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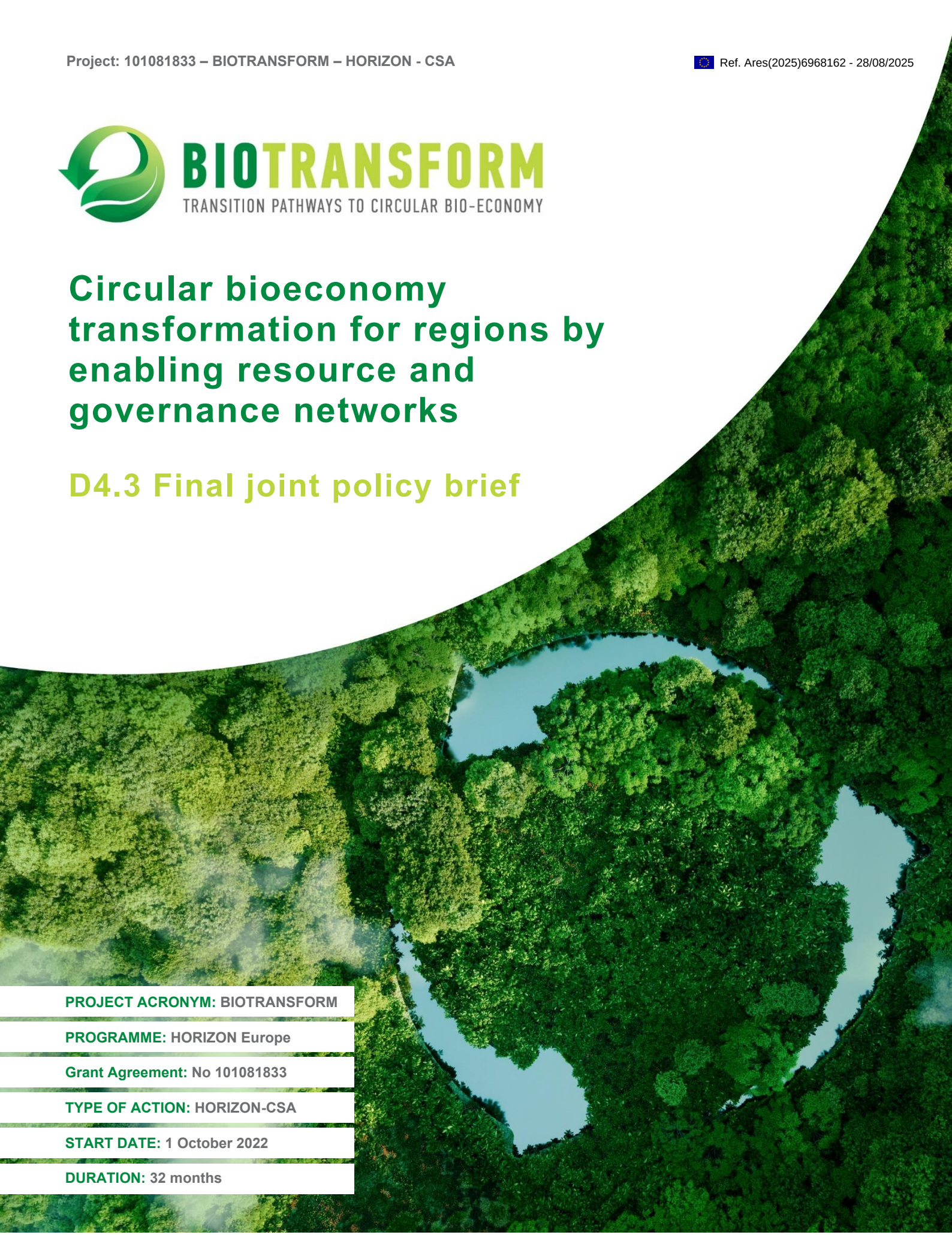
BIOTRANSFORM
TRANSITION PATHWAYS TO CIRCULAR BIO-ECONOMY

Circular bioeconomy transformation for regions by enabling resource and governance networks

D4.3 Final joint policy brief



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Executive Summary

The report formulates general policy recommendations targeting the European Union (EU) and national levels, to streamline the uptake of circular bioeconomy in European regions.
The objective of these joint policy recommendations is to accelerate the transition of EU regions from linear to circular bioeconomy (CBE). The following joint policy recommendations were mainly based on the research of the BIOTRANSFORM project, with the collaboration of three other EU projects - SUSTRACK, ROBIN and BIOMODEL4REGIONS.

The recommendations are based on the challenges and opportunities found in the studies conducted in the projects' pilot areas. The target audience is defined as decision-makers at EU level and national level, and focus on regulation, economic instruments, and technical support.

1. The BIOTRANSFORM project

The BIOTRANSFORM project comes to fill the current gap in policy guidelines for a successful transition from linear and fossil-based systems to circular bio-based ones. The project analysed and evaluated circular bio-based transition pathways across 6 regions in Europe (as described in detail in D3.2) and capitalised on these results to provide a comprehensive methodology towards an EU-wide transition tailored to policymakers.
BIOTRANSFORM equips policymakers with the tools to set informed priorities that serve environmental, economic, and social goals, being actionable, futureproof, and aligned with supply-and-demand trends in related industries and value chains.

2. Objective of the document and methodology

The BIOTRANSFORM joint policy recommendations aim to support EU and national policy makers in implementing actions that can foster the transition towards circular bioeconomy at regional level.

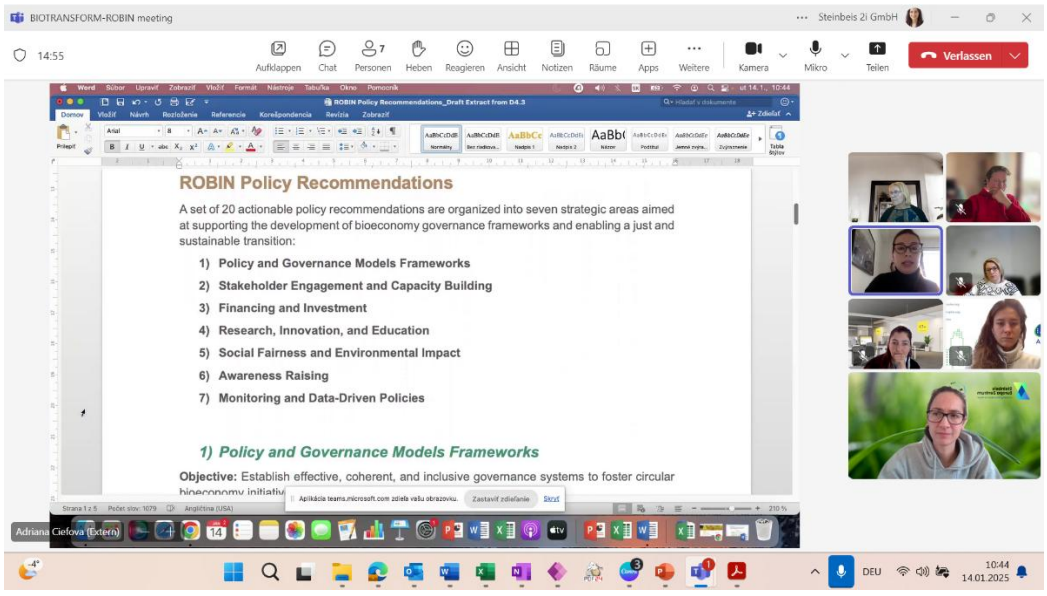
The key recommendations in this document are based on the findings of the BIOTRANSFORM project and its 6 pilot regions. The document further incorporates inputs and good practice examples from other three EU funded projects –BIOMODEL4REGIONS, SUSTRACK and ROBIN.

The document organises recommendations around four key themes (data for decisions, financing and business opportunities, governance and knowledge and education) and is supported by concrete illustrations from the project's outcomes and pilot regions' own experience.

The following documents and exchanges helped to identify the priority aspects to focus on:

-the BIOTRANSFORM policy brief on barriers and opportunities for circular bioeconomy

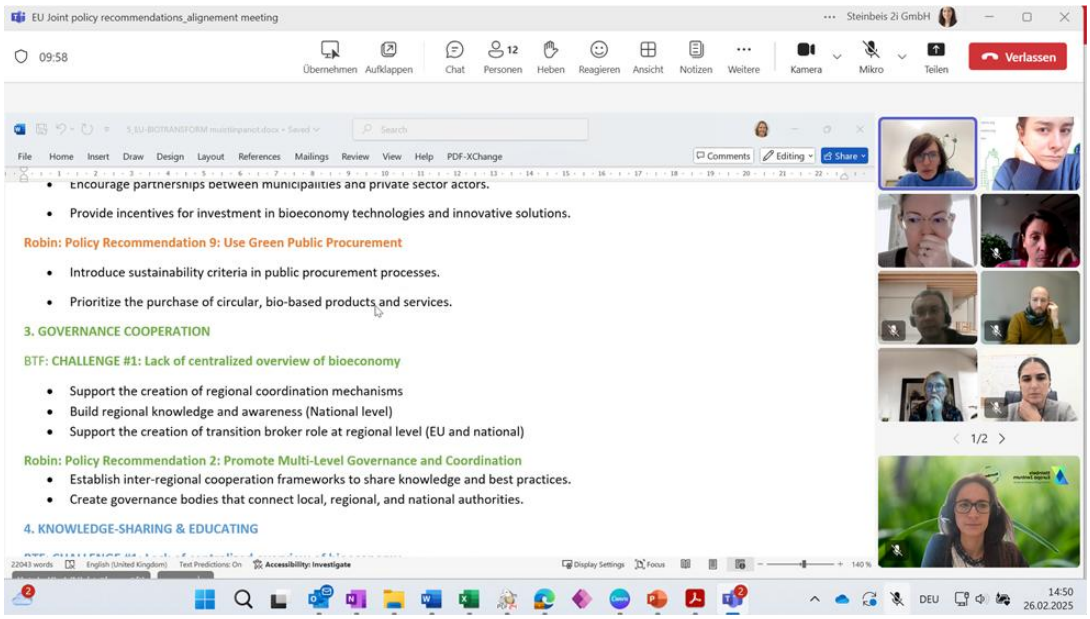
-the draft recommendations of the ROBIN project, shared during bilateral exchanges held in Q1 of 2025[1]



[1] ROBIN Policy Recommendations for Circular Bioeconomy Governance in Europe (See policy brief #3) have been published in July 2025 and they are available at this link: ROBIN_Deliverable template

-the exchanges and collaboration with other EU projects in the context of the BioFuture mutual learning workshop. During this workshop, five EU projects (including BIOTRANSFORM) presented key outcomes and learnings, with each delving into a priority theme. Most of these themes were included in these recommendations. theme. Most of these themes were included in these recommendations.

Based on the abovementioned inputs, the BIOTRANSFORM project drafted a first version of the recommendations and shared it as collaborative document for other projects to provide further suggestions. As a last step, an online meeting was organised in February 2025 featuring the participation of all projects involved to align on the final version and address remaining open points.



3. Data for decisions

While transitioning to circular bioeconomy, several environmental and socio-economic challenges are to be considered, such as addressing climate change and managing natural resources in a sustainable way, including preserving biodiversity. This is well illustrated in the case of **Northern Burgenland** (AT), where taking all pruning material from vineyards for bio-based applications can deplete soil organic carbon, making it more difficult to restore already degraded soils. This highlights the need for sustainable practices that leave or return some carbon and nutrients in a cascading utilisation to the field to maintain soil health.

From an impact perspective, the shift from a fossil to a bio-based economy can also generate socio-economic challenges, as bio-based value chains rely on interdependent actors, creating systemic risks. For instance, feedstock shortages or policy shifts in one sector can disrupt entire supply chains for other sectors

These trade-offs underline the need for careful sustainability assessment by combining environmental and socio-economic aspects to make informed decisions that balance bioeconomy goals with biodiversity conservation, ecosystem restoration and addressing socio-economic limitations. This approach was adopted in the context of the BIOTRANSFORM project, where to assess and compare the overall sustainability of proposed transition scenarios across different pilot regions, a multi-criteria decision analysis (MCDA) framework was applied. This method integrates quantitative environmental

life cycle impacts with semi-quantitative methodology, economic and social indicators, placing stakeholder engagement at the core of the decision-making process.

To conduct robust assessment, data on regional feedstock types, volumes, locations need to be available and easily accessible. Understanding resource flows, such as where materials go and how they are used, does not only allow to detect trade-offs, but is also essential to optimise systems and close resource loops. Additionally, data on logistics and infrastructure is crucial to link decentralized processing with centralized conversion systems efficiently.
Data on workforce composition, sectoral employment trends, and regional skill gaps is also critical for mitigating unemployment risks and designing training programmes. Harmonisation across Europe is vital for enabling cross-regional collaboration and providing entrepreneurs with reliable information on feedstock availability, labour market, product demand and funding schemes. Open access to harmonised data can support policymakers and entrepreneurs in making informed decisions, while addressing emerging gaps for new feedstocks and processes will further strengthen bioeconomy strategies.

3.1 Recommendations

3.1.1 Enable postal code-based resource flow tracking (EU)

Introduce a postal code system at the NUTS3 level to enable precise tracking of resource flows. This would allow policymakers and entrepreneurs to understand where resources are generated, processed, and utilised, facilitating better decision-making and planning.

3.1.2 Develop EU-wide standardised guidelines for collection and analysis of data on secondary streams (EU)

Create harmonised guidelines, for collecting, analysing, and reporting data on secondary streams, possibly led by EUROSTAT and/or JRC in collaboration with National Standards Institutes, for collecting, analysing, and reporting bioeconomy data. Guidelines should cover all types of feedstocks, including forestry residues, agricultural by-products, industrial organic waste, and biowaste. They should also ensure compatibility across regions to enable cross-border collaborations and scalability.

3.1.3 Establish publicly available regional databases for resource availability and utilisation (national)

Mandate national-level legislation to create and maintain annually updated, comprehensive, and freely accessible databases to support sustainability assessments of bioeconomy practices. These databases should be as transparent and as easily accessible as possible, to foster technical innovation for their valorisation and to ensure the materialization of the related environmental and socio-economic benefits. They should capture:

- Quantities, locations, and quality of available feedstocks

- Current uses and destinations of resources

- Seasonal and logistical fluctuations in supply.

-Regional skill mapping

In addition, integrate feedstock flows into national electronic waste management systems to monitor performance at both national and regional levels.

***Good practice (GP) from Finland**: Biomass Atlas is an online service for mapping, analysing and reporting biomasses from forestry and field, as well as manure and waste biomasses.*

***Good practice from Andalucia (ES)**: The Andalucian map on biomass potential gathers extensive information on the energy potential of biomass at the municipal level , with sectoral analyses and biomass production ratios derived from available data. Information on biomass installations in Andalucia can also be downloaded from this platform.*

3.1.4 Support regional resource mapping initiatives (National)

Encourage regions to develop resource maps (local biomass, industries, and workforce strengths) at the local level, supported by the national level. These maps should highlight potential feedstock hotspots, infrastructure availability, and logistics pathways, and several stakeholders, such as municipalities and industry players, should be involved in their design to ensure accuracy and relevance.

***GP from North Rhine Westphalia**: The State Office for Nature, Environment and Consumer Protection of North Rhine-Westphalia (LANUV) carried out* a study analyzing biomass availability in the Rhenish mining region*. The project was carried out from 2023 to 2025 on behalf of the Ministry for the Environment, Nature Conservation and Transport of the State of North Rhine-Westphalia (MUNV) and with funding from the Federal Ministry for Economic Affairs and Climate Protection of the Federal Republic of Germany (BMWK) and the State of North Rhine-Westphalia (NRW).*

3.1.5 Support regions in the definition of sets of indicators to monitor the progress of regional strategies (national and EU)

via guidelines and in the establishment of regional observatories to track bioeconomy progress

4. Financing and Business opportunities

A transition to circular bioeconomy requires both public and private financial support for setting up and bringing bio-based projects to market scale. However, the analysis of the pilot regions has highlighted that one recurrent challenge is the **lack of funding to support circular bioeconomy**.
This is largely due to the difficulty of **finding a sustainable business model** for many bio-based industries, caused among others, to possible fluctuations in the availability of input biomass (*i.e. the case of **Charles SPA (CZ)**, where the input is food waste, the volume of waste is subject to fluctuations due to seasonality of tourism*), and the low demand of bio-based products compared to mainstream products (*i.e. in the case of **North Rhine Westphalia** (DE), new bio-based flows such as sugar beet pulp for the chemical industry compete with long established and optimised systems*). In addition to the challenges above, the novelty of circular biobased business models generates a higher risk perception than conventional businesses, thus discouraging private investors from providing financial support.
In some regions, such as **Andalucia (ES)** and **North Rhine Westphalia (DE)**, circular bio-based projects often face significant barriers when transitioning from the development or pilot phase to commercialization. These challenges include high capital expenditure (CAPEX) requirements for scaling technologies, limited access to financing, and uncertainties in market demand for bio-based products. Additionally, the lack of supportive legal frameworks, standardized certification systems, and established supply chains further complicates this transition. Without clear pathways for scaling and financial backing, many innovative projects fail to achieve long-term economic viability.

4.1 Recommendations

4.1.1 Introduce market incentives to promote bio-based products (EU and national)

Introduce financial incentives for the production, marketing, and adoption of secondary bio-based materials (e.g., extracts, 2nd generation bioplastics, biochemicals, compost) and only after established utilisation cascades also bioenergy (EU Level). Such incentives could for instance consist in Value Added Tax (VAT) reductions for environmentally friendly secondary bio-based products produced within the EU, or direct investment subsidies for small and medium-sized enterprises (SMEs) transitioning from pilot to commercial scale.

These incentives should be linked to overall sustainability assessments (including Life Cycle Assessment and socio-economic assessments), prioritizing materials with demonstrable environmental benefits.

It has to be noted that supporting the bioeconomy with subsidies risks increasing total raw biomass harvests to an inefficient and unsustainable level. For example, total GHG emissions could rise if wood use is considerably increased for construction or textiles[2]. Therefore, to ensure efficient and sustainable use of biomass, policies to boost the bioeconomy should be combined with restrictions on biomass harvests or the use of virgin biomass, such as sustainability criteria.

4.1.2 Strengthen public procurement for secondary bio-based products, guided by EU recommendations for bio-based products (national)

- Set mandatory percentages of secondary bio-based materials in public projects, such as construction, landscaping, and waste management.
- Encourage local governments to prioritise regional bio-based products to stimulate local markets.

4.1.3 Create and/or ease access to dedicated financial mechanisms for scaling bioeconomy projects (EU and national)

- Establish easy access to **bioeconomy-specific funds** to provide low-interest loans or grants for the commercialisation of bio-based projects. Such funding should foresee programmes for specific Technology Readiness Levels (TRLs). It should also be accompanied by ad-hoc

[2] Hurmekoski et al. (2023): Does expanding wood use in construction and textile markets contribute to climate change mitigation?, Renewable and Sustainable Energy Reviews 174 (2023) 113152, https://doi.org/10.1016/j.rser.2023.113152.

advice and counselling service, to guide and help circular bioeconomy companies effectively scale-up and establish a sustainable business model.

- When a regional fund supporting circular bioeconomy projects is in place, such as the **2018-2024 Call for circular economy projects** launched by Pays de la Loire (and which supported 43 bioeconomy projects) valuable support could come from national and EU level in the form of **guidance on selection criteria,** to ensure the most promising and sustainable projects obtain the funding.
- Develop **regional venture capital funds or public-private partnerships** to reduce risks for investors in bioeconomy technologies and innovative solutions.
- Offer **guarantees for bioeconomy start-ups and SMEs** to help them secure loans for scaling their operations.

5. Governance

The transversal nature of circular bioeconomy entails that several policy departments in local and regional administrations are participating in the design and implementation of a circular bioeconomy strategy aiming at exploiting the local and regional potentials and innovations. This requires the alignment of their priorities and already existing sectoral regulations, resulting in a time and resource-consuming process that not all public administrations are willing to undertake. Inclusive internal governance and interservice cooperation are thus key to bring around the table the relevant public administrations and departments at local or regional level, and particularly those in charge of economic development, agriculture and rural affairs, environment and waste, as well as research and innovation.
For instance, this challenge has the potential to limit the impact of the BIOTRANSFORM project in **Western Macedonia (GR).** One of the primary issues is fragmented governance and stakeholder engagement. Sectors such as agriculture, forestry, waste management, and energy may operate independently, without unified communication channels or shared objectives. This fragmentation reduces the efficiency and effectiveness of the project, making it difficult to achieve the systemic change necessary for a successful circular bioeconomy. On the other hand, pilot regions **Finland, Andalucía (ES) and Baden-Württemberg (DE)** constitute a good practice, as they have succeeded in overcoming this challenge and drafting a regional strategy, developed by interministerial steering committees and implemented by several ministries.

5.1 Recommendations

5.1.1 Support the creation of regional coordination mechanisms

- Support the creation of a dedicated position, body, or network at the NUTS3 level, while involving already active players or supportive organizations in the region to ensure coordination across bioeconomy-related departments. At national and EU level, such kind of support could be provided through specific guidelines linked to the national bioeconomy strategy (if any) describing the main features and functions of this coordination body and providing examples of good practices at EU and national level.

- Support the establishment of innovative governance and collaboration models at local and regional level to achieve better-informed decision-making processes, social engagement and innovation. Thus, to support and strengthen EU and international science-policy interfaces to achieve the Sustainable Development Goals.
- If a circular economy organization is already active and operating in the region, like in the case of Finland, a dedicated department to circular bioeconomy should be established within this entity, which can act as coordination body.

***Good practice from Finland**: Finland has formulated the Finnish Bioeconomy Strategy. It is continued by Circular Economy Green Deal where voluntary commitments from organisations are collected aiming to reduce use of natural resources and enable circular economy. Implementation of the strategy is divided between several ministries, and it is carried out in cooperation with many actors. The regions having their own focus areas play a key role in achieving the objectives of the Bioeconomy Strategy, and the ministries hope that the regions will draft their own implementation plans. The Ministry of Economic Affairs and Employment will appoint a steering group for the implementation of the updated Bioeconomy Strategy." In addition, Finland's biodiversity policies are based on the National Biodiversity Strategy and an action plan to 2030, which is still underway. In addition to national objectives, the strategy considers the objectives of the UN Convention on Biological Diversity and the new EU Biodiversity Strategy and the Nordic Council of Ministers' Forest research strategy. The aim of the strategy is to halt the loss of biodiversity by 2030 and turn the trend towards recovery by 2035. Alignment between biodiversity, bioeconomy and climate targets needs to be found at national level first, to enable similar alignment at regional and local levels.*

5.1.2 Build regional knowledge and awareness (national)

- Organise training sessions and awareness campaigns targeted at farmers, SMEs, and policymakers to improve understanding of bioeconomy opportunities and benefits.
- Peer learning platforms: At national level, promote spaces for regions to share best practices. These platforms would also be a space for highlighting successful case studies, such as developed cases within BIOTRANSFORM and other circular bioeconomy projects.
- Develop best practice guidelines for local operators and innovation developers, supporting climate-neutrality and low environmental footprint improvements of bio-based products and services.

***Good practice from Baden-Württemberg:** The international "Bioeconomy Congress Baden-Württemberg" was first organised in 2014 as part of the Baden-Württemberg Bioeconomy research programme initiated by the Ministry of Science, Research, and the Arts. The congress now takes place every two-years and aims to promote networking and cooperation among several actors, and knowledge exchange about researcher, businesses and policymakers, with local and regional activities. The societal engagement is a key aspect of the initiative. During the congress important topics regarding bioeconomy are addressed by information sessions, discussion panels, workshops, excursions, and seminars including real-life practices.*

5.1.3 Support the creation of transition broker role at regional level (EU and national)

Support the creation of specialised roles at regional level to facilitate collaboration and alignment between local biomass, industries, and workforce strengths. Transition brokers are specialised roles/profiles facilitating the collaboration among sectors, by developing a territorial knowledge on available resources and users.

A successful model for this can be seen for example in the South Ostrobothnia region of Finland, where a network of public bodies, business development agencies, and specialised knowledge intermediaries collaborate to guide the bioeconomy transition[3]. Another effective approach is the establishment of regional cluster organisations, as seen in Romania[4] and the Nordic countries[5], which act as central hubs for innovation and collaboration.

From EU and national level, support to establish this role could be provided through:

- Specific funds and training programs to establish this professional profile
- Direct support to regions in defining the tools and instruments for the appointment of transition brokers (i.e. through a dedicated national info point for advisory services, national/EU guidelines)

6. Knowledge sharing and education

There is a general lack of specialised courses and trainings on complex and cross-sectoral topics such as bioeconomy and educational systems are not yet able to provide all the necessary skills required by the biobased industry. This is partly due to the complex and cross-sectoral nature of bioeconomy, as well as the rigid academic structures struggling to keep up with fast evolving industrial contexts[6].

This is even more true in regions where opportunities for higher education are already limited. Here, the younger population and educated workforce tends to migrate outside of the region, in turn reducing the potential of creating a pool of entrepreneurs willing to innovate and test new solutions in this area. This is for instance the case of **Charles SPA (CZ)** region, where qualified workforce, especially in the technical sectors, is lacking; in 2018, 19% of inhabitants had only attained basic education and 11.7% had university education. This may be partly due to the lack of technical universities in the region, despite the concentration of industry. The region is also trying to move away from coal-based activities, which has a significant impact on employment.

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[3] Laasonen, V., 2024. Building dynamic capabilities in the transition toward a knowledge-based bioeconomy: a case study of three Finnish regions. Regional Studies 58, 1308–1319. https://doi.org/10.1080/00343404.2023.2249499

[4] Vajda, B., Drăgan, G., Vajda, L., Gáspár, M.-M., Bagoly, M.L., 2025. The Role of Entrepreneurial Clusters in Advancing Circular Bioeconomy and Innovation: A Case Study from Romania. Sustainability 17, 3787. https://doi.org/10.3390/su17093787

[5] Klitkou, A., Jolly, S., Suvinen, N., 2023. Systemic intermediaries and the transition toward forest-based bioeconomy in the North. Review of Evolutionary Political Economy 4, 321–348.

[6] Source : BIOBEC project - D3.3_Report_about_the_analysis_of_educational_gaps_identified.pics.pdf

The establishment of trainings on bioeconomy to consolidate knowledge in the region is thus an opportunity to create employment, while supporting the region in addressing its economic transformation challenges and revitalizing the economy.

6.1 Recommendations

6.1.1 Establish regional bioeconomy training hubs (national)

- Foster collaborative learning among different bioeconomy stakeholders bringing groups with different knowledge perspectives together and strengthening their capacity to create and govern the bioeconomy clusters.

- Create specialised hubs within existing institutions such as universities, vocational or agricultural schools. Companies in the relevant sectors should also be involved. Training hubs would include a curriculum for bioeconomy transition brokers. They should align with regional needs and include practical courses on biomass utilisation and bioproduct development. They should also include remote options to avoid brain drain in the region.

An example of such hubs is the Bio-Based Education Centres (BBECs) conceptualised by the BIObec project. These centres aim to act as knowledge hubs bridging the gaps between academic institutions, students, innovation entities and policy makers, providing education and training services for a wide range of users, in line with capabilities and skills demanded by the bio-based industries. "A *BBEC is intended to be a bio-based education hub, a regionally delimited construct designed to build and coordinate a community of actors who offer education and training in the bioeconomy and promote knowledge and innovation in the field*"[7].

6.1.2 Develop EU-funded bioeconomy education programmes (EU)

- Expand initiatives in e.g., Erasmus+ to include bioeconomy-specific curricula.

6.1.3 Integrate bioeconomy into existing curricula (national)

- Add bioeconomy modules in school programs (i.e. in agronomy, engineering and business curricula) and vocational training, based on prior analyses of local labor market, to align with regional bioeconomy needs.
- Focus on practical skills and advanced training for professionals (such as the Master's Degree Programme in Chemistry and Analytics for Circular Economy (CACE) in Finland)

Good practice from Andalusia: The Andalusian strategy for circular bioeconomy *features a specific measure that addresses this issue: "**Measure B.3. promoting the introduction of***

[7] Report-on-expectations-on-future-BBEC-elaborated-summary-of-results.pdf

***bioeconomy into educational programs, curricular pathways, and professional training"**. This measure aims to integrate bioeconomy into the comprehensive education of individuals by introducing it into schools, as well as incorporating it into post-compulsory, higher, and professional training programs. This measure includes two main actions: **B.3.1. Introducing bioeconomy and/or its related fields into the curricular content of compulsory education, vocational training programs, relevant university degrees, as well as training courses focused on professional performance and practical skills for workers in related sectors** and **B.3.2. Assessing the state of the art of master's programs related to bioeconomy** and, if necessary, promoting the establishment of a specialized master's degree in bioeconomy.*

6.1.4 *Create a bioeconomy skills certification system (EU)*

Develop an EU-wide certification to standardise skills and improve mobility that covers key areas like cross-sectoral governance, biomass processing, and circular design.