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MAINSTREAMING SMALL-SCALE BIO-BASED SOLUTIONS ACROSS RURAL EUROPE

D4.7

Policy Insights

IUNG

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ABBREVIATIONS

BG	Bulgaria
CAP	Common Agricultural Policy
DK	Denmark
EC	European Commission
EL	Greece
ES	Spain
EU	European Union
Ff55	Fit-for-55
IE	Ireland
MS	Member State
NL	Netherlands
PL	Poland
R&D	Research and Development
RBA	Rural Bioeconomy Alliance
SDG	Sustainable Development Goals
SE	Sweden

Executive Summary

The report D4.7 “Policy insights” is part of task 4.4 “Synthesis of lessons learnt into practical replication guidelines and policy recommendations” carried out in the Horizon Europe MainstreamBIO Project. An initial set of "Policy Insights" is based on outcomes from WP1 “Analysis of current situation and set-up of regional multi-actor innovation platforms” and WP2 “Development of innovation support services and digital toolkit” activities of the project and desk research. Policy insights aim to indicate how the EU can help mainstream small-scale bio-based solutions in rural areas.

This report spans three phases:

- The first phase aims to provide an overview of the current regulatory framework in the field of bioeconomy at European level,
- The second phase analyses selected documents and identifies policy gaps from a stakeholder perspective,
- The final section discusses the political insights resulting from the realization of the MainstreamBIO project so far.

A review of policy documents and publications indicated that at EU level, the bioeconomy is regulated by over 90 policies. Many are still not completely coherent with the core bioeconomy objectives and do not act in synergy with each. Therefore, further updating these policies can better align their objectives with that of the Bioeconomy Strategy. The literature raises the need for greater coordination and harmonisation of these policies. Still many studies criticise the lack of regulations and strategies for ensuring sustainability embedded in many bioeconomy policies and definitions. On the one hand, the need to better respond and contribute to the new policy context is raised, while on the other, greater stability of policies over time is expected.

While progress is being made in countries and regions adopting Bioeconomy Strategies tailored to their circumstances, in places where they have not yet been adopted, this can be an obstacle to bioeconomy development. However, the main barriers to bioeconomy management identified at national level are the lack of capital for start-up companies in the bioeconomy sector. Another significant barrier identified at national level is the lack of policy coordination and harmonisation as it hinders the bioeconomy development. Further improvements in bioeconomy governance are needed as it is tempting to conclude that the current bioeconomy governance framework can open opportunities for bio-based innovation processes but cannot support sustainable economic success beyond the early stages of transition.

Broadening stakeholder participation in policymaking and bioeconomy governance is important. As the literature shows, currently, the bioeconomy is mostly discussed in a triangle of government, researchers, and industry. Policy gaps sketched from the perspective of a wider representation of bioeconomy stakeholders are therefore presented. All comments in this regard are relevant but the views of farmers and forest owners should be particularly noted, as this group of stakeholders is underrepresented in the discourse on bioeconomy.

Small-scale bio-based solutions are subject to all regulations that relate to the bioeconomy. There are no specific references for these solutions in EU, national or regional legislation. In their case, expected changes in policies and governance relate to: unblocking political initiative, extending financial incentives and direct financial support, extending education and outreach to relevant stakeholders, raising awareness, showing all the benefits of applications,

direct financing of good solutions, specific tax reliefs from the initial investments, targeting initiatives to young people, clear policy on biobased products, waste mobilization and valorisation, certifications and standards for a wide range of bio-based products, shielding measures for SMEs and start-ups in the critical phases of their development, removal of bureaucratic barriers, and better cooperation with the administration.

1. Introduction

An initial set of "Policy Insights" is based on outcomes from WP1 “Analysis of current situation and set-up of regional multi-actor innovation platforms”, and WP2 “Development of innovation support services and digital toolkit” activities. The study additionally carried out desk research of policy documents and current literature on bioeconomy policies and governance. Surveys on policies relating to small-scaled bio-based solutions in the focal regions of the project were also included in the analyses. The surveys were completed by consortium members.

The structure of the current report is as follows:

Chapter 2: presents the overall approach and the methodological steps applied;

Chapter 3: presents bioeconomy policies from an EU, MS, and stakeholder perspective;

Chapter 4: includes political insights gathered during the course of the project to date;

Chapter 5: synthesises of the studies conducted, to obtain the main political insights.

2. Methodological approach

Report D4.7 summarises information on policies relating to the bioeconomy from primary and secondary sources. In the first phase, a targeted desk research was conducted using documents and literature to provide an overview of the current regulatory framework in the field of bioeconomy at European level. Phase two of the study identifies policy gaps from a stakeholder perspective at a national level, based on the literature. In phase three of the study, information was extracted from the MainstreamBIO reports on barriers to the development of small-scale biobased solutions and suggested policy initiatives that could remove these barriers. This information was derived from surveys conducted among the four categories of the Quadruple helix (Industry, Academia, Government and Civil Society). The survey was disseminated using the partner network in the 7 countries involved, with a target number of respondents of 350 across the quadruple helix categories. The survey methodology is described in D1.2 “Report on context and needs of rural stakeholders”. An additional source of information on the policies applied to MainstreamBIO's focal regions was a survey of consortium members. Based on the information gleaned from the surveys in the third phase of the study, preliminary policy recommendations were formulated that can help overcome identified gaps or regulatory shortcomings that hinder the development of small-scale bio-based solutions.

3. Political landscape in bioeconomy

3.1 Origins of bioeconomy

The history of the concept of the bioeconomy dates to the second decade of the 20th century (Fig. 1). However, it began to have significant relevance in policymaking in the 1980s and 1990s, when biotechnology began to drive industrial transformation, sparking interest among economists[1],[2]. Bioeconomy concepts and policies have evolved over the years. In 2005, the term “knowledge-based bioeconomy” was adopted within the EU, in line with the emphasis on innovation policy.[2] In 2007, the EU’s Cologne Paper introduced two perspectives on the bioeconomy: (i) the biotechnology innovation perspective and (ii) the resource substitution perspective. In 2012, the EC published its first bioeconomy strategy, defining it as “the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy”[3]. It was entitled 'Innovating for Sustainable Growth: A Bioeconomy for Europe' and was structured around three pillars: (i) investment in research, innovation, and skills, (ii) enhancement of markets and competitiveness, and (iii) reinforced policy co-ordination and stakeholder engagement. In 2014, the EU and Bio-based Industries Consortium established the €3.7bn Bio-based Industries Joint Undertaking public-private partnership, which ran until 2021[4]. In 2017, The European Commission's Bioeconomy Knowledge Centre was established, with the aim of bridging the worlds of science and policymaking. In 2018, the bioeconomy strategy was broadened, placing emphasis on the objectives beyond economic goals, reflecting global and EU environmental policy developments, including the EU Circular Economy, the EU Energy Union, the Paris Climate Agreement, and the 2030 Agenda for SDGs.[5, 6] The pillars of this strategy were: (i) strengthen and scale-up the bio-based sectors, unlock investments and markets, (ii) deploy local bioeconomy across Europe, and (iii) understand the ecological boundaries of the bioeconomy. In 2022, the EU Bioeconomy strategy Progress Report was presented.[7, 8] The Progress Report shows that the actions are on track to achieving the main objectives of the Bioeconomy Strategy:

[1] Gould H., Kelleher L., O’Neill E., 2023. Trends and policy in bioeconomy literature: A bibliometric review. EFB Bioeconomy Journal 3, 100047, https://doi.org/10.1016/j.bioeco.2023.100047

2 Birner, R., 2018. Bioeconomy concepts. In: Bioeconomy. Springer, pp. 17–38, https://link.springer.com/chapter/10.1007/978-3-319-68152-8_3

3 EC, Directorate-General for Research and Innovation, 2012. Innovating for sustainable growth – A bioeconomy for Europe, Publications Office, 2012, https://data.europa.eu/doi/10.2777/6462.

4 Lange, L., Connor, K.O., Arason, S., Bundgård-Jørgensen, U., Canalis, A., Carrez, D., Gallagher, J., Gøtke, N., Huyghe, C., Jarry, B., Llorente, P., 2021. Developing a sustainable and circular bio-based economy in EU: by partnering across sectors, upscaling and using new knowledge faster, and for the benefit of climate, environment & biodiversity, and people & business. Front. Bioengineering Biotechnol. 8, 619066, https://www.frontiersin.org/articles/10.3389/fbioe.2020.619066/full?&utm_source=Email_to_authors_&utm_mediu.

5 EC, Directorate-General for Research and Innovation, 2018. A sustainable bioeconomy for Europe – Strengthening the connection between economy, society and the environment – Updated bioeconomy strategy, Publications Office, 2018, https://data.europa.eu/doi/10.2777/792130.

6 European Commission, Knowledge Centre for Bioeconomy. Bioeconomy Strategy. https://knowledge4policy.ec.europa.eu/bioeconomy/bioeconomy-strategy_en.

7 European Commission, Directorate-General for Research and Innovation, 2022. European bioeconomy policy – Stocktaking and future developments – Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Publications Office of the European Union, 2022, https://data.europa.eu/doi/10.2777/997651.

8 Council of the European Union, 2023. Council conclusions on the opportunities of the bioeconomy in the light of current challenges with special emphasis on rural areas, 8406/23, https://data.consilium.europa.eu/doc/document/ST-8406-2023-INIT/en/pdf.

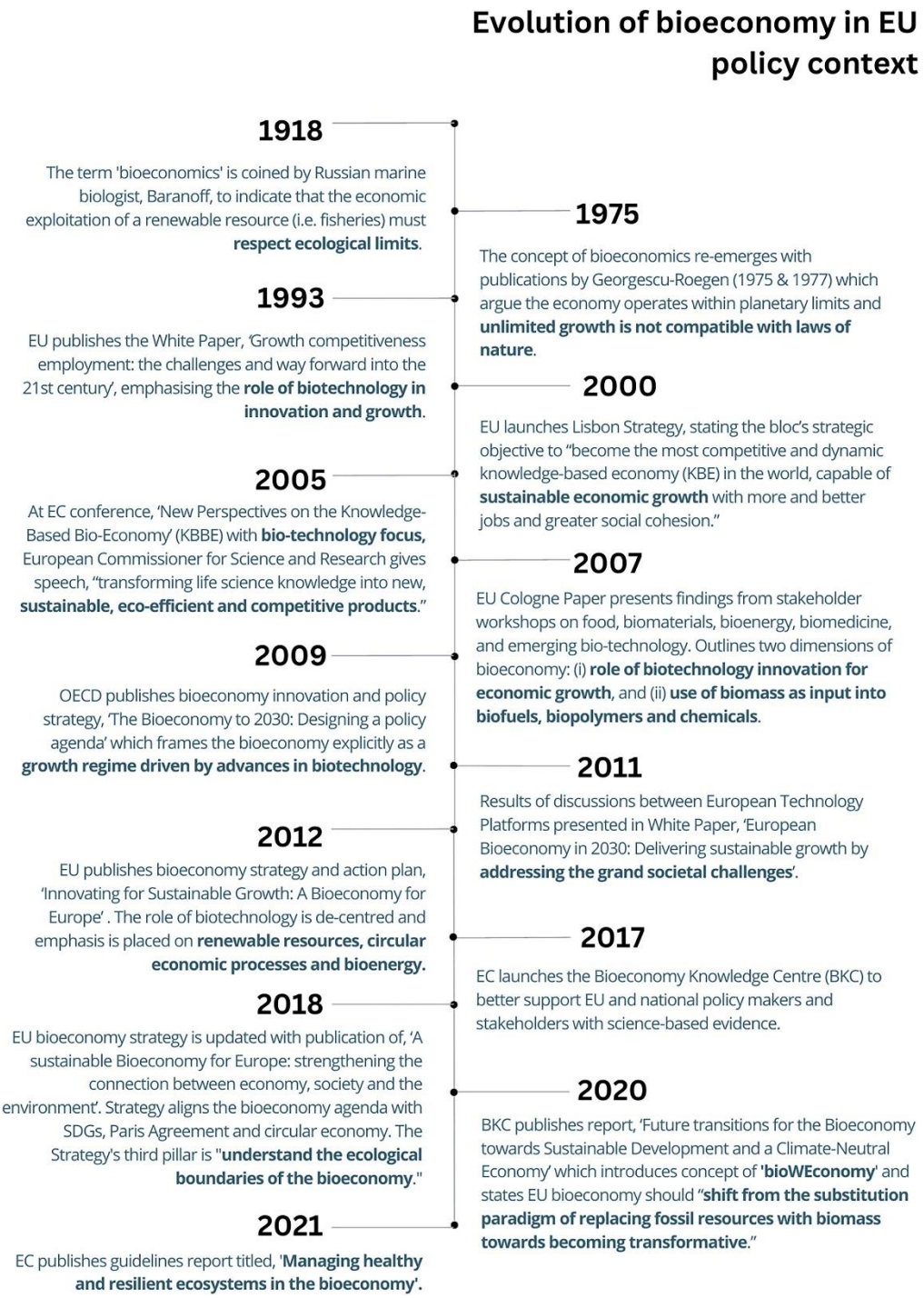

Figure 1 An overview of the bioeconomy concept and its evolution related to EU policy [1].

- An increasing number of national and regional bioeconomy strategies, promotion of cross-sectoral cooperation and sustainability principles, and investment in bioeconomy innovation.
- Progress on bioeconomy deployment has been achieved in Central and Eastern European countries, aided by significant EU funding contributions and the establishment of new fora and networks.

- Mobilisation of private investments and research and innovations in food and other bio-based industries are increasing and show promising developments. Europe has a strong position in the global market for bio-based chemicals and materials.
- The review has also identified gaps in the current Action Plan that require further action. First, increased focus on how to better manage land and biomass demands to meet environment and economic requirements in a climate neutral Europe. Second, work on more sustainable consumption patterns to ensure environmental integrity.

3.2 Links between the Bioeconomy Strategy and key European Commission policies

In its current form, the Bioeconomy is linked to the implementation of mainly the following policies: The European Green Deal, The Farm to Fork Strategy, The New EU Forest Strategy for 2030, The Biodiversity Strategy for 2030, The EU Soil Strategy for 2030, The Circular Economy Action Plan, The Common Agricultural Policy, The Fit-for-55, REPower EU goals and Member States' Strategic Plans.[8]

The European Green Deal was launched in 2019 as a new growth strategy that aims to transform the EU into a modern, resource-efficient and competitive economy, where: (i) there are no net emissions of greenhouse gases by 2050, (ii) economic growth is decoupled from resource use, and (iii) no person and no place is left behind.[9] Bioeconomy can contribute to these goals by: implementing climate pact and climate law, promoting clean energy, investing in sustainable transport, strewing for green industry, financing green projects, using new source of renewable biomass and biobased materials, developing sustainable bioeconomy which can contribute to the enhancement of biodiversity while improving the provision of ecosystem services.[9]

The Farm to Fork Strategy is geared towards transition to a sustainable EU food system that safeguards food security and ensures access to healthy diets sourced from a healthy planet.[10] It will reduce the environmental and climate footprint of the EU food system and strengthen its resilience, protecting citizens' health and ensuring the livelihoods of economic operators. The strategy sets concrete targets to transform the EU's food system, including a reduction by 50% of the use and risk of pesticides, a reduction by at least 20% of the use of fertilizers, a reduction by 50% in sales of antimicrobials used for farmed animals and aquaculture, and reaching 25% of agricultural land under organic farming.

The New EU Forest Strategy for 2030 defines general principles for producing forestry biomass sustainably.[11] European forests are under increasing strain, partly because of natural processes but also because of increased human activity and pressures. This new EU Forest Strategy aims to overcome existing challenges and unlock the potential of forests for the future,

[9] EC. Knowledge Centre for Bioeconomy. Bioeconomy & European Green Deal. https://knowledge4policy.ec.europa.eu/bioeconomy/bioeconomy-european-green-deal_en.

10 EC. Communication COM/2020/381: A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system. https://knowledge4policy.ec.europa.eu/publication/communication-com2020381-farm-fork-strategy-fair-healthy-environmentally-friendly-food_en.

[11] EC. Communication COM/2021/572: New EU Forest Strategy for 2030. https://eur-lex.europa.eu/resource.html?uri=cellar:0d918e07-e610-11eb-a1a5-01aa75ed71a1.0001.02/DOC_1&format=PDF.

in full respect for the principle of subsidiarity, best available scientific evidence and better regulation requirements.

The Biodiversity Strategy for 2030, adopted in 2020, setting out a comprehensive package of commitments and actions to put Europe's biodiversity back on the path to recovery by 2030.[12] The Strategy calls on the Commission to put forward a proposal for legally binding EU nature restoration targets to fill the gaps in the existing regulatory framework and promote the restoration of degraded and carbon-rich ecosystems. Doing so will also give a major boost to Europe's other key environmental challenge, that of climate adaptation and mitigation as well as disaster prevention.

The EU Soil Strategy for 2030 sets out a framework and concrete measures to protect and restore soils and ensure that they are used sustainably.[13] It sets a vision and objectives to achieve healthy soils by 2050, with concrete actions by 2030. It also announces a new Soil Health Law by 2023 to ensure a level playing field and a high level of environmental and health protection.

The Circular Economy Action Plan presents a set of interrelated initiatives to establish a strong and coherent product policy framework that will make sustainable products, services, and business models the norm and transform consumption patterns so that no waste is produced in the first place.[14] This product policy framework will be progressively rolled out, while key product value chains will be addressed as a matter of priority. For the bioeconomy, this will mean promoting increased use of organic waste and recycling of biological resources.[15]

The Common Agricultural Policy (CAP) (2023-2027) includes the bioeconomy explicitly under one of its specific objectives.[7] This policy allows Member States to set out interventions adapted to their local realities to promote the development of the Bioeconomy in rural areas, providing the possibility to move from individual projects to a more systemic approach and supporting primary producers in their efforts to innovate and drive the bioeconomy. CAP in the context of the bioeconomy should contribute to making biomass available at affordable and stable prices and regulate the environmental impact.[16]

The Fit-for-55 - under the European Climate Law, the EU committed to reduce its net greenhouse gas emissions by at least 55% by 2030. The 'Fit for 55' package of legislation makes all sectors of the EU's economy fit to meet this target. It sets the EU on a path to reach its climate targets in a fair, cost-effective and competitive way.[17]

REPower EU is about rapidly reducing dependence on Russian fossil fuels by fast forwarding the clean transition and joining forces to achieve a more resilient energy system and a true

12 EC, Directorate-General for Environment, Restoring nature – For the benefit of people, nature and the climate, Publications Office of the European Union, 2022, https://data.europa.eu/doi/10.2779/439286
13 EC. Communication COM/2021/699: EU Soil Strategy for 2030. Reaping the benefits of healthy soils for people, food, nature and climate. https://eur-lex.europa.eu/legal content/EN/TXT/PDF/?uri =CELEX:52021DC0699.
14 EC, Communication COM/2020/98: A new Circular Economy Action Plan for a cleaner and more competitive Europe. https://eur-lex.europa.eu/resource.html?uri=cellar:9903b325-6388-11ea-b735-01aa75ed71a1.0017.02/DOC_1&format=PDF.
15 EC, Knowledge Centre for Bioeconomy. Bioeconomy & Circular Economy. https://knowledge4policy.ec.europa.eu/bioeconomy/bioeconomy-circular-economy_en
16 EC, Knowledge Centre for Bioeconomy. Bioeconomy & Agriculture Policy. https://knowledge4policy.ec.europa.eu/bioeconomy/bioeconomy-agriculture-policy_en
17 EC, Commission welcome completion of 'Fit for 55' legislation, putting EU on track to exceed 2020 targets. 9 October 2023. https://ec.europa.eu/commission/presscorner/detail/en/ip_23_4754

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Energy Union.[18, 19] Its main objectives are to save energy, diversify supplies, quickly substitute fossil fuels by accelerating Europe's clean energy transition, and to smartly combine investments and reforms. These objectives are in close connection with the 'Fit for 55' package.

3.3 Other policies related to the bioeconomy

The overview of the main bioeconomy policies presented seems to indicate a growing need to analyse them from a value chain perspective. A structural review identified over ninety policies relevant to the biomass, bioprocessing, and biobased products.[20] A catalogue of these policies can be found in the cited paper, which applied the value chain approach to identify challenges and policy gaps across non-food biomass value chains. In doing so, it also examined the objectives of the policies to understand how they can be updated to align with the core objectives of the Bioeconomy Strategy. The latter will be discussed in more detail in another section of the paper presented.

3.4 Key mechanisms supporting bioeconomy policies and strategies in the EU

The further deployment of bioeconomy policies and strategies within the EU is supported through certain key mechanisms. Among the more important ones are these briefly described below.

The **EU Commission's Knowledge4Policy (K4P) platform** supports evidence-based policymaking, bridging the world of policymakers who ideally develop public policy based on sound scientific evidence and the scientists who develop that evidence in the first place.[21, 22] K4P is published by 20 "Knowledge Services": multidisciplinary teams led by the European Commission's Joint Research Centre and involving multiple Commission departments.

Knowledge Centre for Bioeconomy supports policymaking by[23, 24]:

- Identifying, filtering, and structuring relevant information and making it accessible.
- Bringing together researchers, policymakers, and other experts in the field.
- Analysing, synthesising available evidence, and communicating it in a transparent, tailored, and concise manner.
- Enhancing the knowledge base for policymaking on the bioeconomy.

[18] EC, Communication COM/2022/138. Security of supply and affordable energy prices: Options for immediate measures and preparing for next winter. https://eur-lex.europa.eu/resource.html?uri=cellar:22b6b0f8-aac5-11ec-83e1-01aa75ed71a1.0001.02/DOC_1&format=PDF

[19] EC, Communication COM/2022/230. REPowerEU Plan. https://eur-lex.europa.eu/resource.html?uri=cellar:fc930f14-d7ae-11ec-a95f-01aa75ed71a1.0001.02/DOC_1&format=PDF

[20] Singh, A., Christensen, T., Panoutsou, C., 2021. Policy review for biomass value chains in the European bioeconomy. Glob. Transitions 3, 13–42 https://www.sciencedirect.com/science/article/pii/S2589791820300256

[21] EC, Knowledge for Policy. Supporting policy with scientific evidence. https://knowledge4policy.ec.europa.eu/about-knowledge4policy_en

22 EC. Knowledge4Policy: Structure & Future. https://knowledge4policy.ec.europa.eu/sites/default/files/Knowledge4Policy-structure-2022-april.pdf

23 EC Knowledge Centre for Bioeconomy. https://knowledge4policy.ec.europa.eu/bioeconomy/about_en

24 EC. The European Commission's Knowledge Centre for Bioeconomy. https://knowledge4policy.ec.europa.eu/sites/default/files/jrc114122_a0_infografica_bioeconomy_07-01-2019.pdf

European Bioeconomy Policy Forum is a knowledge exchange and policy dialogue forum for EU member states.[25, 26] It has five objectives, enabled by a dual structure: a strategic and political level group, and an operational and working expert level group. The Forum pursues five main objectives, which are:

- Support networking and interaction between member states.
- Enhance cooperation and best practice exchange.
- Shape a concrete agenda of joint actions.
- Increase the visibility/potential of the bioeconomy.
- Enable policy feedback and analysis.

Bioeconomy Policy Support Facility was formed, with the objective of supporting the member states in the development of their own dedicated national bioeconomy strategy and action plans.[27] Concerning governance, the facility took the form of a Mutual Learning Exercise with the aim of identifying and sharing best practices by member states. The process was steered by independent experts and workshops were held addressing specific objectives (e.g., encouraging interministerial cooperation and stakeholder engagement, funding of bioeconomy development).

3.5 Bioeconomy strategies in EU Member States (MS)

There are currently ten MS with dedicated bioeconomy strategies and seven that are in the process of developing theirs.[7] According to the July 2022 EC report "since 2018, there have been several developments at national level: Austria, the Netherlands and Portugal have developed a (new) national strategy while Croatia, Czechia, Poland and Slovakia (supported by the BIOEAST initiative) as well as Sweden, started the process of developing one. Furthermore, Germany, Ireland, Italy, and Finland have updated their existing strategies or action plans, and Finland, France and Spain are currently updating their existing national strategies or action plans.[7] Furthermore, 28 EU regions have their own dedicated bioeconomy strategies in place and 69 other EU regions are in the process or have already adopted strategies in which the bioeconomy is one of the key elements [7] [28]. Within the European scenario, Norway and the UK also have a dedicated bioeconomy strategy while Denmark has a national bio economy panel that are providing recommendations for the government [29].

The 10 policy recommendations for building national (or regional) bioeconomy towards a fair and just climate neutral Europe may be helpful in developing national bioeconomy strategies.

25 EC, Research and innovation. High-Level Launch of the European Bioeconomy Policy Forum. https://research-and-innovation.ec.europa.eu/events/upcoming-events/high-level-launch-european-bioeconomy-policy-forum-2020-11-12_en

26 Gardossi L., Philp J., Fava F., Winickoff D., D'Aprile L., Dell'Anno B., Marvik O. J., Lenzi A., 2023. Bioeconomy national strategies in the G20 and OECD countries: Sharing experiences and comparing existing policies. EFB Bioeconomy Journal, 3, 100053.

27 EC, Policy Support Facility. https://ec.europa.eu/research-and-innovation/en/statistics/policy-support-facility

28 Haarich, S., Kirchmayr-Novak, S., 2022. Bioeconomy Strategy Development in EU regions, Sanchez Lopez J., Borzacchiello M.T. and Avraamides M. Editors. Publications Office of the European Union, Luxembourg ISBN 978-92-76-49341-9 doi: 10.2760/065902.

29 Barrett p., Dupont-Inglis J, Kulišić B., Maes D., Vehviläinen A., 2021 Deploying the Bioeconomy in the EU: A framework approach for bioeconomy strategy development 10 policy recommendations for building national bioeconomies toward a fair and just climate neutral Europe. doi:10.2777/443131. Luxembourg: Publications Office of the European Union, 2021

These recommendations were developed by an independent team of experts considering feedback from experts in the Mutual Learning Experience (MLE), as well as the principles of good governance and systems transition approaches. The document states that: “As a first step towards capturing bioeconomy potential and facilitating transition, political recognition and a mandate for a structured strategic and consultative process is needed to develop an impactful national bioeconomy strategy and action plan. This should bring together and collectively engage bioeconomy policymakers and stakeholders, including primary producers, industry, researchers, academics, non-governmental organisations, and citizens. Secondly, co-creation opportunities should also be explored with these key actors. These opportunities should seek to address local and regional challenges and concerns while ensuring that national bioeconomy development is underpinned by a set of guiding principles on sustainability, innovation, food security, circularity, environmental management, biodiversity protection and multi-actor engagement. Thirdly, dynamic evaluation and ongoing monitoring are needed to ensure the implementation of fully integrated policy that enables the breakthrough of bio-based innovation and develops sustainable, circular bioeconomy”. As the recommendations may be useful for countries preparing strategies, they are reproduced as in the original (tab. 1).

3.6 Bioeconomy policies from a stakeholder perspective

In general, feedback received from Member State experts, members of the European Bioeconomy Policy Forum as well as from external stakeholders shows a positive perception of the EU Bioeconomy Strategy with its Action Plan.[7] However, this feedback also showed further needs to better respond and contribute to the new policy context since the adoption of the European Green Deal and related initiatives, such as:

- A stronger focus on sustainability assessment and sustainable management and use of biological resources (e.g. by addressing relevant trade-offs and excessive consumption).
- A broad multi-stakeholder engagement, strong engagement of citizens and young people.
- A strengthened and comprehensive evaluation and monitoring system.
- Socio-economic aspects such as the impact on the local population and resource price.

Stakeholder perception of the bioeconomy and related policies is not only a useful methodology for identifying real problems in the development of a specific policy but also fundamental for providing rational and appropriate solutions. This issue is therefore worth paying particular attention to.

Table 1 . The 10 policy recommendations for building national or regional bioeconomy[29]

Getting Started		Brief Description	Highlighted Action
Policy Message 1	Ensuring stronger recognition of the importance of bioeconomy policy by decision-makers and stakeholders	In each MS, it is crucial that at the highest political level necessary, policy-makers ensure demonstrable long-term, ongoing commitment towards the development of a national and regional sustainable, circular bioeconomy	The EU Competitiveness Council should request an update from EU MS on how they have responded to the call in the Council conclusions (14594/19)4) "to develop or update their national strategies on sustainable and circular bioeconomies, taking into consideration macro-regional and regional specificities and appropriate initiatives". Collaborative initiatives between MS achieving a high-level political commitment to legitimise bioeconomy policymaking should be sought.
Policy Message 2	Moving from a bioeconomy concept to developing a vision	Each MS should examine the status, positioning and importance of the bioeconomy within its own economy from a range of different perspectives to co-create an integrated vision and to ensure a collaborative approach towards the development its bioeconomy.	A shared vision should be co-created between governmental and nongovernmental experts of what a future bioeconomy should look like and of what should be undertaken within the bioeconomy to aid the achievement of carbon neutrality by 2050.
Policy Message 3	Creating spaces for building collective bioeconomy awareness and leadership	The development of sustainable and circular bioeconomies in MS will involve multiple actors, inside and outside of government, over	In the longer-term, the establishment of formal platforms for engaging stakeholders, such as Bioeconomy Councils, Panels,

		extended time periods. To allow for such engagement, there is a need to develop spaces for engagement to identify, design and implement a bioeconomy vision.	and Forums should be considered to ensure ongoing engagement in inputting to, monitoring and evaluating bioeconomy strategies and action plans.
Building Transformative Coalitions		**Brief Description**	**Highlighted Action**
Policy Message 4	Coordinating across government and across different levels of government to support bioeconomy strategy design and development	The transition to sustainable and circular bioeconomies in MS may not fall neatly under the responsibility of a single government department. A key challenge is the need to build collective leadership capacity to innovate at a scale while integrating numerous policy domains.	Formal groups, such as inter-ministerial groups with mandated members from different ministries and agencies, are considered best practice and should be established to allow for stability in coordination and communication. They also help to ensure long-term commitment to bioeconomy development that outlives electoral cycles and changes in government and its leadership, cabinet compositions or government programmes. The formal groups should reflect the diversity of perspectives needed to represent the transition towards a sustainable and circular bioeconomy.
Policy Message 5	Identification of existing bioeconomy initiatives for building a coherent action plan	The identification of existing and on-going bioeconomy initiatives and lead innovators is a first step towards developing a coherent action plan. These initiatives can serve as lighthouse projects,	MS should use various activities funded through EAFRD, ERDF, Horizon 2020/Europe and national funding to identify existing bioeconomy actions. In this way, they can capture

		motivating case studies or learning environments.	emerging ideas, collect information and connect with local stakeholders. Such activity will yield valuable information through the diversity of perspectives, priorities and concerns. It will also aid the identification of lead innovators who can play a major role in transforming value chains when they adopt new technologies and practices. In doing so, they can help disseminate innovative best practices which can have a significant impact in developing the bioeconomy.
Policy Message 6	Establishing collaborative bioeconomy partnerships for co-investment	Bioeconomy developments by their very nature are highly collaborative activities, requiring participation, expertise and investment on the part of multiple actors. These include government, the private sector, primary producers and entrepreneurs at project level and civil society through engagement consultation and participation.	State agencies/companies and clusters should develop their own plans to facilitate bioeconomy strategic development to allow for alignment of their mandates and sectoral objectives with national and EU bioeconomy strategy goals and objectives.
Steering the Process		**Brief Descripition**	**Highlighted Action**
Policy Message 7	Developing linkages and pathways between bioeconomy policy, funding and national and EU strategic research,	Policy-maker will need to help combine a mix of policies and funding sources, at rural, regional and national level. This will enable	Strategic Research, Innovation, Infrastructure and Investment Agendas should be developed between EU MS e.g., with

	infrastructure, innovation and investment agendas	multi-actor approaches boosting ecological and technological innovation for sustainable and circular bioeconomies.	potential activities in the SCAR SWG Bioeconomy and other research networks, to support bioeconomy development at national and pan-European level.
Policy Message 8	Addressing the concerns and resistance of incumbent industries and patterns of behaviour of citizens and consumers	Addressing concerns and resistance is important for developing sustainable circular bioeconomy strategies and action plans. A key political and communications challenge is ensuring that all stakeholders feel that their voices have been heard and that their concerns are being listened to and addressed.	Methodologies for engaging stakeholders, including concerned citizens, industries, workers, consumers and students, should be developed and implemented for their continuous involvement in bioeconomy implementation and monitoring. This could include the creation of dedicated bioeconomy 'weeks' and 'days' which ideally would be developed together with updated online information about local bioeconomy planned developments and seasonal events.
Policy Message 9	Encouraging diffusion of biobased knowledge, innovation & technological advances to support rural and regional development	In the transition to sustainable circular bioeconomies, relevant agro-ecological good practice, bio-based innovation, and technologies are increasingly available. Enabling diffusion and sharing of these could bring significant benefits for bioeconomies throughout the EU.	The Common Agricultural Policy (CAP) proposes that EU MS develop their National Agriculture (and Rural Development) Knowledge and Innovation System (AKIS). A Horizon Europe coordination and support funding opportunity could be offered to develop prototype AKIS activities for Knowledge Exchange, Farm Advisory Services, EIPAGRI & LEADER and CAP Networks, to

			facilitate up-take of bioeconomy opportunities by primary producers, rural economy entrepreneurs and industry in collaborative ventures. This could include technological developments emerging from the BBI-JU and Circular Bio-based Europe biomass conversion toolbox.
Policy Message 10	Evaluating and gauging progress to help steer development of sustainable, circular bioeconomies	Evaluation will increasingly play a crucial role in gauging progress and steering developments from current bioeconomies towards more sustainable and circular bioeconomy. Monitoring and evaluation needs to be deeply integrated into all stages of the policy making cycle to generate continuous learning, to guide progress and to manage risk.	A Horizon Europe coordination and support action opportunity could be considered to facilitate EU MS to work together to develop a bioeconomy monitoring and evaluation system to support bioeconomy strategy design, development and implementation at national level/in their countries. This should also include consideration of how to align with JRC guidance on monitoring the EU Bioeconomy Monitoring System implemented by the JRC.

The policies discussed here, envisage profound changes in natural resource management and therefore require a clear understanding of the positions of the stakeholders involved and society at large. This should be a matter of widespread and ongoing political concern. After all, those are the various stakeholders who are crucial to the development and management of the bioeconomy. A comprehensive review of the scientific literature on stakeholder perceptions of the bioeconomy in order to enable both the assessment of the current state of research and the streamlining of further research in this field is presented in the cited paper.[30] For the bioeconomy, the most prominent stakeholder groups are government and political actors, researchers (academics), farmers and forest owners, industry and commerce, non-governmental organizations (NGOs), industry, public administration and citizens and consumers. In research articles, the groups of government and political actors, industry and commerce, and research were investigated almost twice as often as citizens and consumers, farmers and forest owners, or stakeholders from social and environmental initiatives and NGOs.[30] Only two articles were dedicated to the analysis of the media. The paper findings suggest that the bioeconomy is mostly discussed in the triangle of government, researchers, and industry. Non-expert society is less often analysed. The imbalance found in stakeholder group studies was also noticeable in the proportion of stakeholders considered to be experts (61.1%) as opposed to laypersons (10.1%), which largely overlaps with citizens and consumers. The implication is that most of the research was on the perceptions of the bioeconomy by established expert groups. The low number of research works on farmers and forest owners is surprising, since they are often considered the backbone of the bioeconomy. Similarly, it has long been argued that the participation of the public is key, but the number of articles concerned with citizens and consumers is even lower, especially since this category also includes articles dealing exclusively with society in its function as a market.

Finally, the understanding of bioeconomy in the media was very poorly represented in the research. In particular, the conclusions of the cited studies state that the existing studies focusing mainly on the bioeconomy perception of industry, political and research stakeholders, is dominated by a technology-based and resource-based understanding of this concept.[30] They further suggest that there is a noticeable lack of research with respect to the ecological dimension of the bioeconomy in stakeholder perceptions and a concerning lack of public involvement, which challenges the bioeconomy concept's claim to contribute to sustainable development. These statements are not a good proxy for the willingness of a broad representation of stakeholders to take on the challenges of a profound transformation towards a sustainable and circular bioeconomy.

30 Dieken S., Dallendörfer M., Henseleit M., Siekmann F., Sandra Venghaus S., 2021. The multitudes of bioeconomies: A systematic review of stakeholders' bioeconomy perceptions. Sustainable Production and Consumption 27, 1703-1717, https://doi.org/10.1016/j.spc.2021.04.006

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3.7 Policy gaps from a stakeholders' perspective

Government and political actors define the political framework of the bioeconomy, and social and environmental initiatives. These have been previously characterised. Policy initiatives are expected in the near future, especially regarding EU energy self-sufficiency.[31]

Table 2. Ff55 European Parliament and Council agreement

Revision of Renewable Energy Directive II	•Collective binding target of renewables in EU's energy mix to 42,5% by 2030 with an indicative top-up of 2.5% •Indicative target for innovative renewable energy technology of at least 5% of newly installed renewable energy capacity by 2030 •Advanced biofuels and biogas produced from Annex IX Part A feedstock AND renewable fuels of non-biological origin in energy supplied to transport at least 5,5 % in 2030, of which renewable fuels of non-biological origin at least 1 % •GHG intensity reduction at least 14,5 % in 2030 by all renewable fuels and renewable electricity supplied to transport OR 29% share of renewable energy in final energy consumption in transport •strengthens the sustainability criteria for biomass use for energy, to reduce the risk of unsustainable bioenergy production
Revision of the Effort Sharing Regulation	•EU-wide reduction of 40% by 2030 in the transport, buildings, agriculture and waste sectors compared to 2005
Revision of the Emissions Trading System Directive	•By 2030 reduce sectors' GHG emissions by 62%, compared to 2005 levels •Carbon pricing for maritime and, aviation from 2026, buildings and road transport (and certain industries) from 2027
Revision of the Land Use Land Change and Forestry regulation	•Increase EU's natural carbon sinks with new EU target of net GHG removals in the LULUCF sector of 310 Mt CO2eq from 2026 to 2030
ReFuelEU Aviation legislative proposal	•In 2030 SAF at least 6% of which synthetic aviation fuels average share 1.2% and minimum annual share 0.7%, rest being advanced biofuels(4,8%) •In 2050 SAF at least 70% of which synthetic aviation fuels at least 35%, rest being

[31] Georgiadou M. The EU framework and perspectives. ETIP Bioenergy 11thStakeholder Plenary Meeting, Brussels 27-28 September 2023

	advanced biofuels (35%) •SAF include biofuels from agricultural or forestry residues, algae, bio-waste, UCO, animal fats, and recycled jet fuels from waste gases and waste plastic, as well as synthetic fuels and renewable hydrogen
FuelEU Maritime legislative proposal	•Biofuels, biogas, renewable fuels of non-biological origin and recycled carbon fuels are taken into account to reduce the GHG content of the energy in ships by 2% in 2025, -6% in 2030 and -80% in 2050 from 2020 average of 91.6 gCO2/MJ
CO2 emissions standards	•Cars and vans running on carbon neutral synthetic fuels can be registered after 2035 (recital) •Commission will create a new category of vehicles in an implementing regulation, and present a delegated act to define how these vehicles can contribute to climate neutrality
CO2 emissions standards HDV proposal	•45% CO2 emission reduction target for new heavy-duty vehicles by 2030 compared to 2019 levels, 65% by 2035 and 90% by 2040
Revision of the Energy Taxation Directive	•Ongoing

Of particular interest to the bioeconomy are the revision of Renewable Energy Directive II and the revision of the Land Use Land Change and Forestry regulation.

It is also argued that the current Bioeconomy Action Plan requires further action.[7] The following is suggested: increased focus on how to better manage land and biomass demands to meet environmental and economic requirements in a climate neutral Europe and work on more sustainable consumption patterns to ensure environmental integrity. This is understandable if one assumes that in the EU there is a biomass gap by 2050 of 40-70 % between sustainable biomass supply and biomass demands for materials and energy. It also raises the issue of a need for policy coordination as a consequence of multiple pressures on land from material demand, notably in sensitive labour markets and further needs to better respond and contribute to the new policy context since the adoption of the European Green Deal and related initiatives.

Research encompasses stakeholders engaging in knowledge generation and technology development. While strategic directions are developed at national or supranational levels, scientists agree that local governments are crucial to their implementation.[32] This is particularly important because the extent of alignment between the proposed national (regional)

32 Marcone R. D., Schmid M., Meylan G., 2022, Closing the gap between EU-wide national bioeconomy monitoring frameworks and urban circular bioeconomy development. Journal of Cleaner Production 379, 134563. https://doi.org/10.1016/j.jclepro.2022.134563

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bioeconomy strategies and supranational developments is not clear.[33] The analysis of the implementation of these policies from the perspective of experts has shown that enabling governance predominantly targets the supply side of the bioeconomy. According to the survey conducted, the main policy measure implemented was “support of R&D (Research and Development) activities”, followed by “training & capacity building programs”. Many studies criticise the lack of regulations and strategies for ensuring sustainability embedded in many bioeconomy policies and definitions. In this regard, there is a significant agreement that existing policies do not adequately address sustainability, especially regarding social and economic concerns. In sum, despite the many bioeconomy-relevant policies in place worldwide, experts still doubt whether this is enough to put emerging modern bioeconomy on a safe track towards a sustainable future. The main barriers to bioeconomy management, identified at national level are the lack of capital for start-up companies in the bioeconomy. Less but still high importance was attached to the "Lack of commercialisation success". In comparison to these two barriers, the “lack of experimental spaces”, “lack of bioeconomy-related R&D”, “lack of access to existing technology and knowledge”, and “lack of capacity building and education” were assessed as comparatively less important. “Lack of bioeconomy-related legal frameworks” and “limited infrastructure” were considered relatively important but less critical than the abovementioned barriers. The results presented seem to indicate that present bioeconomy governance frameworks could open the possibility for bio-based innovation processes but cannot support sustained economic success beyond the early stages of transformation. Another barrier identified at national level is the lack of policy coordination and harmonisation as the significant barrier to bioeconomy development. Out of almost 90 policies for biomass, bioprocessing and biobased product reviewed, many are still not completely coherent with the core bioeconomy objectives and do not act in synergy with each. Therefore, further updating of these policies can better align their objectives with those of the Bioeconomy Strategy.

From the point of view of the value chain approach, several gaps were identified.[20] In relation to challenges at land use stage, a lack of European-wide harmonised characterisation of marginal land and integration among sectoral policies targeting soil quality and financial measures incentivising the uptake of sustainable soil improvers were stated. At the biomass production stage, inadequate policy support was found for waste mobilization and valorisation. Furthermore, there is a lack of policy provisions and financial support improving collaborations among value chain actors to overcome the complexity associated with harmonising biomass logistics and conversion processes. Finally, regarding the end-use stage, policy interventions targeting the distribution and standardisation of the wide, available range of biobased products and services remain limited. The quoted paper articulates policy recommendations for each value chain stage. These recommendations are rationalised according to their potential to achieve the five core objectives of the European Bioeconomy Strategy, overcome the identified challenges, and contribute to a more harmonised set of policy interventions:

- **Land use**. Future interventions within the Common Agricultural Policy, Farm to Fork and Biodiversity Strategy should harmonise their policy interventions to promote the use of marginal lands and increase financial support for existing flagship projects

33 Dietz T., Jovel K. R., Deciancio M., Boldt C., Börner J., 2023. Towards effective national and international governance for a sustainable bioeconomy: A global expert perspective. EFB Bioeconomy Journal 3 (2023) 100058. https://doi.org/10.1016/j.bioeco.2023.100058

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successfully turning marginal land into productive biomass systems to sustain the bioeconomy.

- **Biomass production**. Policy refining is required to integrate the sustainable expansion of biomass cultivation and natural resource (land, soil, water) use; the mobilisation of underutilised waste sources to reduce resource competition and the improvement of biomass production logistics through investment in infrastructure and pre-treatment processes.
- **Conversion**. The main policy needs for the conversion stage are to increase support for the optimisation of complex conversion processes and logistics to attract consistent year-round supply of low-cost, high-quality sustainable feedstock, and to monitor the heterogeneous composition of biological materials produced during the conversion process of biomass resources from multiple sources (including bio-waste) to bio-based products.
- **End use**. The key policy developments for the end use stage are to improve support for large-scale distribution as well as to create European-level labels, certifications, and standards for a wide range of bio-based products and services.

Farmers and forest owners provide biomass. Their views on policies need to be listened to carefully, as they will determine whether and to what extent the projected future sustainability gap for biomass can be minimised or perhaps even closed. This group of stakeholders is underrepresented in the discourse on bioeconomy and in the transformation of the economy in line with the stated objectives of established policies. Material on their willingness to participate widely in the green transformation economy is rather scarce. We welcome with interest the position of primary biomass producers for the next steps in the EU bioeconomy policy framework.[34] The document pointed out:

- "A revision of the Bioeconomy Strategy is needed to address the challenges and opportunities that come with fully integrating the bioeconomy into rural areas.
- Considering the current challenges, a more coherent policy approach under a new EU Bioeconomy Strategy should be considered.
- The bioeconomy should be considered as a long-term solution to climate challenges and be supported by long-term policies.
- Primary producers should be engaged in the whole policymaking process for farmers, forest owners and managers to enhance their contribution to a more sustainable bioeconomy.
- Build on producers' cooperatives as key stakeholder entities implementing concrete actions to further develop the rural bioeconomy in the EU.
- The EU should support a bioeconomy that capitalises on the huge diversity of its supply chains specific to each EU region.

[34] CEPF, 2023. Recommendations of EU primary producers for the next steps on the EU bioeconomy policy framework. 20.09.2023. https://www.cepf-eu.org/news/recommendations-eu-primary-producers-next-steps-eu-bioeconomy-policy-framework.

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- Cross-border knowledge networks should be developed through the promotion of joint research opportunities funded by EU programmes.
- The gap between Member States' actions for agriculture and forestry bioeconomy should be better addressed and the countries/regions that are lagging behind should be better supported.
- Collaboration between public-private partnerships could help turn niche production into norm to support the development and implementation of bioeconomy initiatives".

The document also draws attention to the need for **new skills, education, and knowledge exchange on national and Union level to enhance the EU bioeconomy:**

- The skills and knowledge gaps related to the bioeconomy should be identified and required skills should be further aligned with those set out in the economic, social, and environmental pillars of sustainability.
- More work at EU and national level should be done to bridge the gap between science and practice by developing practice-based knowledge and looking at the cost-effectiveness of solutions proposed on the ground.
- Educational pathways in agriculture and forestry for students should be diversified to seize the opportunities of the bioeconomy and gain the right skill set.
- Advantage should be taken of peer-to-peer learning by promoting the establishment and reinforcement of knowledge exchange networks on bioeconomy, collaborating with the different actors involved.
- Improvement of the interface between policy, science and practice is needed, by sharing knowledge at all levels of decision-making.

It also presents views on how to **scale up the transition toward a circular EU bioeconomy:**

- A market incentive is missing to upscale the bioeconomy in the EU. The EU and Member States need to stimulate the bioeconomy and ensure the financial resources for forest owners and managers, farmers, and their cooperatives to invest more in circular value chains.
- Investment in and building up an EU network as well as national networks of young innovators and experts and stimulating their participation in the bioeconomy sectors.
- More effort is required to close the gap between farmers, foresters, and the EU policy makers to make them understand the legislation and get them on board with the transition.
- Appointing in the next EU Commission President's cabinet a bioeconomy coordinator with a focus on policy coordination or, at least, a dedicated cabinet member for each bioeconomy-relevant Commissioner (GROW, CLIMA, ENV, REGIO, AGRI, RTD).

It further focuses on the importance of the bioeconomy as **the enabler of the sustainable use of natural resources:**

- Designing policies through the lens of viewing the bioeconomy as a vehicle in the transition to a sustainable and circular use of natural resources.
- The environmental sustainability of the bioeconomy needs to be better quantified and communicated and its contribution to key EU objectives recognised.
- Regarding farms and forests as a whole ecosystem in which trade-offs are addressed between different functions, policy framework should provide the best advice and assess these trade-offs and their impacts.
- Capitalising on the bioeconomy's potential to develop European rural economies regarding all the three pillars of sustainability (environmental, social, and economic), within planetary boundaries and without exerting pressure on ecosystems.
- A paradigm shift around the bioeconomy shall be a major tool in having the economy transition away from fossil fuels as opposed to decarbonising it.

Industry and commerce utilize knowledge and biomass to create bio-based products. This group is characterised by many biomass-related industries that are more likely to take a resource-based bioeconomy perspective.[30] The Bio-based Industries Consortium[35], which brings together over 250 industry representatives, urges EU policymakers:

- to develop a dedicated and long-term policy framework for the circular bioeconomy to transition into a strategic industry sector, and contribute to the EU's ambitious policy objectives, in consideration of the EU Leads Market Initiative,
- to appoint a high-level EU policy coordinator reflecting the cross-sectoral nature of the bioeconomy, e.g., a dedicated European Commissioner, or a cabinet member of the European Commission President.
- to more strongly acknowledge the role that the circular bioeconomy already plays,
- to exploit readily available and future bio-based solutions,
- to take policy actions in order for Europe to benefit from a prospering circular bioeconomy,
- to update the EU's Bioeconomy Strategy,
- to ensure that the forthcoming EU biotech and biomanufacturing initiative enables the bioeconomy – in its broadest sense – to play its full role to serve the people and the planet,
- to support policies that focus on the safety and sustainability of the end-product, not on the processes used to produce them. Policies should be technology neutral across production methods,
- to create and expand market opportunities for bio-based products to spur innovation, sustainable growth, and secure strategic autonomy.

35 Bio-based Industries Consortium, Manifesto, November 2023, https://biconsortium.eu/sites/biconsortium.eu/files/publications/BIC%20Manifesto%202024.pdf

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Non-governmental organizations (NGOs) define the societal and ecological framework for bioeconomy. Civil society has so far been little involved in bioeconomy discussions.[30] They most often represent the bio-resource vision of the bioeconomy. However, direct participation of NGOs in bioeconomy policy consultations was rather rare.[36] Adding to a lack of political will, participation is also hampered by a lack of financial resources, which limits NGO activities in this field. By contrast, the biotech industry has ample means and lobby power to influence politics in their favour. However, the time seems to be coming for civil society to change from an observer on the sideline to the centre of the playing field. This requires more than routinely mentioning stakeholder participation in policy papers. Moving from paper to practice will not only need inclusive fora for dialogue but also adequate resources to do so.[36] In any case, a broader participatory inclusion of NGOs in the multi-stakeholder collaboration of the different stakeholders (businesses, public actors, NGOs, academia, and citizens) involved in the decision-making and implementation of bioeconomy projects seems much needed.

Public administration defines the governance of the bioeconomy and its adaptation at different administrative levels. The public administration should promote, facilitate, and enable the transition to a circular and climate-neutral economy, ensure a system change across decision-takers, as well as define proper assessment methods allowing to measure the sustainability of circular bio-based products and processes able to capture complexity and interdependencies, and provide a comprehensive and objective balance useful to address the sustainability of integrated production and consumption systems. Coordination between all governance levels and regional approaches is essential, especially since MS have heterogeneous bio-resources, different climate conditions, and regional specialisations.[37]

Media present an expression of public opinion. Taking 5,480 X/Twitter user accounts as the basis for the study, which included a total of 16,737 tweets using bioeconomy-related terms, it was found that associated themes included sustainability, circular economy, climate, carbon, innovation, newness, and specific industries (food, agriculture, energy, forestry).[38] The societal discourse as represented on X/Twitter demonstrated the ability to connect multiple stakeholder groups. However, those engaged disproportionately represented high-income, high-technology countries, and highly educated individuals with limited evidence of engaging outsiders or those unfamiliar.

Citizens and consumers reflect the societal demand for bioeconomy products and the participation in bioeconomy governance. In this stakeholder group, further actions would be advisable to increase social acceptance of the bioeconomy, minimise social conflicts that may occur and the potential for disappointment with the transition.[39] Research seems to indicate that this group is insufficiently involved in bioeconomy governance.[40] Moreover, research on citizens' perceptions is challenged by this group's considerable lack of knowledge of the

[36] Kuhlmann W., 2022. Shaping Bioeconomy Strategies in Europe: The Role of Civil Society. https://www.ressourcenwende.net/wp-content/uploads/2022/04/Shaping-Bioeconomy-Strategies-final.pdf

37 EC, 2021. Research and innovation. European bioeconomy policy: Stocktaking and future developments. Summary of stakeholder feedback analysis. https://research-and-innovation.ec.europa.eu/news/all-research-and-innovation-news/stakeholder-feedback-2018-bioeconomy-strategy-2021-12-17_en

38 Neill A. M., O'Donoghue C., Jane C. Stout J. C., 2023. Who is talking about bioeconomy? Stakeholder and sentiment analysis using social media. EFB Bioeconomy Journal 3, 100055. https://doi.org/10.1016/j.bioeco.2023.100055

39 Meyer, R., 2017. Bioeconomy strategies: Contexts, visions, guiding implementation principles and resulting debates. Sustainability, 9:6, 1031. https://doi.org/10.3390/su9061031

40 Stern T., Ploll U., Spies R., Schwarzbauer P., Hesser F., Ranacher L., 2018. Understanding Perceptions of the Bioeconomy in Austria-An Explorative Case Study. Sustainability, 10:11. https://doi.org/10.3390/su10114142

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bioeconomy, which has been identified as a threat to the acceptance of and participation in a bioeconomy transformation[41]. Against this background, the reviewed literature demonstrates a worrisome lack of engagement with the public.[30]

Summarising the reflections presented on the role of stakeholders, it should be stated that their participation in policy formulation and implementation should be greater than before. Stakeholders should be capable of impacting policy development, as policy implementation is difficult when a participatory approach has not been systematically applied.[42]

3.8 The EU project alliances as knowledge sharing and police recommendation forums

In mid-2023, European bioeconomy projects formed alliances to accelerate and support the development of circular rural Bioeconomy initiatives in the EU. The involved projects are BioRural, MainstreamBIO, P2Green, RELIEF, RuralBioUp, SCALE-UP, COOPID, BioModel4Regions, ShapingBio, CEE2ACT and ROBIN (https://mainstreambio-project.eu/the-rural-bioeconomy-alliance-is-officially-launched/). Rural bioeconomy alliance (RBA) members can benefit from communication and dissemination advantages to technical validation, exploitation, and replication. The RBA also provides a forum to discuss potential policy recommendations for the EC in support of shaping the future of bioeconomy in Europe.

An important initiative is the alliance of 150 European bioeconomy projects gathered in the European Bioeconomy Network (https://eubionet.eu/events/). Its mission is, among other things, to strengthen the role of the European Commission in supporting the sustainable circular bioeconomy uptake and to stimulate the debate, knowledge sharing and mutual learning to address bioeconomy related challenges and opportunities. The European Bioeconomy Network maximizes the impact of the European Commission funded projects participating, creates opportunities and networks, and significantly increases the awareness of bioeconomy in Europe, thanks to the joint efforts of the involved projects.

Supposedly, the indicated alliances can also bring valuable information about how policies work in practice and provide tips on how to correct policies in the future.

41 Wydra S., Daimer S., Hüsing B., Köhler, J., Schwarz A., Voglhuber-Slavinsky A., 2020. TRANSFORMATIONSPFADE ZUR BIOÖKONOMIE: Zukunftsszenarien und politische Gestaltung. Karlsruhe. https://www.isi.fraunhofer.de/content/dam/isi/dokumente/cct/2020/transformation_bio_web.pdf

42 Falcone P. M., García S., Imbert E., Lijó L., Moreira M. T., Tani A., Tartiu V. E., Morone P., 2019. Transitioning towards the bio-economy: Assessing the social dimension through a stakeholder lens. Corp Soc Resp Env Ma. 26:1135–1153, https://onlinelibrary.wiley.com/doi/pdf/10.1002/csr.1791

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4. MainstreamBIO Policy Insights

The aim of the MainstreamBIO project is to contribute towards bringing small-scale bio-based solutions into the mainstream across rural Europe. This is achieved by significantly enhancing collaboration between key bioeconomy stakeholders (the Quadruple helix encompassing Industry, Academia, Government and Civil Society), resulting in pathways for sustainable business models for bio-based innovation in rural areas. Along these lines, the project is based on an integrated methodology to establish regional multi-stakeholder structures for demand-driven innovation and deliver a combination of communication materials, training programmes, events, a decision support system, and other practical digital tools included in the MainstreamBIO toolkit.

The consortium of MainstreamBIO brings together 10 partners across 9 different countries. It has been instrumental in inviting more than 3,000 stakeholders (farmers, producers, consumers and other stakeholders from the agri-food and forestry sectors). They will be involved in testing, validating, and using the business and technical support services of the MainstreamBIO toolkit. To make this possible in the specifics of each MS 7 multi-stakeholder innovation platforms are being set up in the same number of countries/regions across Europe. Each MainstreamBIO multi-stakeholder innovation platform is composed of individuals from different agri-food, forestry and bioproducts fields who are strategically involved in the key activities of the project, bringing their knowledge and specific perspectives on the bioeconomy, as well as representing the views and interests of their stakeholder communities, to provide the consortium with insights into current bioproduct solutions / innovations and good practices in nutrient recycling that will facilitate the delivery of demand-driven and value-added tools, materials and recommendations for biomass producers and consumers in a way that is beneficial and acceptable to other stakeholders in the bioeconomy sector.

4.1 General Policy Insights

Based on mixed research methods, which included conclusions drawn from targeted desk research, semi-structured interviews and an online survey, several factors hindering the development of the bioeconomy were identified (Fig. 3). As this research shows, the main barriers to bioeconomy development appear to be economic (e.g. high costs, lack of investment and access to finance), social (low social acceptance) and political (e.g. policy gaps, lack of regulatory framework). Further development of the bioeconomy, especially small-scale bio-based solutions, would seem to require a reduction in these hindering factors. Directional proposals are shown in Figure 4.

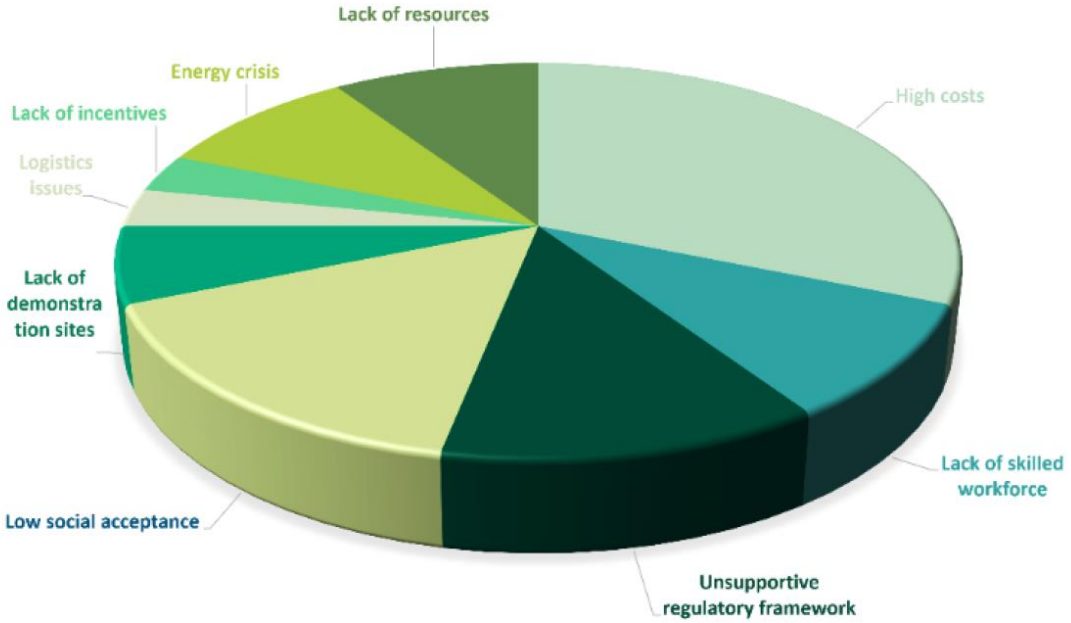

Figure 2. Hindering factors for bioeconomy development[43]

[43] MainstreamBIO. 2023. Report on context and needs of rural stakeholders. D1.2 White Research.

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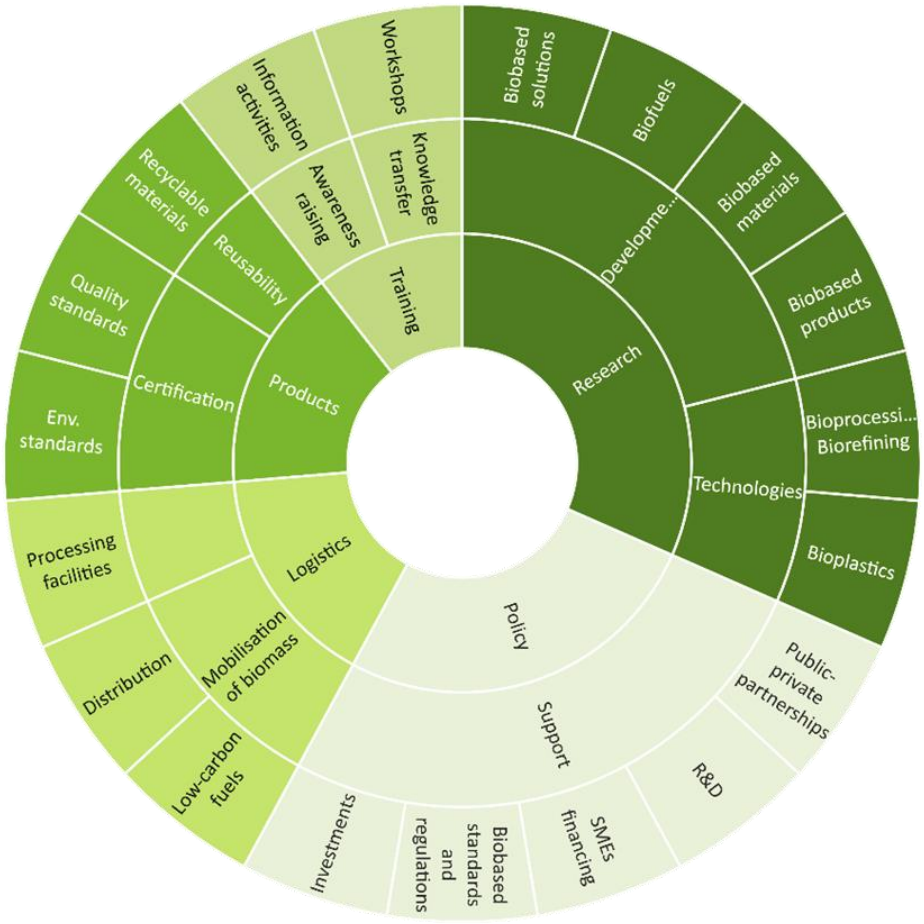

Figure 3. Priorities for bioeconomy development

4.2 Policy Insights for MainstreamBIO target rural areas

Determinants of bioeconomy development vary from country to country and focal region to region, so policy insights also vary.

Bulgaria. No dedicated bioeconomy strategy at national level. However, Ministry of Agriculture, Food and Forestry adopted policies and programs in the main sectors of the bioeconomy - agriculture, forestry, fisheries, and organic production. They refer, among other things, to EU policies on the bioeconomy. Noteworthy in this respect is the Draft of Strategy and Action Plan for the Transition to a Circular Economy of the Republic of Bulgaria for the period 2021-2027. Local initiatives have also been undertaken around the city of Plovdiv and the South-Central Region. These are: Regional Bioeconomy Hub - Plovdiv, strategy to strengthen the role of the agricultural sector in the bioeconomy and regional innovation development strategies for the region. Measures recommended for the further development of the bioeconomy: free economic zones for bio-based products, protective measures for local businesses to use local bio-based products, Governmental financial support (e.g. subsidies) and strong cooperation among key players of the value chains.

Denmark. No dedicated bioeconomy strategy. However, existing policy frameworks are developed under public support policies, financial incentives, and local initiatives. The Green Transformation of Danish Agriculture Agreement (2021) and the National Bioeconomy Panel are typical examples of this kind of policies and initiatives. The latter, set the direction towards bioeconomy transition including targets for land use, biorefining and cascading. Moreover, the

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National Bioeconomy Panel recommends that a national bioeconomy strategy is to be developed to set the direction for a major bioeconomy transition. The strategy should include targets for land use, biorefining and cascading, as well as increased optimised bioresource yields to free up land for other uses. The National Bioeconomy Panel assesses the need for the lower end of the cascade (pyrolysis and HTL) to be developed and commercialised as integrated industrial symbioses. It is essential to consider, inter alia, the recycling of nutrients, including phosphorus, and the achievement of recycling and carbon storage objectives. Measure recommended: need for further governmental support and unblocking political initiatives.

***Ireland*.** There is no dedicated bioeconomy strategy. Although the focal region does not currently have a dedicated bioeconomy strategy, it is evolving and is rooted in the Food Vision 2030, the European Green Deal, and national policies. Furthermore, the region can also be considered as part of the broader 2018 National Bioeconomy Declaration. In terms of bioeconomy development, the consensus view is that the region has great potential to become a leader in the bioeconomy sector, due to the availability of renewable raw materials such as seaweed, manure, and other agricultural raw materials. Despite this, progress in bioeconomy has been slow, especially in the business sector and raw material producers. Lack of access to funding and lack of political incentives are identified as the main political factors hindering the implementation of bio-based and bioeconomy solutions. Recommended measures: further government support (e.g. subsidies) and tailored and specific strategies.

The Netherlands. There is a bioeconomy strategy in force. It is mainly focused on support by the Dutch Government and activities in the province. Specifically, at this moment there is a discussion whether the Dutch Government should subsidize less profitable cultivation of crops for biobased products. Moreover, public authorities try to support renewable initiatives also by their procurement policy. Main barriers for the development of a circular biobased economy are the price of the product or the application. Incentive is needed, to give the buyer/user of the product/application an advantage. Farmers are willing to be innovative, but legislation is a barrier, e.g. lack of clear and consistent policy on biobased products, limited quality standards for biobased products, national laws and regulations not tailored to local needs. Measures recommended for the further development of the bioeconomy: Governmental financial support (e.g. subsidies).

***Poland*.** No dedicated bioeconomy strategy. In 2015-2018, initial efforts were made to implement the idea of bioeconomy by preparing a draft map, namely the Circular Economy Roadmap which defines strategy, outlines the key areas of activity, and identifies projects involving a wide range of stakeholders. Several national policies also refer directly or indirectly to the bioeconomy. In addition, there have been some regional and local initiatives (e.g. policy institutions, technology transfer centres, clusters, and smart specialization's) that are involved in developing the bioeconomy and related activities. The main obstacles to the development of the bioeconomy are financial issues, e.g. the lack of economic incentives such as subsidies, tax reliefs, lack of stable regulation, weak cooperation among key players of the value chains and ineffective cooperation with public administration. Measure recommended: financial support, national-wide measures, measures to strengthen stakeholders' cooperation.

***Spain*.** The Spanish Bioeconomy Strategy Horizon 2030 was published in 2015. Since then, several regions in Spain have developed its own specialised strategy, including the Bioeconomy Strategy of Catalonia. In other cases, bioeconomy has been included as part of the circular economy, as is the case of the Agenda for the development of the Circular

Economy in Navarra 2030 or the strategy Aragón Circular 2030. Each autonomous community also counts on a specific Rural Development Programme with common elements such as sustainable management of natural resources, balanced territorial and rural development and improving the competitiveness of the agri-food system. Despite the relatively favourable political landscape, Spain is considered to have acknowledged progress in bioeconomy development, however they admitted that it is still slow. Further needs are felt in considering challenges such as: logistics, social acceptance, administrative support through further research and innovation, financial support and target funding, as well as the creation of specific strategies for both industrial and rural communities. Measure recommended: stable policy regulations, stronger cooperation among key players of the value chains and better and effective cooperation with public administration.

***Sweden*.** There is no dedicated national and regional bioeconomy strategy. The main barrier for bioeconomy relates almost exclusively to national and EU policies development and economic initiatives driven by current political leadership. Specifically, it can be observed that the development of the bioeconomy is influenced by changes in political direction. Another significant barrier that is currently increasing uncertainty for new forest-based biorefining initiatives is the drive for policy to decrease the use of forest biomass and where the policies fail to differentiate between sustainable forest management practices in different regions of Europe. The most prominent example is the proposed EU law LULUCF (Land Use, Land Use Change and Forestry) which if implemented in its current form would decrease the possibility to use forest-based biomass for new circular biobased products and according to the Swedish Forest Industries. The bioeconomy in the focus region is experiencing significant growth and development, with numerous innovative companies working in the biobased sectors. Thus, they also identified the lack of funding for large-scale production and lack of expertise as potential barriers to the development of the bioeconomy. Policy factors hindering the uptake of biobased solutions and bioeconomy: lack of governmental support, absence of policy incentives, lack of a clear and consistent policy on biobased products, lack of information about bio-based products make it difficult for consumers to make informed choices, and strict regulation on feedstock and biobased commodities. Recommended measures: support for stimulating investment in bioeconomy development, recognising that these are high-risk investments, reconciling political support for sustainable forestry with investment in large-scale bioeconomy applications, and relaxing strict regulations on the sourcing of raw materials and bio-based commodities such as biofuels.

In conclusion, a supportive regulatory framework was reported as a major requirement to stimulate investment in the biobased sector. Particularly, in Denmark, government support was valued as sufficient, thus, all other target regions argued that there is a need for financial and political support (Tab. 2)

Table 3. Policy and governance barriers that may cause problems to uptake of biobased solutions and bioeconomy development in the focal regions[43]

Bulgaria	• Lack of cooperation among key players of the value chain

Denmark	• Many barriers including regulations • Lack of policy incentives
Ireland	• Absence of policy incentives
The Netherlands	• Farmers are willing to innovative, but legislation is a barrier • Lack of clear and consistent policy on biobased products • Limited quality standards for biobased products in place • National laws and regulations not tailored to local needs
Poland	• Lack of stable regulation • Ineffective cooperation with public administration • Weak cooperation among key players of the value chain • Lack of economic incentives
Spain	• Lack of stable regulations • Weak cooperation among key players of the value chain • Ineffective cooperation with public administration
Sweden	• Absence of policy incentives • Strict regulation on feedstock and biobased commodities

These barriers exist both in countries (regions) with dedicated bioeconomy strategies as well as in those that do not yet have such strategies. They suggest that insufficient policy initiatives in translating EU regulations into national and regional policies and shortcomings in bioeconomy governance are felt. This hinders the wider deployment of bio-based solutions and bioeconomy development in focal regions.

From the material in Chapter 4.2 and Table 4, it was possible to extract policy needs that could contribute to better development of small-scale bioproducts. These are presented in concise form in the survey summary.

Table 4. Policy considerations for the development of small-scale bio-based solutions according to feedback MainstreamBIO project participant surveys (Qx- answer to the survey question; the questionnaire is included in Annex I)

Number	Country	Needs that could support small-scale bio-based solutions
1	Belgium	Direct references to the bioeconomy are made in the New Circular Economy Action Plan, the Land Use, Land Use Change, and Forestry (LULUCF) Directive, national and regional policies to support bio-based business models and interregional policies (Q5, Q6). The number of policy instruments apply in the areas of biofuel production, waste management, maintaining high standards in forest management, financial support for research (R&D) and the development of new technologies (Q6). In national and regional policies, the focus is on the Plan National energie - climat 2021 - 2030, Energy Fund, and biomethane production goal by 2030. In agriculture, attention is paid to environmental aspects (e.g. water quality protection, manure management, catch crops).
2	Denmark	It is recognised that the most important EU policies of relevance in a region are Regulation (EU) 2021/2115 and Regulation (EU) No 1305/2013 (Q5). More effective implementation of policies would require adapting the policies to the local challenges, to consider the strategic wishes of the public/state/politicians, to write a concrete local policy that will motivate and drive the necessary development and to exclude the possibility to misinterpret the law and make a "wrong" application for support. Future needs are an increased political focus stimulating the market for small scale bio-based solutions, a constant focus on other national policies when making policies that stimulate small-scale bio-based solutions, a law for supporting new solutions, long-term planning and a simplification of the national regulations covering the agricultural area (Q6). There are many national policies directly or indirectly linked to the implementation of small-scale biobased which well adapted to the national characteristics (Q7, Q8). They respond to the challenges to create greater sustainability and solve some of the climate and environmental problems facing society - while at the same time continuously improving the economy so that the food sector can continue to create growth and secure jobs. A specific policy needs are to make the policies seem relevant and meaningful for the parties affected by them, to make them supportive of development instead of applying new limiting rules forcing the development through, to make them able to stimulate entrepreneurs and stakeholders (Q8). It would be helpful in the implementation of policies to establish a hierarchy of them so that their application becomes easier, and funding is sound and robust, which gives willingness and motivation to implement solutions and confidence in current and future legislation. Any policy initiative that reduces the risk for the stakeholder and considers a whole mindset of the stakeholders would also be welcome

		(Q10). Attention is also drawn to the fact that the upcoming CO_2 tax is causing anxiety among farmers, which should be alleviated by appropriate measures.
3	Greece	[I] The development of the bioeconomy is supported by national law (Q5). It lacks specific references to small-scale bio-based solutions. The main problem remains how to raise funds for these solutions when they are mainly aimed at larger-scale enterprises, while SMEs do not have the human resources to search for funding options. In this situation, micro-funding and micro-financing could significantly benefit SMEs and facilitate the use of small-scale biobased solutions (Q6). National policies supporting small-scale biobased solutions are circular economy, wastewater management and some composting programs (Q7). A political need is the management of agricultural waste to ascertain what kind of solutions could be implemented based on the specific volumes and the tailored used of the agricultural waste (Q8). Streamlining national policies (e.g. Research - Innovate) could reduce bureaucratic processes which result in big delays in the implementation and eventually in the funding (Q9). Expected changes in policies and governance relate to financial incentives, education, and awareness always related ultimately to financial benefits, direct financial support to farmers for small-scale biobased solutions, specific tax reliefs from the initial investments, and targeting initiatives to young people (Q10). [II] Horizon program and EU funds distributed by national programs are the main supporting policies, not specified in small-scale bio-based solutions (Q5). Expected initiatives include broadening the scope of funding topics could facilitate greater participation and innovation within the agricultural sector, encouraging proposals that address sustainability, technology, and modern agricultural practices can be beneficial, supporting, and guiding farmers in navigating proposal submissions by establishing intermediaries or support networks can make the process more accessible. The current gap in policies that restrict the declassification of waste for reuse in the bioeconomy might require revisiting waste classification frameworks and regulations at both the EU and national levels. Policy initiatives that could be considered: more decentralised support to regions with CAP, creating specific funding streams or grants tailored to support, offering financial incentives or tax breaks for farmers, investing in research initiatives that focus on developing and improving small-scale biobased technologies, developing educational programs and workshops to disseminate information. These initiatives could bring benefits in terms of sustainability, diversification of income streams and rural development (Q6). The lack of authority at the regional level might result in challenges for regions to craft specific policies tailored to their unique needs or priorities, especially in sectors like small-scale biobased solutions. It could lead to a disconnect between national policies,

		which may not sufficiently address regional nuances or challenges (Q7). Raising awareness and educating customers solutions is crucial for their acceptance and implementation. Here are some effective strategies to achieve this: launch informational campaigns targeting consumers through various channels like social media, workshops, seminars, and community events, establish recognizable certifications or labels for biobased products, share success stories and case studies of local farmers or businesses, engage with local communities through workshops, farmer's markets, or community events (Q8). National law refers mainly to bigger companies, such as small industries, and not to the small farmers from the agricultural sector. A common problematic part of the existing policy is the certification of the waste, resulting in difficulties in their use as bio-based products (Q9). Policy should change and facilitate the de-characterization of the wastes. Till now, they cannot sell the waste in the market due to the regulatory framework. To maximize the impact on farmers' willingness to adopt biobased practices, they should receive solid and clear information about their potential income increase and diversification in order to realize that their waste could be used again in production and provide more income (Q10).
4	Ireland	[I] EU Bioeconomy Strategy, EU Bioeconomy Action Plan, and national policies support actions to scale-up and deploy locally the bioeconomy (Q5 & Q7). The gaps are "know-how" to get funding more coherent, use the funds for research and funding education and upskilling (Q5). Effective implementation of policies is sometimes difficult when stakeholders do not accept the bioeconomy concept (Q5). The level of this acceptance could increase with policy changes towards funding for capital expenditure that mobilise bioeconomy action, value chain creation, funding for piloting and demonstration, focus on education and upskilling, alignment of standards for biobased products and integration of bioeconomy with other policies (Q6). National policies are sufficiently regionally adapted (Q8). Further regulation to incorporate bioeconomy into existing policies would be helpful (e.g.): coherence between local authorities, planning permission, sharing coherence between authority, regulation towards investment, insurance, Green Public Procurement, and waste management (Q8). Regional bioeconomy deployments are supported by national, regional, and local authorities, regional assemblies, and county councils (Q9). Further improvements in the application of policies regionally could be brought about by improving cooperation between all government departments responsible for bioeconomy policy and better funding of pilot and demonstration projects to demonstrate the bioeconomy in action for all stakeholders in the bio-based value chain. Awareness-raising activities for farmers are being carried out to adopt bio-based practices (Q10). [II] Small-scale biobased solutions are supported by EU and national policies, however only to a certain degree by CAP (Q5, Q7). The most important EU policies of relevance in the region are environmental policies to support

		the development of bioeconomy. Difficulties associated with the implementation of policies are bureaucratic barriers, getting the money to the right people and lack of knowledge for the bio-based solution in the local communities, farmers, and foresters. Initiatives are needed for a greater emphasis on the use of the biobased or recycled products, tax policy, reducing VAT and excise on biobased products (Q6). Further regulation is needed to promote national and EU self-sufficiency, good stewardship of soils and other natural resources and policy to support area of recycled fertilizer (Q8, Q9). A positive impact on farmers' willingness to adopt biobased practices could be increased by easy access to grant aid, short payoff time, capital investment, tax credits and reduce labour (Q10).
5	The Netherlands	[I] The development of the bioeconomy is linked to EU and national regulations (Q5). Some provinces also have dedicated programmes in this area (e.g. Flevoland in Overijssel). The need for even greater emphasis on the use of bio-based materials is recognised in EU and national policies (Q6). The government has set up several organisations with financial support for the use of biobased materials (e.g. building materials) (Q7). A more efficient application of policies in the region could be achieved by considering the complete value chain, the use of long-term production contracts and a fair distribution of benefits across the production links (Q8). It is recognised that there is a further need to create awareness of the importance of bio-products not only among their producers but also among consumers (Q11). [II] Supporting the development of, among other things, bio-based products is the Flevoland Horizon agency in the Flevoland region (Q5). It offers various forms of support to companies (https://www.horizonflevoland.com/). It is expected that some new opportunities for small-scale biobased products may arise in new regional policies such as food vision (2024) and agriculture vision (2025). Some support for small-scale bio-based solutions in regions can be offered by regional development agencies (ROMs). There are nine of them operating in the country (Q6). The ROMs are neutral partners, financed by the national and provincial governments to stimulate middle/small companies in the region. Some are really catered toward regional synergies, but other themes are handled nation-wide, like biobased building. ROMs operate according to the scheme: invest, innovate, and internationalise and seek, among other things, to ensure the conditions for start-ups to survive. Educational initiatives are undertaken in the region (e.g. cooperation with a vocational school). The country has regulations that make the use of waste difficult. Flevoland has been exempted from these to experiment with a circular economy (Q8). Employers are extensively trained in the circular economy (Q9).

		[III] It is believed that national regulations on the use of residuals and wastes and the lack of regulation of bioproducts are real barriers to the development of small-scale biobased solutions (Q5). Further work is needed on business models for bioproducts and the creation of sound principles to support bioproduct initiatives (Q6). It is appreciated that the government has designated experimental areas where some legal barriers have been removed. This allows experimentation with new applications of bio-base solutions (Q7). Five initiatives for small-scale bio-refinery were set up as part of the experiments. Their effects are being monitored and, if positive, this will encourage farmers to follow. Creating good examples of the application of specific solutions will be more effective than restrictive policies (Q8). Further support is required to protect soils and the agricultural landscape (Q11).
6	Poland	Themes related to bioeconomy appear prominently in Poland's 'Strategy for the Development of the Country 2020' and in the 'Roadmap of a Transition to a Circular Economy (2019)', awaiting an updated national bioeconomy strategy (Q5). Some elements supporting the Green Deal and the bioeconomy are included in the CAP Strategic Plan (2023-2027). In the focal region of Lublin, a smart specialisation including bioeconomy was implemented by the local government in 2014-2020 in the regional innovation strategy and the region's development strategy. The revised smart specialisations up to 2030 consider, among other issues, food quality and the green economy. The adoption of national and regional bioeconomy strategies could also contribute to wider applications of small-scale bio-based solutions in the region (Q6). Currently, no regulations explicitly address small-scale biobased solutions in region (Q7). National policies are not adapted to regional specificities (Q8). However, local government is making efforts to ensure that these specifics are considered in their strategies. The financial support offered by local government for smart specialisation initiatives, including the bioeconomy, is not sufficient. However, a need of no less importance is to facilitate access to existing funds in the form of grants or loans (Q8). It is essential to support stakeholders not only with knowledge of possible small-scale solution applications, but also with legal advice, business models and an equitable share of the benefit chain (Q9). In general, biobased solutions at the stage of the green transition of the economy are investments of increased risk and sometimes even temporary too low economic competitiveness. It would therefore be advisable to take well-considered shielding measures for SMEs and start-ups in the critical phases of their development (Q10).

5. Conclusions

In each MainstreamBIO participating country (Bulgaria, Denmark, Ireland, The Netherlands, Poland, Spain, and Sweden) and in each of the seven MainstreamBIO focal regions, the policy environment for the development of small-scale biobased solutions is different. However, if the existing specificities are left aside, it can be concluded that the development of biosolutions could be improved by introducing the following policy initiatives:

- unblocking political initiatives,
- extending financial incentives and direct financial support,
- extending education and outreach to relevant stakeholders,
- raising awareness, showing all the benefits of applications,
- financing potential solutions directly,
- promoting specific tax reliefs from the initial investments,
- targeting initiatives to young people,
- promoting clear policy on biobased products,
- facilitating waste mobilization and valorisation,
- initiating certifications and standards for a wide range of bio-based products,
- shielding measures for SMEs and start-ups in the critical phases of their development,
- removing of bureaucratic barriers,
- support better cooperation with the administration.

These policy initiatives, as well as those resulting from further implementation of the project, will be discussed in the future during a dedicated EU policy roundtable. The material gathered and the results of the discussion will be used to develop the final set of 'Policy recommendations and briefs'.

6. Annex – Interviews material

Interview Questionnaire

Interviewer: _____ Title:

[First Name] [Last Name]

Date:

Part 1: Background Information

Question 1:

- Which of the following stakeholder groups do you associate with?
  - Biomass producer (farmers, forestry, aquaculture, unions, associations, etc.)
  - Business (agri-food & bio-based industry, rural entrepreneurs, tech providers, logistics, financing, etc.)
  - Academic/Researcher (experts, researchers, etc.)
  - Government/policy-maker/public authority
  - Civil Society (non-governmental organisations, consumer associations, etc.)
  - Other, specify _____

Question 2:

- Affiliation _____
- Position _____

Question 3:

- Your region: _____

Question 4:

- What is your highest educational level achieved?
  - Primary school
  - Secondary school
  - Bachelor's degree or equivalent
  - Master's degree or equivalent
  - Doctorate or equivalent

Part 2: Policy insights

Initial policy insights for decision-makers to facilitate the application of small-scale biobased solutions in rural areas

EU level

Question 5:

Can you identify which EU policies support the use of small-scale biobased solutions in your region?

- List the most important EU policies of relevance in your region.
- Do you see gaps in these policies that may hinder the introduction of small-scale biobased solutions?
- Which makes it difficult to implement these policies effectively?

Question 6:

What specific EU policy changes or initiatives do you believe would enhance the success of small-scale bio-based solutions in your region?

- What further policy initiatives could expand or facilitate the use of these solutions?
- Which of these changes do you think is the highest priority?

What benefits could arise from the proposed policy

National level

Question 7:

What national policies are directly or indirectly linked to the implementation of small-scale biobased solutions in your region?

- Are these policies merely an extension of EU policies?
- How can they be characterised?

Question 8:

Are the national policies sufficiently tailored to the specific characteristics of your region?

- What are the unique challenges and specific policy needs in your region?
- What further regulations would increase the implementation of a small-scale biobased solutions?

Stakeholder level

Question 9:

Whether existing policies support stakeholders in the use of small-scale biobased solutions?

- Which policies in place facilitate your operations?
- Which policies are most problematic to apply?
- What policy changes could improve the efficiency of your operations

Question 10:

What should change in policies to provide stronger support small-scale biobased solution applications at the levels considered (EU, country/region, stakeholder)?

- What are the suggestions for the necessary legislation changes?
- What are the suggestions for the financial support and investments?
- What actions could have a positive impact on farmers' willingness to adopt biobased practices?

Part 5: Final Thoughts

Question 11:

- Would you like to share any final thoughts?
- Anything you consider important to highlight.
- Any references to (practical or scientific) information about nutrient recycling practices, legislation, etc.

The project

MAINSTREAM BIO
MAINSTREAMING SMALL-SCALE BIO-BASED SOLUTIONS ACROSS RURAL EUROPE

MainstreamBIO is a Horizon Europe EU funded project, which sets out to get small-scale bio-based solutions into mainstream practice across rural Europe, providing a broader range of rural actors with the opportunity to engage in and speed up the development of the bioeconomy. Recognizing the paramount importance of bioeconomy for addressing key global environmental and societal challenges, MainstreamBIO develops regional Multi-actor Innovation Platforms in 7 EU countries (PL, DK, SE, BG, ES, IE & NL). The project aims to enhance cooperation among key rural players towards co-creating sustainable business model pathways in line with regional potentials and policy initiatives. MainstreamBIO supports 35 multiactor partnerships to overcome barriers and get bio-based innovations to market with hands-on innovation support, accelerating the development of over 70 marketable bio-based products and services. Furthermore, the project develops and employs a digital toolkit to better match bio-based technologies, social innovations and good nutrient recycling practices with available biomass and market trends as well as to enhance understanding of the bioeconomy with a suite of educational resources building on existing research results and tools. To achieve these targets, MainstreamBIO involves 10 partners across Europe, coming from various fields. Thus, all partners combine their knowledge and experience to promote the growth of

Coordinator: **Q-PLAN INTERNATIONAL ADVISORS PC (Q-PLAN**)

Partner		Short Name
Q-PLAN INTERNATIONAL	Q-PLAN INTERNATIONAL ADVISORS PC	Q-PLAN
MTU Ollscoil Teicneolaíochta na Mumhan Munster Technological University	MUNSTER TECHNOLOGICAL UNIVERSITY	MTU
WAGENINGEN UNIVERSITY & RESEARCH	STICHTING WAGENINGEN RESEARCH	WR
IUNG Institute of Soil Science and Plant Cultivation State Research Institute	INSTYTUT UPRAWY NAWOZENIA I GLEBOZNAWSTWA, PANSTWOWY INSTYTUT BADAWCZY	IUNG
RI. SE	RISE PROCESSUM AB	PROC
AGRARIAN UNIVERSITY - PLOVDIV	AGRAREN UNIVERSITET - PLOVDIV	AUP
Food & Bio Cluster Denmark	FBCD AS	FBCD
innovarum	EURIZON SL	INNV
DRAXIS ENVIRONMENTAL TECHNOLOGIES	DRAXIS ENVIRONMENTAL SA	DRAXIS
WHITE	WHITE RESEARCH SPRL	WHITE

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