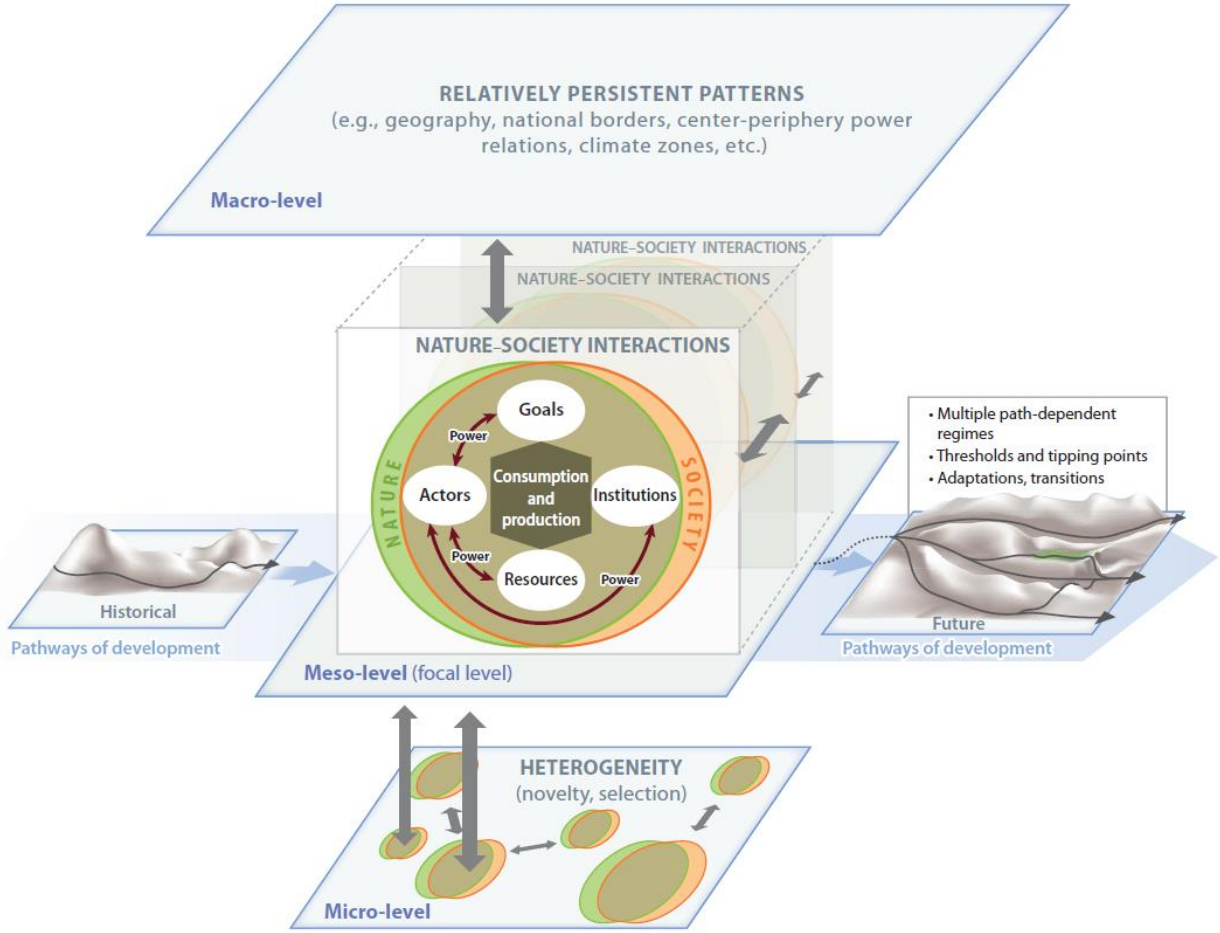


Figure 16 An integrated (nature-society) framework for sustainability research

Source: Clark and Haley (2020)

4.6 Transformative agency of social innovation and social entrepreneurship

In this paragraph we emphasize the relevance of literature and insights that address transformative agency, specifically of social innovation and social entrepreneurship. According to Geels (2011), the MLP has been criticized for underplaying the role of agency in transitions. Agency was certainly included, but some aspects or forms of agency get less attention. The role of the state for instance, goes beyond regulating. Mazucato (2011) emphasised the entrepreneurial role of the state in technological change and transformations. For our study the role of social innovation is questioned. As such it is not included in the original model (Geels 2002), although Geels (2011) mentions that some have looked at the role of social movements in relation to the MLP. He also points at power differences as one aspect that some people have mentioned that could be more developed. In the discussion at the workshop on ecosystems in the RIBES regions, differences in power were mentioned by a few participants. In some perspectives on social innovation empowering vulnerable and marginal people is central in its concept. The OECD concludes that: *"Social innovation can empower communities to take action and innovate especially in a rural setting". (OECD 2024, p.6*). According to Mulgan (2012) social innovations often emerge from contradictions, tensions, and dissatisfactions caused by *"new knowledge, new demands, and new needs that make the transition from being personal to being*

recognized as social in their causes and solutions". The social innovations sustain "when they can attract vital resources, that include money, time, attention, and power". Although scaling happens in a different way than growth of firms and commercial innovation, social innovations gain impact through being formalized, as pilots, ventures and programmes (Mulgan 2012). Considering the large variety of social innovations, it would be helpful to use or develop a typology. Sovacool et al. (2023) for instance distinguish types of social relations and interactions (cooperation, exchange, competition, and conflict). Howaldt & Schwarz (2017) describe social innovation as a process of social change and as new combinations of social practices.

According to the socio-technical regimes, the MLP points at 6 sub-regimes. Actors of these sub-regimes are likely to have a different view (and instituted logic). Maybe not every sub-regime agent is represented as stakeholders in the MTFs (Table 7). In the case study interviews it seems interesting to have a broad representation and pay attention to different actors with different roles, kind of power (Avelino & Wittmayer 2015) instituted logics, and capabilities.

Table 7: Type of regimes, organisations and individual agents

SOCIO-TECHNICAL REGIME	ORGANISATIONS	INDIVIDUAL AGENTS
Science	University, Faculty,	Scientist, Student
Industry/production	Company, Farm, Association, Cooperative	Entrepreneur, Employee, farmer
Technology	Value chain infrastructure Laboratory Plant	Engineer, Designer,
Policy	Ministry Agency Inspection	Policymaker, civil servant
Market, user preferences	Media	Consumer
Culture	Civil Society Organisation, Cooperative	Citizen

Applying the insights of Strasser, de Kraker & Kemp (2022) it would furthermore be interesting to specify relations between actors in terms of power-relations, knowledge relations and norm-based relations,

which each have different transformational effects and align with the three types of rules/institutions mentioned by Geels (2002): regulative, normative, and cognitive. Each also having their leading domain.

Table 8: Relational Transformations

RELATIONAL	TRANSFORMATIONAL	DOMAINS THAT LEAD	RULES/INSTITUTIONS
Power relations	Depth	Political Administrative	Regulative
Knowledge relations	Width	Techno Economic	Cognitive
Norm-based relations	Length	Socio-Cultural	Normative

Pel et al. (2020) define social innovation as 'changes in social relations, involving new ways of doing, organizing, knowing and framing'. According to Pel et al. (2020) a social Innovation process is transformative if it involves "challenging, altering or replacing dominant institutions" (Pel et al., 2020, p. 5). This indicates that social innovation can be relevant for bringing change and dynamics in every element and level of a regional socio-technical system (niche, regime, landscape).

According to the OECD (2024) social innovation plays a particularly important role in rural areas, namely it *"addresses a variety of market failures, fills the public service gap and brings partners together to deliver necessary products or services. Working together, social innovators can better experiment, apply new models, and propose new services or products specifically relevant to the local context"*.

Social innovation can take place in many sectors and bridge actors in different sectors. The fact that social innovations can fill public service gaps, implies that it can in or related to the public service sector. During the workshops also the connection to other sectors and cross-overs were mentioned, e.g. tourism.

The earlier mentioned work of Strasser, de Kraker & Kemp (2022) also looks at the transformative capacity and describes roles, practices and challenges. The variety of transformational activities and their effects in terms of **transformational depth, width, and length** can be helpful in identifying the ways in which social innovation can fulfill different roles contributing to transforming the regional bioeconomy to sustainability in terms of **environmental, economic and social sustainability** (See Figure 17).

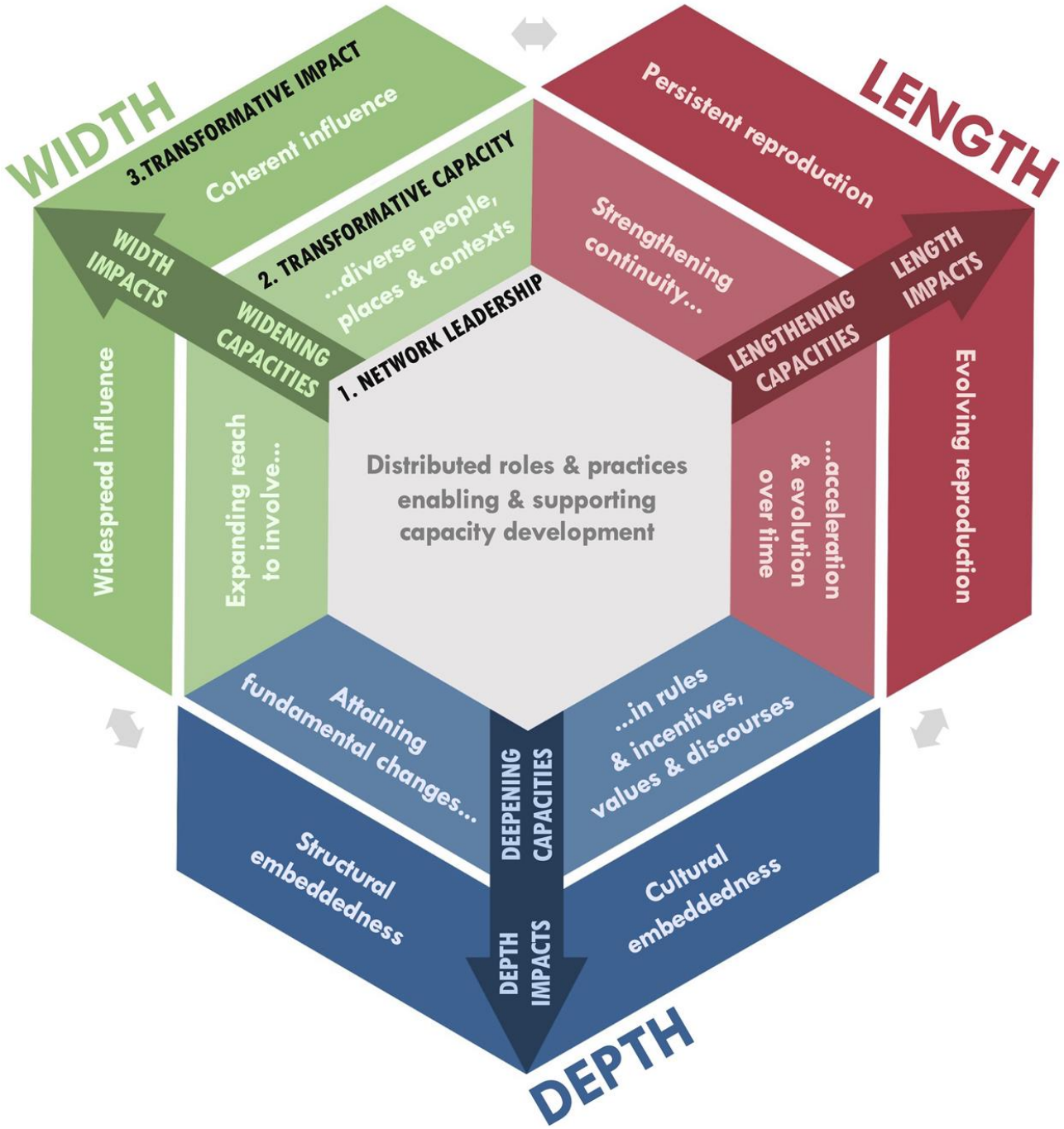


Figure 17 Types of transformative capacity

Source: Strasser, de Kraker & Kemp (2022)

Regarding the transformative agency of social innovation, a relevant concept is 'Institutional entrepreneurship' (Tracey et al., 2011) which relates to social innovation as bridging between organisations and creating new ones. This refers to the organisations-kind of institutions (rather than the rule-kind of institutions in the MLP framework).

Moulaert et al. (2017) show that social innovation can indeed be a trigger for transformations. Others that provide insights in various forms of agency in sustainability transitions are Grin et al. (2011) and Farla et al. (2012).

Fuenfschilling & Truffer (2014) have relevant empirical suggestions regarding the analysis of the structuration of socio-technical regimes. They point out that: *"empirical applications tend to depict regimes as too 'monolithic' and 'homogenous', not adequately considering persistent institutional tensions and contradictions"*. Searching for these tensions and contradiction may help to assess transition dynamics. Helpful here is the recommendation to distinguish various institutional logics for involved actors in the system and to trace conflicts and contradictions between them. For instance, scientists may have different interest in a certain transition and may have a different incentivised motive to participate in a Multi-actor Transformative Forum.

Social innovation and social entrepreneurship are experiments regarding directionality and balancing the trade-offs between counter-effective directions. As such they can support regions in analysing local societal problems and selecting local societal solutions which may be relevant for scaling up.

Multi-actor Transformative Forums (MTFs), each as a local site/hub/platform of experiential discussion, learning and co-creation, are a variation of the Living Lab concept, combined with the idea of an Open Innovation Platform that includes entrepreneurs and regional/local authorities, and links up to incubation activities. Living Labs and Open Innovation Platforms are usually defined as an innovation ecosystem which typically involves early engagement of users in real time and real life outside the controlled conditions of a traditional lab environment.

Importance of network effects and users for mutual value creation is stressed in the literature on open innovation activities facilitated by platforms (Raunio et al., 2016). Instead of a predominant focus on technological issues, however, MTFs provide an experimental approach to address complex societal challenges and problems by putting stakeholder participation and deliberation processes at the centre. MTFs provide protected spaces for experimentation on ideas, prototypes, pilots and solution testing. Moreover, as institutional structures these Forums aim to sustain the new behavioral pathways and collaborative business models in rural context.

Regarding transformative agency of the state Borrás & Edler (2020) identify 13 roles of the state in the governance of socio-technical systems' transformation: observer, warner, mitigator, opportunist, facilitator, lead-user, enabler of societal engagement, gatekeeper, promoter, moderator, initiator, guarantor and watchdog.

Individual civil servants can also be social innovators, either at work or after work, e.g. as a volunteer. Klitkou et al. (2022) furthermore show that "practices from different spheres of everyday life" are linked and how these interconnections of practices hinder or enable pathways of transformative change. The various aspects of daily live co-evolve and co-locate which has implications for transformations towards sustainability.

Ludvig et al. (2019) study social Innovation contributing to the Forest Bioeconomy and come to three main types relevant for forest bioeconomy:

- Social benefits and needs (A); often serving and including vulnerable groups. Often, these are organized as social enterprises and comprise volunteer work.
- *"Sustainable rural development (B): Social innovation covering forest policy objectives in consistency with regional/rural development.*

- *Participation and collective action (C): Social innovation covering collective civil society involvement, community forestry, and interactions in the forestry actors' network."*

We conclude from this branch of literature that it would be relevant to address in our case studies the transformative dynamism that social innovation and social enterprise can bring. Interesting insights on this exist and will be further explored in the empirical stages.

4.7 Co-designing bioeconomy value chains and assessment of sustainable development

Co-designing innovations and new business models happens in niches. Circularity calls for co-designing new value chains. How can we assess the contribution to sustainable development. Literature with insights on these issues is discussed in this paragraph.

Pyka and Urmetzer (2022) point at a challenge in bioeconomy modelling related to the difference between the notions of transition and transformation. In a transition process one industry can be replaced by another industry, e.g. a fossil-based industry by a bio-based industry offering similar products. Transformation is "not a simple replacement, but a complex and irreversible adaptation of the whole system". This distinction is similar (but not the same) to the one made by Geels & Kemp (2007): *"a transformation is an adjustment and re-orientation of a socio-technical system where existing regime actors remain dominant actors. This is in contrast to a transition, where new actors become dominant actors."*

Designing a new product or value chain with the aim of increasing sustainable development in the region could be regarded as an innovation, which could develop in a niche, but not necessarily leading to a transition, or a transformation. A niche has been described as a protected space, for experimenting, the innovation may not have developed fully and may not have all the benefits that is hoped for. Alternatives may still be seen as the best solution, but the project is not killed, it is protected because it still holds potential. In the RIBES project the Multi-actor Transformative Forums can be seen as social innovation in itself, but it can also serve as a niche, a protective environment where new problems can be discussed freely and ideas for solutions can lead to experiments and where new bio-based value chains will be co-designed to increase regional sustainable development.

The distinction made by Hohmann, Bieker and Truffer (2025) between four principal coordination tasks for Blue-Green Infrastructure projects, seem relevant for value chains: "(i) coordination for value creation, (ii) coordination of stakeholders with formal decision-making power, (iii) engaging stakeholders who have no formal mandate, and (iv) intermediation".

Relevant protected spaces for rivalry and experimentation include concepts such as living labs (Leminen 2015; Hossain et al. 2018; Timmermans et al. 2020), incubators, bootcamps (Virgen et al. 2020) and hackathons (Happonen et al. 2022). For social innovations there are also contests where an audience and jury decide after a pitch on the most appreciated social innovation (Barnett 2022). The MLP on socio-technical systems for sustainability transitions is influenced by large technology assessments in the previous century, e.g. with respect of the impacts of building a major infrastructural project like a river dam. The approach of Responsible Research and Innovation (RRI) as promoted by

the European Commission was seen as an extension of those old technology assessments. Another recent assessment approach is the Life Cycle Assessment (LCA) which can be used to assess the efficiency/performance of RIBES value chains, considering environmental, economic and social aspects across all the life cycle stages of biomass, i.e. feedstock collection, transportation and conversion to high added-value products. Current assessments mostly do not include social impacts, but are limited to environmental impacts, such as GHG emissions and non-renewable energy consumption.

Life Cycle Assessments could fulfil a role in place-based transformations towards sustainability, since the chapter of Learning in the Action-book (Bianchi 2024), point at monitoring and evaluation to inform a reflection on the transformation process. The assessments are at the level of product value chains, not at the level of innovation systems, policy, or regional transformations.

Krlev and Terstriep (2022) address measuring innovation for sustainability transitions, concerning social innovation they classify the status of measurement as immature, referring to suggestions for measurement at the micro level of social innovation initiatives and the level of regional regimes (Wintjes et al. 2019; Unceta et al. 2022).

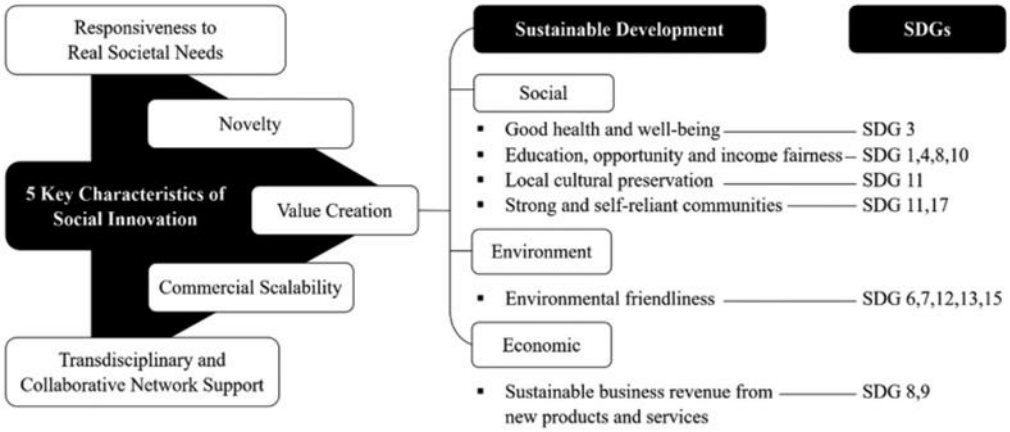


Figure 18 Key characteristics of social innovation towards sustainable development

Source: Phuangprayong & Noonin (2024; p. 1368)

Eichler & Schwarz (2019) show that most social innovation case studies deal with an improvement of health and well-being. They identify five types of innovators that are involved in developing and implementing social innovation: social entrepreneurs, NGOs and non-profits, public institutions, civil society, firms, and social enterprises.

Researchers in the traditional field of (technological) innovation studies now regard the normative assessment of innovation as a major research challenge (Martin, 2013). As Geels (2011) stated:" Because *sustainability is an ambiguous and contested concept, there will be disagreement and debate about the directionality of sustainability transitions".* Engagement of relevant stakeholders and citizens in an early phase is therefore important in place-based transformation. The advantages and trade-offs of certain solutions and directions, and related policy instruments need to be discussed with users and stakeholders in the system.

This is also stressed by Stirling (2024) who *emphasizes the political nature of the processes* and makes a distinction between directing, direction and directionality: *"Directing innovation involves driving narrow motivating processes towards some given end. The direction of innovation concerns broader steering of pathways towards more openly chosen ends. Directionality of innovation entails grasping deeper political potentialities spanning pluralities of ends."*

Concerning circular bioeconomy value chains one expects high score on sustainability, but Kirchherr et al. (2017) find that the circular economy is most frequently depicted as a combination of reduce, reuse and recycle activities. The main aim of the circular economy "*is considered to be economic prosperity, followed by environmental quality; its impact on social equity and future generations is barely mentioned*."

Bröring and Vanacker (2022) identify major challenges for designing business models for the Bioeconomy. Specificities of the bioeconomy such as *"the complex knowledge base, fragmented policy schemes, and diverse innovation types cause such challenges"*. They identify three types of business models: 1) new bio-based products, 2) new bio-based processes, and 3) integrated (bio-based)

Textbox 1: Challenges for designing bioeconomy business models (Bröring and Vanacker (2022)

"Technological upscaling is critical, but technology has never been tested on a larger scale" (Donner et al., 2021);

"Society needs to be made aware and encouraged to engage in the consumption of bio-based products". (Salvador et al., 2021, p. 10);

"companies many times fail to communicate and integrate the customer into the value creation process" (Salvador et al., 2021, p. 10);

"Hence, the lack of confidence of consumers in the product is also hampering the market uptake of bio-based products." (Orozco et al., 2021, p. 10)

"Another barrier is the lack of new and efficient channels for the provision of the circular business model. Channels need to facilitate take-back flows to enable reuse, remanufacturing, and recycling that put a high demand on the development of delivery networks" (Reim et al., 2019, p. 9)

"the shift to new business models in ecosystems often leads to ambiguity in roles and a lack of clarity on who should take what role in value cocreation, which requires focal actors to take a more active role in orchestrating the ecosystem." (Reim et al., 2019, p. 9)

"Separation and purification processes can be difficult to perform" (Collins et al., 2021, p. 7)

"There is competition between different sectors for the same agricultural by-products" (Donner et al., 2021, p. 6)

"Recent research has shown that difficulties in mobilizing biomass is one of the main barriers that hamper the development of bio-based supply chains" (Orozco et al., 2021, p. 6)

"Seasonality alters the availability of by-products; thus, stocks must be carefully planned (transport, storage, processing)" (Donner et al., 2021, p. 6)

"One of the most challenging management (and economic) issues within circular systems is logistics. It might increase costs significantly, and consequently turn an operation unfeasible" (Salvador et al., 2021, p. 11)

"Depending on the local context, agricultural residues or by-products are limited in volume per farm – need to collect them from many sources, possibly with varying qualities" (Donner et al., 2021, p. 5)

"Virgin biomass, byproducts, and wastes, can have a range of applications." (Salvador et al., 2021, p. 11)

"adequate revenue streams are dependent on public financial support that hinders the bio-economy from proving its economic feasibility in the long term" (Reim et al., 2019, p. 10)

"The motivation to develop and implement new technologies in the bio-economy requires large upfront investments that its greater uncertainties hinder." (Reim et al., 2019, p. 10)

"Some market sectors regulations/requirements, in particular the pharmaceutical sector, require detailed information regarding how a bioactive compound functions to produce a specific effect. This can be a difficult process" (Collins et al., 2020, p. 7)

Limited access to bioresources/capacity to replicate in lab (Collins et al., 2020, p. 7)

"Our results revealed that internal development is challenging, mainly due to cognitive barriers, path dependence, and resistance to break the current business for a new one." (Carraresi and Bröring, 2021, p. 10)

"Companies will need new skills and competencies to manage the new technologies and value networks." (Reim et al., 2019, p. 9)

services. Within the literature on sustainable business models the notion of value in the business model relates to economic value, environmental value and social value (e.g. Bocken et al., 2014). Ferasso et al. (2020) further integrate circular economy principles.

Bröring and Vanacker (2022) list examples of challenges as found in the literature concerning designing business models for the bioeconomy. In Textbox 1 we refer to a selection of them.

For analysing and designing business models the approach of business model canvas is often used. Regarding bioeconomy and social enterprise there are different specialised canvas approaches developed, e.g. Sparviero (2019) proposes a socially oriented business model canvas: The social enterprise model canvas.

According to Marmol et al. (2023) the first life-cycle assessment (LCA) **of products** with an environmental approach was carried out in the early 1970s. Standardization began in 1990 by the SETAC (Society of Environmental Toxicology and Chemistry). In 2003, UNEP and SETAC recognized the need to integrate social criteria into LCA. **Social LCA (S-LCA)** approaches were actively explored and in 2009 the first guidelines on the methodological approach were developed (UNEP 2009). An update of the guidelines in 2020 included also an assessment guideline on organisations, which is close to Corporate Social Responsibility issues.

The use of **Social-LCA for bioeconomy** was studied by Rebolledo-Leiva et al. (2023). They found that from the stakeholder types, Workers was the most studied with 93%, followed by Local Community (70%) and Society (58%). Consumers are less often included in the assessments. Other stakeholders which are hardly considered include: Policymaker, Farm owners, suppliers, shareholders, and Authorities (Rebolledo-Leiva et al. 2023). To understand the role of social innovation in transforming bioeconomy transformation to sustainable development these could be interesting stakeholders. The methodology of Social-LCA could in theory be used to compare the impacts of a bioeconomy product value chain with and without social innovation. But for assessing social innovation specific additional stakeholders, e.g. volunteers, NGOs, public sector, students, elderly, sponsors, might be relevant to include. Impacts in and from other sectors/cross-overs (as social innovation value chains) are not included, e.g. public services, health, or tourism. Concerning the design of the assessment, and steps to be taken, such as selecting relevant indicators, it seems appropriate to do it in an inclusive approach and multi-actor setting of for instance in an MTF.

Lago-Olveira et al. (2024) report that for monitoring the bioeconomy *"A total of 17, 26 and 101 indicators were identified for the environmental, economic and social pillars, respectively"*. For environmental indicators see Figure 18. According to the Directive 2014/24/EU (European Commission, 2022), Article 68, which refers to Life Cycle Cost Assessment, such a cost analysis should include all relevant stages of the value chain (See Figure 19)

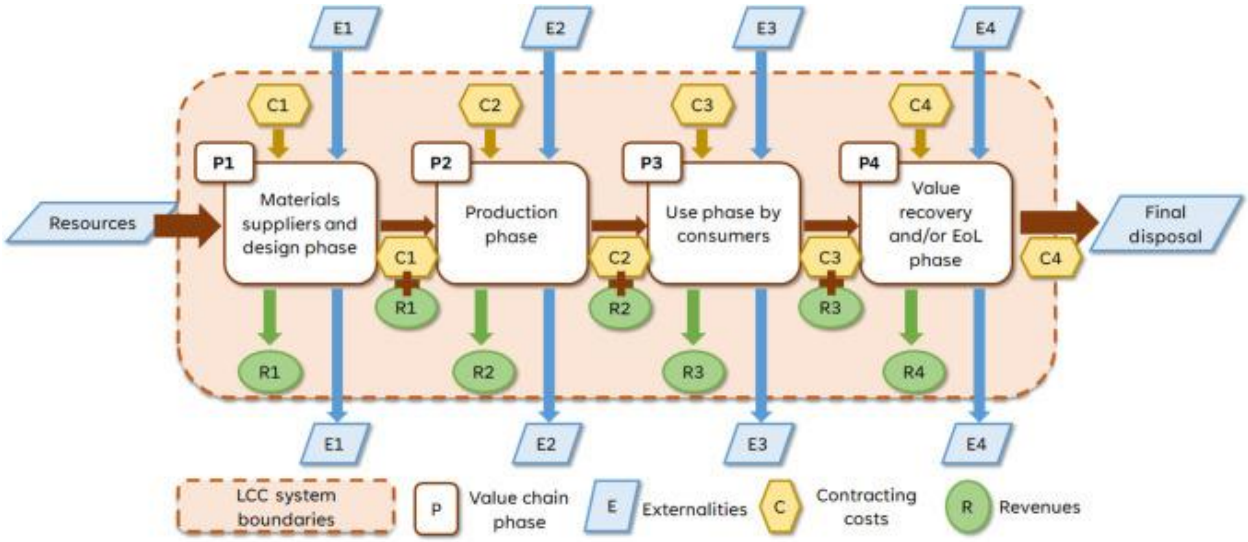


Figure 19 Main stages of the LCC system boundaries for a value chain

Source: Lago-Olveira et al. (2024); Adapted from UNEP-SETAC Life Cycle Initiative (2009).

Lago-Olveira et al. (2024) report that for the social dimension indicators were categorized, according to six categories of stakeholders (children, workers, consumers, local community, society and value chain actors). *"Children encompasses evaluating the impacts on the younger population, where issues such as their safety, education, well-being, and protection from any harmful or exploitative practices are central"*. See Figure 21.

Figure 20 Count of indicators classified by impact categories

Source: Lago-Olveira et al. (2024); after the HAP, ILCD and UNEP-SETAC Life Cycle Initiative guidelines.

We conclude from this paragraph that there is not much relevant literature concerning the integrated design of bioeconomy & social innovation in one value chain.

A very crucial characteristic of Life Cycle Assessment is that it is the result from standardisation efforts, which makes it a scalable tool. A social Life Cycle Assessment of a bioeconomy value chain could call attention for stakeholders that in the current guidelines are headed under 'other stakeholders', such as government, policy makers, university, and farmers. Specific additional stakeholders regarding social innovation aspects of value chains could include, e.g. volunteers, NGOs, public sector, students, elderly, sponsors. Concerning the design of the assessment, and steps to be taken, such as selecting relevant indicators, it seems appropriate to do it in an inclusive approach and multi-actor setting of for instance an MTF.

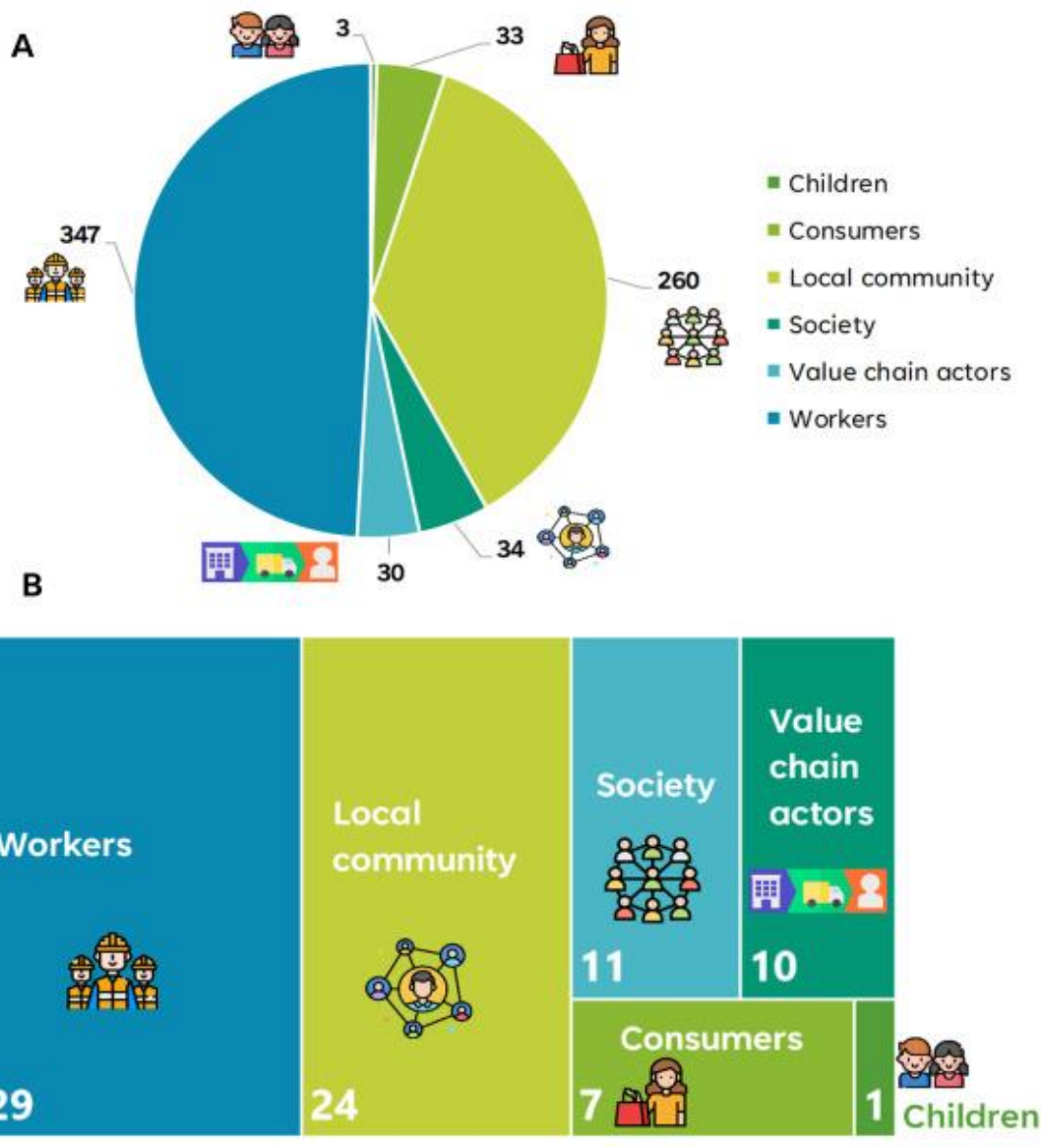


Figure 21 Classification of indicators according to stakeholder category (A) and number of bibliographic references per category (B).

Source: Lago-Olveira et al. (2024)

5. Conclusions and the Outlook towards Case Studies

5.1 Conclusions

In this deliverable, the literature review and bibliometric analyses (Section 2) reveal that the literature on **bioeconomy and social innovation** are strictly separated. Those few publications which directly address both fields highlight that social innovation plays a critical role by promoting participatory, community-driven approaches that integrate local knowledge, stakeholder engagement, and inclusive decision-making to address societal needs and sustainability challenges. It can foster cross-sectoral collaboration and knowledge transfer through adaptive governance, innovative business models, and flexible partnerships, enabling the scaling of sustainable, bio-based innovations across diverse regions. However, identifying the hidden links between the two fields additionally showed that there are general overlaps between the two strands indicating a shared knowledge base (e.g., Geels 2002 as most common reference), joint research interest and topics (**sustainability**) and, thus, potential areas of interaction not only from an academic point of view. However, the literature review also showed that there are no widely accepted, universal definitions for each of the concepts and, consequently, potential overlaps and synergies strongly depend on the respective understanding and interpretation of each concept.

The MTF workshops in June and July 2024 (Section 3) revealed that the reason why there is no universally accepted definition is that both (the bio- and the socio- aspect inherent in both terms) *bio*economy and *social* innovation, are highly contextual. Although generic and alternative definitions can be understood throughout different contexts, in this case by RIBES partners, **regionally** actionable definitions rely on interests, ambitions, existing or envisioned practices that are highly contextual or yet to be contextualised for the regions. The prevailing view on bioeconomy seems a biomass based substitution approach, which questions what kind of transformation and sustainability is needed, or aimed for.

This makes our research a more explorative search for possible roles that social innovation could have for transitioning the bioeconomy towards sustainable rural development, and how these processes and interactions may evolve. With the Multi-Level Perspective (Geels, 2002) as starting-point, we conclude that not only technology and society co-evolve, also the co-evolving ecology should be integrated (at niche, regime and landscape level) to make the perspective more relevant for transforming the bioeconomy towards sustainability.

It is this context dependency and/or contextualization of economic and innovation concepts and associated practices that pave way to the need for localisation and place-based approaches for better grounded solution designs and implementations that can deliver results in the regions. The "place" in the place-based approaches indicate an immediate and spatially local: bioeconomy, society, environment, ecology, ideas, interests, institutional voices, logics, conditions, resources, and current

and prospective future. Unlike pure public goods, knowledge in social innovation and bioeconomy transformations is context-dependent and to some extent socially constructed.

The bioeconomy operates at the intersection of technology, society, and ecology. Solutions to placed-based bioeconomic issues, in a rural environment where an immediate society resides, are expected to be more sensitized towards proximate negotiations, spillovers, learnings and trade-offs. Trade-offs between the local bioeconomic gains, the societal conditions, (such as wellbeing), the environmental and the ecological conditions (such as sustainability for resilience) and continuous functioning of the local and rural economy (and its interlinked sectors and value chains) make it complex systems of which the boundaries are not easy to describe.

In this regard, the niche innovators (technological, non-technological, social and organisational entrepreneurs and innovators) through platforms like MTFs, discuss not only a transition from the previous socio-technical regime towards a new socio-technical regime, but also target a socio-ecological regime shift. Demanding sustainability challenges of rural bioeconomies, are environmentally sourced and ecologically dependent, and are also challenged by rural population dynamics. In this regard, integration of social life cycle assessment (S-LCA), into assessment towards inclusive bioeconomy value chains provides opportunities for evaluation of the impact on both society and ecology. Multi-actor partnerships allow for an adaptive, place-based approach, considering innovation pathways, governance, and sustainability outcomes

By co-designing and implementing rural bioeconomy value chains, with a variety of local (potentially globally connected technological, non-technological, social and organisational/institutional) entrepreneurs, innovators and stakeholders, the transformative leap from mono/single value to multiple value creation and composite value delivery is expected to take place in rural areas. A transformative leap, which in turn, feeds the corresponding rural economic, social, ecological rejuvenation points of the rural places in the processes of socio-ecological shift and transformation. Studying how different actors co-create, negotiate, and share knowledge offers deeper insight than assuming universal access to relevant knowledge and capabilities.

Social innovation and social entrepreneurship are experiments regarding directionality and balancing the trade-offs between counter-effective directions, or synergies in pathways. As such they can support regions in analysing local societal problems and selecting local societal solutions which may be relevant for scaling out or institutionalisation (length, width, depth of transformative capacity).

Life Cycle Assessment (LCA) assessments are at the level of products in value chains, not at the level of innovation systems, policy, or regional transformations. For assessing social innovation (and the value chains involved) specific additional stakeholders (e.g. volunteers, NGOs, public sector, students, elderly, sponsors) might be relevant to include. Concerning the design of the assessment, and steps to be taken, such as selecting relevant indicators, it seems appropriate to do it in an inclusive approach and multi-actor setting of for instance in an MTF.

5.2 Towards case studies

Throughout this deliverable we have referred to useful insights and appreciated some of them as suggestions for activities in RIBES.

Some of the implications for designing case studies (Task 2.4) are drafted in Textbox 2 in a sketchy, brainstorming way. For each region we propose to gain qualitative insights on three things:

- how MTFs have emerged and evolved (socio-institutional innovation);
- how a particular bioeconomy value chain emerges or evolves (socio-technical innovation);
- How social, social-ecological and environmental aspects change (socio-ecological innovation).

Box 2: Case Study Template

CASE

Region generic info

a) Socio-organisational entrepreneurship to socio-institutional innovation:

Establishment of MTFS, MTF Representative as social organisational entrepreneur, transformative leadership towards institutionalisation of MTFs over Inclusive circular bio-based value chains

MTF in Region X

b) Socio-technical entrepreneurship to socio-technological innovation:

Low technical. High technological solutions as part of value chain (supply side social enterprise, raw material supplier, part and product/service developer/provider, marketeer), as part of support to supply side (education, skills, capacity development social enterprise), demand side/support to demand side (awareness campaigners), new institutional social entrepreneurs (community organisers)

Examples: Already existing, emerging, future value chains

c) Socio-environmental entrepreneurship to social ecological innovation:

Environmental and social aspects from social behavioural change and socio-cultural transformation in relation to societal ecological mindset, opportunities, and futures

Perceptions and perception openness/change awareness about inclusive circular bio-based economy in the region.

Society and ecology are both resource and outcomes of activities. In case studies it is interesting to explore how new rules, norms and knowledge emerge that shape and constrain the socio-ecological relations with physical nature in the region.

Searching for differences and **asymmetries** (e.g. in objectives, instituted logics, capabilities) among actors involved in the MTFs is important as it can clarify tensions and contradictions that may help to assess transition dynamics. How can farmers, cooperatives, policymakers, and researchers co-create sustainable bioeconomy solutions? How can cross-overs between social innovation and bioeconomy value chain be co-designed? How do multi-stakeholder partnerships ensure fair distribution of benefits across the multiple value chain partnership? How can we prevent dominant actors from capturing innovation benefits? How can bio-based products (e.g., bioplastics, bioenergy, regenerative agriculture)

be scaled in a way that benefits local communities? Can asymmetries in local partnerships serve to develop opportunities from the benefits of **variety of values, knowledge and capabilities?**

A multi-actor partnership lens helps understand cross-sectoral synergies. It is difficult ex-ante to predefine the **system borders** of the transformative activities of **multi-actor partnerships** since actors and sectors other then directly producing, distributing and transforming biomass in biobased value chains may be relevant to include, since social innovation may involve including a diversity of (previously related or unrelated) actors, sectors and value chains (e.g. tourism, education, food, energy, public service, communities) in local multiple value creation / sustainable development.

Based on the literature and this initial framework we identified relevant aspects in a matrix form (Annex 2) and filled in the respective categories ex-ante, suggesting a baseline.

Literature

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Annex 1 Economy-wide keyword analysis

For capturing economy-wide potential interactions, (e.g., bioeconomy (BE), social economy (SE), circular economy (CE) and digital economy (DE)), the bibliographic data is acquired through the database Web of Science. Searching for articles on each of the four economy visions and practices separately as either part of the “topic” or “title", using the Boolean operator “OR” and "AND" is performed. We only used articles from 2013-2023. 2024 is not included for predictive purposes. We acquired via the query “bioeconomy”, “bio-economy”, or “bio-based economy”, 5,365 articles, and 2,740 articles for “social economy”. Including circular economy, 22,327 articles for “circular economy”, and for digital technological dimension, 5,306 articles for “digital economy". All BE queries ialso nclude “bioeconomy”, “bio-economy”, or “bio-based economy variations.

The queries: “circular economy” AND “bioeconomy” returned **764** articles; “circular economy” AND “digital economy” 29 articles; “circular economy” AND “social economy” resulted in **18** articles; “social economy” AND “digital economy” 7 articles, “digital economy” AND “bioeconomy returned 9 articles; and "social economy” AND “bioeconomy” **3** articles. These results indicate that **circular economy** is the main domain through which social economy and bioeconomy is most likely to interact, if not directly, since both bioeconomy and social economy visions and practices independently concentrate more on circular economy, relative to on digital economy or on each other.

At keyword level, we detected 23,799 distinct keywords within bioeconomy literature; 11,418 distinct keywords within social economy literature; 116,159 distinct keywords within circular economy, and 26,228 distinct keywords within digital economy literature are detected.

Intersection of independent BE & CE literature resulted in 4,655 common keywords; DE & CE literature resulted in 2,328 common keywords; SE & CE literature resulted in 1,732 common keywords; DE & SE literature resulted in 1,183 common keywords; BE & DE literature resulted in 930 common keywords; BE & SE literature resulted in 767 common keywords. 803 common keywords for SE & CE & DE literature; 785 common keywords for CE & BE & DE literature; 678 common keywords for CE & BE & SE; and 434 common keywords for BE & SE & DE literature are detected. Finally, for circular economy, digital economy, bioeconomy, and social economy literature, the number of common keywords found was 413.

Following vectors are extracted: (Economies, not yet researched common keyword, already researched common keywords): (BE & DE; 895; 35); (BE & SE; 757; 10); (BE & CE; 2,673; 1,982); (DE & SE; 1,151; 32); (DE & CE; 2,214; 114) (SE & CE; 1,657; 75); (CE & BE & DE; 777; 8) (CE & BE & SE; 678; 0); (BE & SE & DE; 434; 0); (SE & DE & CE;803; 0); (BE & SE & DE & CE; 413; 0).

The keyword lists below are the main common keywords among bioeconomy and social economy, and a participatory discussion about defining, contextualising and implementing a socially innovative bioeconomy should touch upon these common concepts as debate and/or action points (See Table).

Table Potential Interactions/Topics between Bioeconomy, Social Economy, Circular Economy and Digital Economy

Keyword (BE & SE)	Value
sustainability	**23234**
sustainable development	6315
innovation	5672
economy	4808
development	4772
environment	4340
cooperatives	**3032**
model	1846
social	**1655**
policy	1632
entrepreneurship	**1521**
social innovation	**1393**
enterprise	760
food	694
sustainable	630
energy	604
governance	547
economic development	505
analysis	495
quality	484
agriculture	423
renewable energy	421
coordination	383
SDGs	344
capital	308
regional development	292
management	289
public policies	268

Keyword (BE & SE & CE)	Value
sustainability	**3024032**
recycling	**428203**
sustainable development	164513
waste	**109978**
innovation	80182
environment	63871
waste management	**50671**
supply chain	**36052**
sustainable	34972
barriers	28732
transition	24691
food waste	15976
efficiency	15309
policy	15115
strategy	13827
energy	13637
bioeconomy	11397
recovery	9744
environmental sustainability	9659
technology	8493
EU	8174
governance	7297
indicators	7212
blockchain	6986
systematic review	6448
SDGs	5877
circularity	5766
drivers	5693

Keyword (BE & SE & CE & DE)	Value
sustainability	**3024261**
recycling	**428203**
sustainable development	193169
waste management	50671
supply chain	36151
sustainable	35626
barriers	28733
transition	24797
efficiency	22820
policy	15736
energy	**14516**
strategy	14087
bioeconomy	11397
EU	9935
digitalization	**9776**
environmental sustainability	9679
governance	8553
blockchain	**7410**
indicators	**7273**
technological innovation	**7146**
systematic review	6448
SDGs	5877
drivers	5693
ecology	5522
construction	5291
food	5081
climate change	4926
supply chain management	4723

transition	263		ecology	5522		production	4460
social capital	240		construction	5291		internet of things	4339
value	237		food	5080		consumption	4181
resilience	235		climate change	4922		transformation	4110
local development	229		supply chain management	4723		case study	4104
rural development	221		production	4352		stakeholders	4013
optimization	197		internet of things	4339		economic development	3898
regional	188		case study	4101		sharing economy	3274
region	185		stakeholders	4013		quality	3187
circular economy	175		digitalization	3599		cooperatives	3080
indicators	166		cooperatives	3080		resources	3045
monitoring	165		resources	2923		GIS	2966
evaluation	157		GIS	2916		SME	2885
EU	141		consumption	2911		bibliometric analysis	2874
system	138		SME	2865		entrepreneurship	2816
resources	138		bibliometric analysis	2852		digital transformation	2765
economic	138		sharing economy	2774		big data	2752
market	137		biomass	2676		social	2597
application	137		assessment	2556		assessment	2583
regulation	129		social	2436		system	2403
conservation	126		environmental policy	2356		resilience	2218

Value: total times the articles and its keywords were cited in the WoS core collection per year

Annex 2 Generic/Stylized Framework Constituents to be used in Verification and Validation Processes, towards Task 2.5

Section 4.6	Section 4.6	Section 4.3	Section 4.4	Section 4.3	Section 4.2	Section 4.5	Section 4.5	Section 4.5	Section 4.5	Section 4.5
Supply Chain Element	**Generic Description**	**Value Chain Element**	**Ecosystem Actors**	**Multiple Value Chain Dynamics**	**MLP (Multi-Level Perspective)**	**Social and Organizational Innovations**	**Power (Political and Administrative) Relations**	**Economic Relations (Economic and Financial)**	**Knowledge (Scientific and Technological) Relations**	**Norm-based (Social and Cultural) Relations**
Primary Production	Cultivation or extraction of renewable biological materials (e.g., crops, forests, fish, algae, microorganisms). [PP 1]	**Input Production:** Creating the raw biological resources that feed into the bioeconomy. [PP 2]	Farmers, foresters, fishers, aquaculture operators. [PP 3]	**Economic:** Creates jobs and sustains rural economies. **Social:** Empowers local communities. **Environmental:** Preserves biodiversity. **Digital:** Precision agriculture and remote sensing improve yield. [PP 4]	**Niche Innovations:** Precision farming, vertical agriculture. **Regime Status:** Dominated by traditional agricultural practices. **Landscape Pressures:** Climate change, food security demands. [PP 5]	**Social:** Farmer cooperatives, knowledge-sharing networks. **Organizational:** Community-supported agriculture (CSA), farmer alliances. [PP 6]	**Power: Public (Governments)** regulate land use and subsidies. **Private:** Corporations influence farming practices. [PP 7]	**Economic: Private (Corporations)** provide financing for tech and operations. **Public (Governments)** offer subsidies. [PP 8]	**Knowledge: Private (Agri-tech firms)** lead innovation. **Public (Governments)** fund research [PP 9]	**Norm-based: Social (Farmers' organizations)** lead cultural shifts in sustainability. **Private** emphasizes efficiency. [PP 10]
Biological Resources	Sources like agriculture, forestry, aquaculture, and fisheries used for biomass production.	**Resource Sourcing:** Identifying and cultivating resources for further use.	Agricultural cooperatives, forestry agencies, NGOs. [BR 3]	**Economic:** Supports the raw materials market. **Social:** Ensures equitable resource access.	**Niche Innovations:** Sustainable forestry, bioengineered crops. **Regime Status:** Conventional	**Social:** Community forestry initiatives, fair trade practices. **Organizational:** Sustainable resource	**Power: Public (Governments)** enforce resource regulations. **Private:** Corporations drive resource extraction.	**Economic: Private (Agribusiness)** controls pricing and availability. **Public (Governments)**	**Knowledge: Private (Biotech firms)** lead innovation, **Public (Universities)** provide research. [BR 9]	**Norm-based: Social (NGOs)** advocate for ethical sourcing. **Public (Governments)** enforce regulations. [BR 10]

	[BR 1]	[BR 2]		**Environmental:** Promotes sustainable resource use. **Digital:** Blockchain enhances traceability. [BR 4]	resource extraction. **Landscape Pressures:** Deforestation, resource scarcity. [BR 5]	management frameworks, forestry certification schemes (e.g., FSC). [BR 6]	[BR 7]	regulate access to land. [BR 8]		
Biomass Supply	Harvesting, collecting, storing, and transporting raw biological materials to processing facilities.	**Material Collection:** Gathering raw inputs and ensuring efficient supply.	Logistics companies, suppliers, storage facility owners.	**Economic:** Reduces transportation costs. **Social:** Improves labour opportunities in rural areas. **Environmental:** Minimizes resource loss. **Digital:** IoT optimizes logistics operations. [BS 3]	**Niche Innovations:** Automated harvesting systems. **Regime Status:** Reliant on traditional supply chains. **Landscape Pressures:** Rising energy costs, logistics emissions. [BS 4]	**Social:** Workforce training in biomass logistics. **Organizational:** Regional supply chain cooperatives, shared storage facilities. [BS 5]	**Power: Public (Governments)** set infrastructure policies. **Private (Logistics companies)** manage operations. [BS6]	**Economic: Private (Logistics firms)** dominate investments. **Public (Governments)** support local infrastructure [BS7]	**Knowledge: Private (Tech firms)** develop logistics platforms. **Public (Academia)** supports research.	**Norm-based: Social (Consumers)** expect efficiency and sustainability. **Private** focuses on cost reduction. [BS 10]
Logistics	Managing efficient movement of biomass to ensure timely delivery [LO 1].	**Transportation & Storage:** Maintaining quality and supply flow across the chain. [LO 2]	Trucking firms, rail operators, warehouse providers. [LO 3]	**Economic:** Enhances supply chain efficiency. **Social:** Supports economic hubs. **Environmental:** Lowers carbon footprint with optimized routes. **Digital:** AI-	**Niche Innovations:** Low-carbon logistics, biofuel-powered transport. **Regime Status:** Dependence on fossil-fuel systems. **Landscape Pressures:** Push for	**Social:** Urban-rural logistics partnerships. **Organizational:** Logistics hubs for efficient biomass distribution, digital platforms for route optimization. [LO 6]	**Power: Public (Governments)** set transportation and energy policies. **Private (Logistics firms)** manage operations. [LO 7]	**Economic: Private (Logistics and transport)** firms invest in fleet. **Public (Governments)** fund infrastructure [LO 8]	**Knowledge: Private (Tech firms)** drive logistics innovation. **Public (Academia)** conducts optimization studies.	**Norm-based: Social (Consumers)** demand cleaner logistics. **Private** focuses on cost-effectiveness.

				enabled logistics tracking. [LO 4]	decarbonization in logistics. [LO 5]					
Processing & Conversion	Converting raw biomass into bio-based products using biorefineries and technologies like fermentation, pyrolysis, and gasification.	**Transformation:** Adding value by turning raw materials into usable intermediates.	Biorefineries, chemical companies, biotechnology firms.	**Economic:** Drives value-added industries. **Social:** Generates skilled jobs. **Environmental:** Reduces reliance on fossil resources. **Digital:** Automation improves operational efficiency.	**Niche Innovations:** Advanced biorefineries, enzymatic conversions. **Regime Status:** Emerging but needs scaling. **Landscape Pressures:** Energy transitions, fossil fuel decline. [PC5]	**Social:** Skills development programs for biorefinery workers. **Organizational:** Collaborative biorefinery clusters, public-private partnerships. [PC6]	**Power: Public (Governments)** fund R&D and set environmental regulations. **Private (Corporations)** drive commercialization.	**Economic: Private (Biotech firms)** invest in scaling production. **Public (Governments)** provide R&D grants.	**Knowledge: Private (Biotech firms)** lead technological breakthroughs. **Public (Universities)** support research [PC 9]	**Norm-based: Social (Consumers)** demand greener products. **Private** emphasizes profit from innovation.
Intermediate Products	Outputs such as biochemicals, bio-oils, and bio-based fibers used in further production.	**Product Development:** Creating foundational materials for downstream use. [IP2]	Industrial manufacturers, intermediate goods producers.	**Economic:** Boosts industrial applications. **Social:** Encourages local manufacturing. **Environmental:** Creates eco-friendly alternatives. **Digital:** Digital twins model production processes. [IP4]	**Niche Innovations:** Bioplastics, bio-based chemicals. **Regime Status:** Competes with petrochemical dominance. **Landscape Pressures:** Ban on single-use plastics, public awareness of pollution. [IP 5]	**Social:** Community manufacturing hubs for small producers. [IP6.1] **Organizational:** Bio-based material standardization bodies, cross-industry alliances. [IP6]	**Power: Public (Governments)** enforce environmental standards. **Private (Corporations)** lead product innovation. [IP7]	**Economic: Private (Industrial firms)** dominate production. **Public (Governments)** fund sustainable alternatives.	**Knowledge: Private (Tech companies)** develop alternative materials. **Public (Academia)** drives fundamental research. [IP9]	**Norm-based: Social (NGOs)** advocate for greener alternatives. **Private** drives production efficiency. [IP10]
Product Development	Creation of bio-based	**Manufacturing:** Finalizing	Biotech startups,	**Economic:** Expands	**Niche Innovations:**	**Social:** Consumer	**Power: Public (Governments)**	**Economic: Private**	**Knowledge: Private (Innovative firms)**	**Norm-based: Social (Consumers)** demand eco-

	products (e.g., bioplastics, biofuels, biochemicals) and innovative materials like biodegradable polymers. [PD 1]	products for consumers or industries. [PD 2]	multinational corporations, R&D labs. [PD 3]	market opportunities. **Social:** Meets consumer needs sustainably. **Environmental:** Reduces plastic waste. **Digital:** AI accelerates product design and testing. [PD 4]	Bioplastics, sustainable biochemicals. **Regime Status:** Challenged by petrochemical dominance. **Landscape Pressures:** Consumer demand for greener products. [PD 5]	awareness campaigns on sustainable materials. **Organizational:** Industry-wide product standardization initiatives, packaging redesigns. [PD 6]	regulate safety and sustainability standards. **Private (Firms)** drive innovation. [PD 7]	**(Corporations)** lead production and distribution. **Public (Governments)** offer subsidies for green products. [PD 8]	lead in R&D. **Public (Academia)** provides scientific backing. [PD 9]	friendly products. **Private** focuses on meeting market needs. [PD 10]
Waste Management	Collection, recycling, and disposal of organic and non-organic waste materials through composting, anaerobic digestion, or landfilling.	**Waste Processing:** Converting waste into valuable resources or disposing sustainably.	Waste management firms, recycling centers, municipalities.	**Economic:** Creates waste-to-value business models. **Social:** Raises awareness of waste reduction. **Environmental:** Reduces landfill use. **Digital:** Digital tracking for waste management.	**Niche Innovations:** Waste-to-energy plants, compostable plastics. **Regime Status:** Fragmented industry needs integrated solutions. **Landscape Pressures:** Global waste crisis, zero-waste goals.	**Social:** Community-driven recycling initiatives. **Organizational:** Closed-loop supply chains, waste exchange platforms. [WM 6]	**Power: Public (Governments)** create waste regulations, incentivize recycling. **Private (Waste management firms)** provide services.	**Economic: Private (Recycling firms)** operate collection systems. **Public (Governments)** regulate and fund projects.	**Knowledge: Private (Tech startups)** develop recycling technology. **Public (Research institutions)** fund waste studies.	**Norm-based: Social (NGOs)** push for sustainable consumption. **Private** focuses on recycling efficiency.
Energy Recovery	Generating bioenergy from waste materials. [ER1]	**Sustainability Enhancement:** Maximizing energy and resource efficiency.	Renewable energy firms, biogas producers, utilities.	**Economic:** Reduces energy costs. **Social:** Provides alternative energy options. **Environmental:** Cuts greenhouse gas emissions.	**Niche Innovations:** Biogas plants, algae-based bioenergy. **Regime Status:** Limited adoption compared to fossil fuels. **Landscape Pressures:** Shift	**Social:** Energy cooperatives for local renewable projects. **Organizational:** Shared biogas systems for agricultural communities. [ER5]	**Power: Public (Governments)** create renewable energy policies. **Private (Energy firms)** develop biogas infrastructure. [ER 6]	**Economic: Private (Energy firms)** lead in biogas production. **Public (Governments)** provide subsidies for renewable projects.	**Knowledge: Private (Tech firms)** innovate in energy recovery. **Public (Research institutions)** fund biogas studies.	**Norm-based: Social (Environmental NGOs)** advocate for clean energy. **Private** focuses on profit from green energy.

				Digital: Smart grids manage energy distribution. [ER 3]	to renewable energy, carbon taxes. [ER 4]					
Supporting Systems	R&D for innovation, policies for sustainability, funding for projects, and collaboration between stakeholders. [SS1]	**Enabling Infrastructure:** Providing the framework and support for the bioeconomy.	Governments, academic institutions, investors, NGOs.	**Economic:** Fosters innovation and investments. **Social:** Encourages knowledge sharing. **Environmental:** Develops sustainable practices. **Digital:** Big data drives policy and innovation.	**Niche Innovations:** Policy labs, sustainability funds. **Regime Status:** Fragmented global collaboration. **Landscape Pressures:** Green growth agendas, international agreements (e.g., Paris Accord).	**Social:** Public innovation labs, knowledge networks. **Organizational:** Funding partnerships for bioeconomy innovation, cross-sectoral R&D collaborations. [SS5]	**Power: Public (Governments)** lead policymaking. **Private (Investors)** fund innovations.	**Economic: Private (Investors)** provide capital. **Public (Governments)** create funding programs.	**Knowledge: Public (Academia)** conducts research. **Private (Tech firms)** push technological advancements.	**Norm-based: Social (NGOs)** drive sustainability policies. **Private** drives profit-oriented innovations.
Circular Economy Integration	Designing products and systems to enable reuse, recycling, and composting, ensuring minimal environmental impact. [CE1]	**System Optimization:** Reducing waste and promoting resource efficiency across the chain. [CE2]	Policy makers, product designers, sustainability NGOs. [CE3]	**Economic:** Extends resource value. **Social:** Promotes sustainable behaviour. **Environmental:** Minimizes resource extraction. **Digital:** Circular systems leverage digital platforms [CE4].	**Niche Innovations:** Circular product designs, eco-industrial parks. **Regime Status:** Dominated by linear economy practices. **Landscape Pressures:** Rising demand for sustainable production systems. [CE 5]	**Social:** Circular economy advocacy campaigns. **Organizational:** Partnerships for circular supply chain management, regional circular economy frameworks. [CE 6]	**Power: Public (Governments)** lead regulation. **Private (Corporations)** adopt circular practices. [CE 7]	**Economic: Private (Corporations)** embrace circular models. **Public (Governments)** incentivize circular practices. [CE 8]	**Knowledge: Private (Startups)** push circular innovation. **Public (Academia)** supports circularity research. [CE 9]	**Norm-based: Social (NGOs)** promote circular lifestyle. [CE10, CE11] **Private** focuses on system efficiency. [CE 12]

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RIBES
REGIONAL INCLUSIVE BIOBASED ENTREPRENEURSHIP SOLUTIONS

The project

The **RIBES** project **aims** to enhance the uptake of bio-based innovations in nine (9) European regions (Bulgaria, Greece, Croatia, Italy, Poland, Romania, Serbia, Slovakia and Western Balkans) by developing new governance and business models that combine social entrepreneurship with rural development, thus advancing the transition to a circular economy.

Coordinator: **CENTRAL EUROPEAN INITIATIVE (CEI)**

PARTNER		SHORT NAME
CEI CENTRAL EUROPEAN INITIATIVE	Central European Initiative	INCE
Maastricht University	Maastricht University	UM
CERTH CENTRE FOR RESEARCH & TECHNOLOGY HELLAS	Centre for Research and Technology Hellas	CERTH
BIOCOM	BIOCOM	BIOCOM
WHITE	White Research	WR
UNIVERSITY OF HOHENHEIM	University of Hohenheim	UHOH
circe Creating together	CIRCE - Centro Tecnológico	CIRCE
Q-PLAN INTERNATIONAL	Q-PLAN International	QPL
arx.net MOBILE INNOVATIONS	ARX.net	ARX.NET
www.erdn.eu	European Rural Development Network	ERDN
	Agricultural University Plovdiv	AUP

	MedINA	MedINA
	Energy Institute Hrvoje Požar	EIHP
	SPRING	SPRING
	Lucian Blaga University of Sibiu	ULBS
	Rzeszowska Agencja Rozwoju Regionalnego S.A.	RARR
	Balkan Rural Development Network	BRDN
	Faculty of Technical Sciences University of Novi Sad	FTN
	Bioeconomy Cluster	BEC
	FORZA Agency for Sustainable Development of the Carpathian Region	FORZA