European Network for Rural Development

ENRD Thematic Group on ‘Mainstreaming the Bioeconomy’

Scoping Paper

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Contents

Mainstreaming the bioeconomy in rural areas

Introduction

This background paper was prepared to inform and outline the scope and context of the Thematic Group on 'Mainstreaming the bioeconomy' and as background to the 1st Thematic Group (TG) meeting on the 9th October 2018.

The bioeconomy already exists and has done for centuries. It involves primary producers of both agricultural and forest products, processors, retailers and consumers of bio-based products from food and feed to fuels and materials. However, there is a growing desire to deliver more from the bioeconomy in terms of added economic value and prosperity as well as outcomes that meet emerging social and environmental needs, such as low-carbon and renewable materials. This is driven by a variety of factors including a desire to promote rural development and add value to biomass commodities, reduce dependency on fossil fuels throughout the economy, reduce greenhouse gas emissions, increase resource efficiency and reduce waste by using and adding value to wastes and residues and reduce plastic pollution. As a consequence, there is a move to reimagine the bioeconomy and its delivery of products and materials to society.

In the EU a combined Bioeconomy Strategy and Action Plan was adopted in 2012[1], setting out key definitions and needs from the bioeconomy but focusing primarily on research needs. The Strategy was reviewed in 2017[2]. The review concluded that: further mobilisation of investment is needed and can be achieved; emerging policy objectives need to be addressed (including global commitments to the UN Sustainable Development Goals and climate mitigation); and clear indicators for monitoring progress should be defined to ensure the bioeconomy operates within natural resources limits. In Autumn 2018 a revised Strategy is scheduled to be adopted by the European Commission.

The Thematic Group offers an opportunity to examine the role of Rural Development Programmes (RDPs) in supporting further the evolution and development of the bioeconomy, the actors involved and opportunities for rural areas. The emphasis on new products and outputs from the bioeconomy offers the opportunity of developing new value chains and to maximise the value and diversity of products emerging from existing value chains. Moving towards a bioeconomy is not intended simply to deliver and proliferate new bio-based products. The bioeconomy is, importantly, seen as a mechanism to drive more sustainable production (and consumption when integrated with circular economy principles) and sustainable development delivering on social, economic and environmental objectives. If effectively regulated and implemented the bioeconomy can offer an opportunity for rural investment and improved delivery of public goods including biodiversity and ecosystem services, closely aligned with the delivery of a more circular economy.

[1] European Commission (2012) Innovating for sustainable growth: A bioeconomy for Europe https://publications.europa.eu/en/publication-detail/-/publication/1f0d8515-8dc0-4435-ba53-9570e47dbd51

[2] European Commission (2017) Review of the 2012 EU Bioeconomy Strategy. URL: https://ec.europa.eu/research/bioeconomy/pdf/review_of_2012_eu_bes.pdf

What is the bioeconomy?

Defining the Bioeconomy at the EU level

Given the historic and ongoing use of biomass in the economy the question might be asked: Why the emphasis now on creating or transitioning to a bioeconomy? The answer relates to the desire to both promote and respond to advances in scientific knowledge and the evolution of technologies that offer alternative opportunities for creating value from biomass. Furthermore, the opportunities for the bioeconomy to drive sustainable development have not yet been realised at scale. As a consequence, this offers potential opportunities for producers, processors, consumers and society at large.

Analysis by the SCAR network[3] identified two premises on which the bioeconomy is built. First, biomass is being underexploited, as many waste streams are not used in an optimal way. More materials and more energy could be extracted from current biomass streams, particularly waste and residues. Second, the biomass potential can be upgraded by increasing current yields, increasing productivity of land, introducing new or improved species that may be generated by various biotechnological advances, and introducing new and improved extraction and processing technologies[4].

The EU's 2012 Bioeconomy Strategy defines the bioeconomy[5] 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 as well as bioenergy". The aim of the Strategy is to pave the way to a more innovative, resource efficient and competitive society that reconciles food security with the sustainable use of renewable resources for industrial purposes, while ensuring environmental protection. To this end the strategy identifies five key objectives of the bioeconomy:

1. Ensuring food security;
2. Managing natural resources sustainably;
3. Reducing dependence on non-renewable sources;
4. Mitigating and adapting to climate change;
5. Creating jobs and maintaining EU competitiveness.

It is important to note the multiple aims of the strategy and the wider bioeconomy agenda. The goal is not simply to increase agricultural or biomass output, but also to deliver more sustainable resource use, mitigate and adapt to climate change and promote sustainable growth. Hence the bioeconomy is closely linked to the circular economy agenda, i.e. one of resource efficiency, the circular use and reuse of resources, reduction in consumption and more sustainable consumption and production patterns.

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[3] The Standing Committee on Agricultural Research operates based on a mandate from the Council of the European Union, requested to advise the Commission and the Member States on the coordination of agricultural research in Europe.

[4] Sustainable Agriculture, Forestry and Fisheries in the Bioeconomy - A Challenge for Europe, 4th SCAR Foresight Exercise (2015) https://ec.europa.eu/research/scar/pdf/ki-01-15-295-enn.pdf

[5] It should be noted that there are multiple definitions of the bioeconomy, including different definitions used across EU Member States, for example the German Bioeconomy Council defines it as "the production and utilization of biological resources (including knowledge) to provide products, processes and services in all sectors of trade and industry within the framework of a sustainable economy". This paper is based on the EU adopted definition.

Arguably, the (sustainable) bioeconomy agenda fundamentally depends on achieving a circular, more efficient economy. This is because of the potential scale consequences of, for example, attempting to replace the existing consumption of non-renewable sources with bioresources on a one to one basis. Excessive emphasis on alternative uses of biomass, in the absence of a wider shift in consumption and efficiency of resource use, could shift the focus away from models of agriculture and food production based on high quality products and services, conservation and management of cultural landscapes, preservation of multifunctional ecosystems, support to local economies based on synergy with tourism[6]. These aspects are seen as key to the competitive advantage of many rural areas and give a strong identity to European agriculture. As highlighted in the EEA's 2018[7] report on the circular and bioeconomy: "exploiting biomass is not necessarily circular and sustainable. Processed biomaterials are not always biodegradable, and mixing them with technical materials can hamper recycling. In addition, exploitation of biomaterials may increase pressure on natural resources and dependence on use of non-biological materials with considerable environmental impact, including agrichemicals". Clear principles are needed in order to fulfil the potential of the bioeconomy towards sustainability and green growth[3].

Under the EU's Strategy a Bioeconomy Panel made up of key stakeholders[8] was set up. In 2017 they published a 'Manifesto' setting out principles on which they considered a European bioeconomy should be based. It noted that "the development of the bioeconomy needs to be driven by the desire to meet several of the big societal challenges of our time. The EU bioeconomy should be sustainable in terms of people (jobs, inclusiveness), planet (limits to resources, biodiversity, ecological balance and climate) and profit (resource efficiency, competitiveness)"[9].

Supporting a Sustainable Bioeconomy

Within the conception of the bioeconomy all three elements of sustainable development feature strongly. Economic, social and environmental change have to be driven by a more innovative, efficient and multi-faceted approach to the use of biomass. The bioeconomy is often cited as a mechanism by which the aims set out in the UN 2030 Agenda for Sustainable Development [10] could be realised, potentially contributing to the achievement of several Sustainable Development Goals (SDGs).

SDGs commonly cited as relevant to the bioeconomy are: economic growth and eradication of poverty (SDG 1); food security and nutrition (SDG 2); healthy lives (SDG 3); water and sanitation (SDG 6); affordable and clean energy (SDG 7); sustainable consumption and production (SDG 12); climate

[6] Schmid, O., et al. (2012). The bioeconomy concept and knowledge base in a public goods and farmer perspective. Bio-based and Applied Economics 1(1): 47-63.
[7] European Environment Agency - EEA (2018) The circular economy and the bioeconomy: Partners in sustainability, Report 8/2018 https://www.eea.europa.eu/publications/circular-economy-and-bioeconomy
[8] European Commission (2013) European Bioeconomy Panel - Profiles of panel members. URL: https://ec.europa.eu/research/bioeconomy/pdf/european-bioeconomy-panel-list-17092013_en.pdf
[9] Bioeconomy stakeholder manifesto (2017) https://ec.europa.eu/research/bioeconomy/pdf/european_bioeconomy_stakeholders_manifesto.pdf
[10] United Nations Resolution (2015) Transforming our world: the 2030 Agenda for Sustainable Development. URL: http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E

change (SDG 13); oceans, seas and marine resources (SDG 14); and terrestrial ecosystems, forests, desertification, land degradation and biodiversity (SDG 15).[11]

As much as the bioeconomy can contribute to the sustainable development goals, it may also challenge their achievement. This will depend on the approach to implementation and the scale of use and sustainable production (see Table 1 below).[12] At the recent Global Bioeconomy Summit, stakeholders from across the globe recognised the need for the bioeconomy to fulfil and address sustainability issues in order to provide a contribution to the SDGs.

Table 1: Opportunities and challenges of the bioeconomy to the SDGs

	Sustainable Development Goal (SDG)	Opportunities	Challenges
	**No poverty (SDG 1)**	Poverty reduction through economic development and knowledge and/or technological transfer	Increased divide due to unbalanced technological development or misuse Lack of emphasis on added value for producers compared to processors
	**Ending hunger and ensuring food security (SDG 2)**	Increase food security via higher yields and new production systems	Fluctuation depending on food prices Risk to achievement of sustainable agriculture goal 2.4, if increasing demand for biomass is not managed effectively and delivery of the bioeconomy leads to increased environmental degradation
	**Healthy lives (SDG 3)**	Improvements through new and refined forms of therapy	New or risky diseases through the use of non-sufficiently tested technologies Increase in environmental pollution associated with unsustainable production to meet increasing biomass demand
	**Water and sanitation (SDG 6)**	Savings and better conservation through more resource-efficient use	Further losses due to increased or inefficient resource use

[11] Global Bioeconomy Summit (2015) Communiqué: Making Bioeconomy Work for Sustainable Development. URL: http://gbs2018.com/fileadmin/gbs2015/Downloads/Communique_final_neu.pdf

[12] Dietz, J. et al (2018) Governance of the bioeconomy: A global comparative study of national bioeconomy strategies, based on von Braun (2015), von Braun (2010), Swinnen and Riviera (2013). URL: https://www.zef.de/uploads/tx_zefnews/ZEF_DP_264.pdf

	**Natural resources (energy; marine; terrestrial ecosystems) (SDGs 7, 14, 15)**	Savings and better conservation through improved cultivation and production methods	Further losses due to increased or inefficient resource use
	**Ensuring sustainable consumption and production (SDG 12)**	Enhanced sustainability linked to development based on knowledge and/or technological transfer	Increased misuse or overuse of resources
	**Combating climate change (SDG 13)**	Adaptation through new cultivation and production systems; mitigation through emission reduction	Exacerbated direct and indirect land use change, especially in countries producing agricultural commodities for export

Source: Dietz, J. et al (2018) Governance of the bioeconomy: A global comparative study of national bioeconomy strategies, based on von Braun (2015), von Braun (2010), Swinnen and Riviera (2013). URL: https://www.zef.de/uploads/tx_zefnews/ZEF_DP_264.pdf

Promoting the bioeconomy

National and Regional Approaches in Europe

At the EU level the Bioeconomy Strategy published in 2012 was intended to offer guiding principles for the development of the bioeconomy and form a basis for future research. While the EU Strategy emphasises the need for integration of key EU policies relevant to the bioeconomy, including the CAP, forestry and environmental policies, it does not set specific requirements for national action on the bioeconomy. The Strategy does, however, note the importance of action at both the EU and national level on the bioeconomy and many Member States have adopted national approaches and strategies focused on the bioeconomy as a whole (or relevant aspects of innovation).

Of the 28 EU Member States only a minority have dedicated, national bioeconomy policies in place, including Austria, Finland, France, Italy, Latvia, Germany and Spain. Other countries are taking forward action relevant to the bioeconomy but adopting a more sectoral approach, for example: Denmark has a growth plan focused on water, bio and environmental solutions and a separate growth plan focused on food; the UK has a strategy looking explicitly at opportunities from waste linked to the bioeconomy; Lithuania has a national industrial biotechnology development programme.

Importantly, given the rural nature of production and regional differences in resources, bioeconomy strategies are also being developed at the regional level, for example in Flanders, Bavaria, Baden-Wurttemberg, Extremadura and Andalucía. It also includes macro-regional strategies such as the Baltic Sea Region, Danube region and West Nordic Countries.

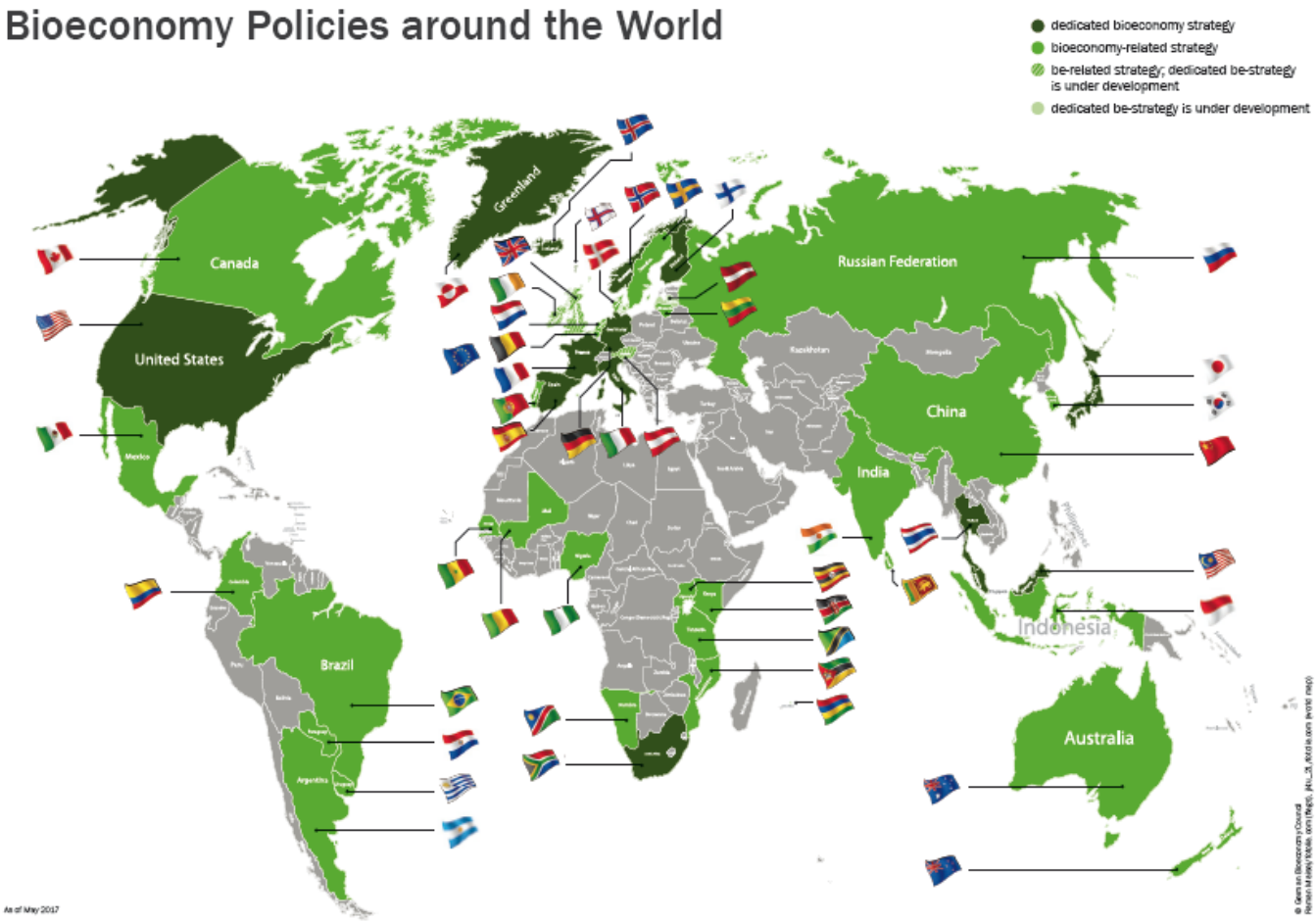
A summary table setting out details of key bioeconomy strategies adopted in Europe, and related policies, is set out in Annex I. It should be noted that the coverage of such strategies and dossiers varies in extent and emphasis. There is no one consistent model for a bioeconomy strategy at national or regional level. Some strategies, for example those in Spain, have a strong emphasis on evolving the agricultural sector including improved cropping systems, processing and the use of residues and by-products from production. The Spanish national and regional strategies also cross-reference the potential change in approaches within RDPs in order to support the bioeconomy and green growth. Other documents, for example the Lithuanian National Industrial Biotechnology Development Programme, are focused on bioplastics, second generation biofuels and biopharmaceuticals; similarly, the Bavarian Bioeconomy Strategy emphasises research and innovation focused on biogas, lignocellulosic materials and algae. The Italian Bioeconomy Strategy explicitly mentions the role of EAFRD in fostering new value chains for bioenergy and bio-based industries.

Global Transition

Interest and a desire to promote and generate opportunities from a renewed bioeconomy is not confined to Europe. At present, almost 50 countries or groups of countries have formulated their policy strategies or plans of actions to steer and develop the bioeconomy at macro-regional, national or regional level. Analysis and stakeholder engagement show that there is a proliferation of bioeconomy initiatives in Africa, the Americas, Europe, Asia and the Pacific (see Figure 1 below), different countries

being at various stages of strategy development[13]. The trends seen at the EU level are echoed when looking at national and regional strategies and plans globally. As summarised in Table 2, strategy and plan emphasis and coverage vary considerably. Outside of Europe bioeconomy strategies and plans appear to more strongly emphasise the research elements of the bioeconomy, i.e. support for scientists and research (South Africa), bio-industrial innovation (Japan and Malaysia); and support to research and development on biomaterials and easy uptake of innovations in the market (USA).

Figure 1: Overview of bioeconomy policies around the globe



Source: BioStep Project - http://www.bio-step.eu/fileadmin/BioSTEP/Bio_documents/BOER_Bioeconomy_Around_World_Map.pdf

[13] German Bioeconomy Council (2018) Bioeconomy Policy (Part III) Update Report of National Strategies around the World. URL: http://biooekonomierat.de/fileadmin/Publikationen/berichte/GBS_2018_Bioeconomy-Strategies-around-the_World_Part-III.pdf

Table 2: Overview of dedicated bioeconomy strategies

Country/region	Strategy	Focus
Baltic Sea region	A Bioeconomy for the Baltic Sea Region (2014)	Scoping interest among stakeholders to develop a bioeconomy strategy for the Baltic Sea Region
Danube region	Bioeconomy for the Danube region (2017)	Mapping bioeconomy-related initiatives in the Danube Region and supporting the initiation of bioeconomy strategy for the region
European Union	Innovating for Sustainable Growth: A Bioeconomy for Europe (2012)	Reconcile food security with sustainable use of renewable resources, while ensuring environmental protection
Finland	The Finnish Bioeconomy Strategy (2014)	Forest-based bioeconomy to boost growth and competitiveness
France	A Bioeconomy Strategy for France (2017)	Sustainable economic growth; Increased employment and improved trade balance and international competitiveness; Self-sufficiency, alongside efficient and sustainable use of natural resources
Germany	National Policy Strategy on Bioeconomy (2013)	Knowledge-based bioeconomy
Italy	Bioeconomy in Italy: A unique opportunity to reconnection economy, society and environment (2017)	Increased competitiveness and promotion of green growth. Reduce fossil fuel dependence and promote rural and coastal development.
Latvia	Latvian Bioeconomy Strategy 2030 (2017)	Promotion of rural development and increased per capita income; Development of high value-added bio-based products and services
Japan	National Plan for the Promotion of Biomass Utilisation (2010)	Industrial use of biomass
Malaysia	Bioeconomy Transformation Programme (2013)	Industrial upgrading and application of biotechnology
Nordic Council of Ministers	Future Opportunities for Bioeconomy in the West Nordic Countries (2014)	Boost green growth and create added value through the use of natural resources, with a focus on fisheries
Norway	Familiar resources – undreamt possibilities. The Government's Bioeconomy Strategy (2016)	Creation of wealth and employment and improvement of the country's competitiveness, alongside moving towards a circular and low emission economy
Spain	The Spanish Bioeconomy Strategy: Horizon 2030 (2016)	Increase competitiveness and economic growth, alongside diversifying and getting to a more environmental sustainable economy. At global level, it focuses on food security and climate change
South Africa	The Bioeconomy Strategy – Partnership for Action on Green Economy (2014)	Improving innovation capacity by way of training and education for scientists, engineers and technicians along bioeconomy value chains
USA	National Bioeconomy Blueprint (2012 and 2017)	Bio-innovation support and support for access to market, bioengineering and innovation

Source: Adapted from the European Commission (2017) Review of the 2012 EU Bioeconomy Strategy. URL: https://ec.europa.eu/research/bioeconomy/pdf/review_of_2012_eu_bes.pdf

The potential role of RDPs in supporting the mainstreaming of the bioeconomy

"Advancements in bioeconomy research and innovation uptake will allow Europe to improve the management of natural resources and to open new and diversified markets in food and bio-based products. This will be important in order to cope with an increasing global population, rapid depletion of many resources, increasing environmental pressures and climate change, as Europe needs to radically change its approach to production, consumption, processing, storage, recycling and disposal of biological resources". Bioeconomy Stakeholder Manifesto, 2017

Moving towards the future vision of a bioeconomy implies a shift in the way biological resources are produced, processed and consumed. As noted within the priorities set out in the 2012 Bioeconomy Strategy, this requires:

- A coherent policy framework;
- Increased knowledge transfer and upskilling;
- Connecting actors across the bioeconomy;
- Making links between scientific outcomes and rural actors.

Within the EIP-AGRI work on the bioeconomy (2015 Stakeholder Workshop and Report[14]) key risks to the transition to the bioeconomy identified included: lack of communication, knowledge transfer and cooperation between different actors in the value chain due to cultural barriers, difference in mindset and lack of trust; the lack of market pull and limited research and development support for new value chains linked to alternative crop uses; lack of investment in logistical infrastructure to meet new value chain needs; and the need to develop value chains that increase incomes to the biomass producers.

The experts participating in the above-mentioned workshop noted that "building up a bioeconomy vision at regional level is important for reaching a common understanding between the different actors of a value chain. These strategies and visions as well as success stories and databases of relevant information (e.g. innovation support services, available conversion technologies, logistical costs), are also a starting point for communication and dissemination and have not yet been sufficiently developed in Europe."

EU Rural Development Programmes (RDPs) are an important source of funding to enable the bioeconomy transformation, especially to develop value chains, associated infrastructure and facilities. Their potential to do this has not been fully explored yet, and the work of the Thematic Group will in particular aim at shedding a light on the role of RDPs in promoting sustainable bioeconomy value chains in rural areas. The development of the bioeconomy offers potential to support the CAP objectives of viable food production, sustainable management of natural resources and climate action, and balanced territorial development. However, the ability to deliver particularly the latter two objectives

[14] European Innovation Partnership for Agricultural Productivity and Sustainability, EIP-AGRI (2015) Building new biomass supply chains for the bio-based economy, Final Workshop Report, 27-28 May 2015 https://ec.europa.eu/eip/agriculture/sites/agri-eip/files/field_event_attachments/report-ws-bioeconomy_final_28052015.pdf

will depend on a targeted and considered approach to the development of the bioeconomy. Ensuring that shift requires considering environmental and social needs: supporting value added within rural communities and more resource efficient, environmentally beneficial and climate sensitive practices, alongside delivering new, innovative end products. RDPs have a potentially important role in helping to target actions promoting new or improved value chains under the auspices of the bioeconomy, to deliver across the whole spectrum of desired outcomes.

In terms of existing opportunities linked to RDP support for the bioeconomy, these are dispersed across multiple measures and focus areas. This means that it is important to provide coordinated and coherent action to provide bioeconomy-targeted support; but it also means that there are a variety of intervention points.

Box 1 summarises potential focus areas and measures that could be used to support the evolution of the bioeconomy.

Box 2 provides a range of examples setting out how RDPs have already been utilised to promote diversification of activity and income, generate added value products and support innovation – all potential elements of a future approach to RDP support focused on the bioeconomy.

Research completed to date identifies the importance of RDPs, regional action and coordinating value chains. **A potential opportunity within the Thematic Group is to understand how a more structured approach to the use of these measures, and RDPs in general, can be adopted for delivering the bioeconomy in a way that balances the objectives of viable food production, sustainable management of natural resources and balanced territorial development.**

Box 1: Focus Areas and Measures offering the potential to support and invest in the bioeconomy

The following focus areas have been identified as key to potentially supporting the bioeconomy, and the measures linked to these focus areas (based on reporting by the ENRD) are set out.

Focus Area	Description	Measures noted to be of importance in delivery*
1A	Fostering innovation, cooperation and the development of knowledge base in rural areas	M1, M2, M16
1B	Strengthening the links between agriculture, food production and forestry and research and innovation, including for the purposes of improved environmental management and performance	M16
1C	Fostering life-long learning and vocational training in the agricultural and forestry sectors	M1
4A	Restoring, preserving and enhancing biodiversity	M10, M13, M11, M8
5B	Increasing efficiency in energy use in agriculture and food processing	M4
5C	Facilitating the supply and use of renewable sources of energy	M4, M8
5D	Reducing greenhouse gas and ammonia emissions from agriculture	M10
5E	Fostering carbon conservation and sequestration in agriculture and forestry	M8
6A	Facilitating diversification, creation and development of small enterprises as well as job creation	M2, M8, M7, M4, M6, M1, M16

6B	Fostering local development in rural areas	M16, M1, M2, M4, M6, M13, M19, M7

*Based on ENRD focus area summaries https://enrd.ec.europa.eu/policy-in-action/rural-development-policy-figures/priority-focus-area-summaries_en on public expenditure per priority and per measure.

There are a broad range of measures and specific sub measures that have the potential to be used to facilitate the development of the bioeconomy. These include measures that offer relatively broad scope and also specific measures relevant to certain aspects of bioeconomy development, specifically forestry.

Measure	Description	Sub Measures of Particular Interest
Generally Applicable to the Bioeconomy		
M1	Knowledge transfer and information actions	1.1. Support for vocational training and skills acquisition actions
		1.2. Support for demonstration activities and information actions
		1.3. Support for short-term farm and forest management exchange as well as farm and forest visits
M2	Advisory services, farm management and farm relief services	2.1. Support to help benefit from the use of advisory services
		2.2. Support for the setting up of farm management, farm relief and farm advisory services as well as forestry advisory services
		2.3. Support for training of advisors
M3	Quality schemes for agricultural products and foodstuffs	3.1 new participation in quality schemes
		3.2 information and promotion activities implemented by groups of producers in the internal market
M4	Investments in physical assets	4.1investments in agricultural holdings
		4.2 investments in processing/marketing and/or development of agricultural products
		4.3 investments in infrastructure related to development, modernisation or adaptation of agriculture and forestry
M6	Farm and business development	6.2 business start-up aid for non-agricultural activities in rural areas
		6.4 investments in creation and development of non-agricultural activities
M7	Basic services and village renewal in rural areas	7.2 investments in creation, improvement or expansion of all types of small scale infrastructure, including investments in renewable energy and energy saving
M9	Setting up of producer groups	9 Setting up of producer groups and organisations in the agriculture and forestry sectors
M16	Co-operation	16.2 pilot projects and for the development of new products, practices, processes and technologies
		16.4 horizontal and vertical cooperation among supply chain actors for the establishment and development of short supply chains and local markets and promotion activities in a local context relating to this development
		16.6 cooperation among supply chain actors for sustainable provision of biomass for food and energy production and industrial processes
M19	Support for LEADER local development – Community led local development	Includes integrated approaches, making links between stakeholders and start up initiatives dependent on Local Development Strategy objectives
Specific to the support of forestry activities		
M8	Investments in forest area development and improvement of the viability of forests	**8.1.** Support for afforestation/creation of woodland
		8.2. Support for establishment and maintenance of agroforestry systems
		8.6. Support for investments in forestry technologies and in processing, mobilising and marketing of forest products
M15	Forest-environmental and climate services and forest conservation	**15.2.** Support for the conservation and promotion of forest genetic resources

Box 2: Examples of approaches to the use of European funding for rural development to promote diversification, innovation and added value compatible with mainstreaming a sustainable bioeconomy in rural areas.

The following are examples extracted from the ENRD database of projects demonstrating potential mechanisms for support of the bioeconomy. It should be noted that most are not defined as delivering the bioeconomy but in terms of delivering diversification of income, innovation in the rural economy or adding value to the supply chains. The following were selected to illustrate the potential types of action and modes of investment. Other instruments are also available at EU level that can also promote such innovations, including research funding under H2020 and LIFE. For instance, examples of funding from H2020 include:

- ENABLING NETWORK – bring together partners from 13 countries to spread best practices and innovation in relation to production and pre-processing of biomass for bio-based industry, based on the premise that most farms have neither sufficient scale or biomass volume nor ability to specialise to deliver consistently against bio-based industry needs.
- AGROINLOG – aiming to demonstrate the feasibility of local integrated centres for biomass treatment for processing for food and non-food products.
- 3i Bioeconomia – a multipartner project in the Tagus Valley aimed at using the bioeconony as a mechanism to address land abandonment of mountain areas in Portugal.

Project Name	Summary	Link to the Bioeconomy	Funding Stream Utilised	Member State/Location
IMES-SEMI - Adding value to seed oil production	Nine arable farms came together to explore the possibilities of growing oleaginous crops including cultivation trials, developing and testing new products and processes and market analysis. Collaboration between farm partners and the university of Pisa	Collaborative action, supporting knowledge exchange and practical development of new products and processes	EAFRD – Measure 16.2 development of new products, practices, processes and technologies	Italy – Province of Pisa
Innovative service – Bio construction from hemp	Support used to purchase equipment that enabled the production of various construction materials where hemp is used as a base material. Provided a basis for developing demonstration buildings made from hemp shive concrete	Promoting and facilitating the use of biomaterials in an innovative way and providing a basis for knowledge sharing	EAFRD – LEADER	Latvia – Lielvarde
Feasibility study to upscale biocomposite production line	Business start-up, using RDP financing to carry out a feasibility study which helped lower the risks in upscaling production capacity for bio-composites based on pulp fibre	Facilitating investment decisions and roll out of R&D outcomes into the wider commercial sector	EAFRD – Measure 6 – Farm and Business Development	Finland – Sastamala
VACASTO – Adding value to chestnut growing	Project aimed at preserving chestnut production reducing risk of abandonment linked to economic, environment and supply chain factors. New harvesting and forestry equipment were required. Funding used to coordinate actors in the supply chain, restore abandoned areas, purchase equipment and logistical facilities such as storage	Promoting coordination across the supply chain to retain and add value	EAFRD – LEADER	Italy – Tuscany
Darzini 2 – modernisation of a farm specialised in floriculture	Support to buy tractor and other equipment for the cultivation and transportation of harvested plants and flowers and specialist drying equipment to create new products for cosmetics companies and use in saunas	Promoting new market opportunities and diversifying products	EAFRD – Measure 6 – Farm and business development	Latvia – Ciemupe
Setting up a biogas plant	Diversifying to stabilise farm income and protect against volatile agricultural process. Support to install two bio-digesters and generators to generate renewable energy and support pig manure management on farm	Promoting use of wastes and residues and the production of added value products i.e. energy and fertilisers. Diversification of on farm income	EAFRD – Measure 6 – investment in non-agricultural activities	Czech Republic – Jetrichovec
Producing and packaging pellets from olive	Setting up of a complete line for producing and packing pellets for bioenergy. The pellet mill provides economic benefits to the olive producers who are now paid to	Coordination of a new production stream for products, supporting	EAFRD – LEADER	Greece – Epitalio

harvesting residues	collect and deliver waste material to the plant	engagement with producers of materials		
Supporting organic rose oil production in Bulgaria	Supporting the production of organic rose essential oils, extending the product range. Investment in distillery equipment. Enabling product diversification into both organic and non-organic products and added value products	Development of added value products and support for facilitating innovation	EAFRD – Measure 4.3 – adding value to agricultural and forestry products	Bulgaria - Panagyurishte

Thematic Group Objectives and the Focus of the Thematic Group

The overarching objective of the Thematic Group is "**to encourage the development of sustainable bioeconomy value chains in rural areas** in order to promote employment and economic growth, while preserving eco-systems."

To this end the TG will identify opportunities to support the development of bio-based business models through Rural Development Programmes and will produce a set of recommendations for improving sustainable rural value chains in the bioeconomy through RDPs. This will be achieved by identifying and considering the different areas of value chains that can benefit from the development of the bioeconomy, how these benefits can be delivered in rural areas, and how they can be made sustainable and self-supporting.

Potential priority areas for focussing the TG's work include:

- How can a more structured approach to the use of these RDP measures, and RDPs in general, be adopted for delivering the bioeconomy in a way that balances the objectives of viable food production, sustainable management of natural resources and balanced territorial development?
- How can the CAP/RDPs be used to generate added value (economic, social and environmental) at each stage of the value chain, and in particular for rural actors?
- How can the CAP/RDPs be used to develop circular bioeconomy value chains, where economic, environmental and social value can be returned or flow to rural areas, even if they are generated outside of those areas?[15]
- How can pilot projects and innovations, such as those developed through EIP operational groups, be systematically rolled out and upscaled?
- How can sustainable rural bioeconomy value chains attract more (private) investment?
- How can environmental and social sustainability be ensured in the development of rural bioeconomy value chains?

The Thematic Group's work is rooted in the use of the CAP, and particularly RDPs in support of these objectives. Our work will focus on how to better target support under RDPs in the current programming period (2014-2020) to promote the bioeconomy and provide recommendations to the future operation and design of successor programmes in the CAP beyond 2020.

In considering the potential for improving sustainable rural value chains in the bioeconomy, it is important to be clear about the distinction between supply chains and value chains so that the work of the TG can remain focussed - see Box 3. A sustainable rural value chain is one in which the economic, environmental/climatic, and social added value is distributed equitably between the different actors in that value chain, rather than being concentrated in certain areas or being distributed unequally outside of the rural sectors.

[15] For example, the return of recovered nutrients from digestate or food waste.

Box 3: Key differences between supply and value chains

Supply chains describe the flow of goods and services between different actors, such as the production of wheat, its collection, processing, the manufacturing of pasta and eventual sale.
Value chains describe the flow of value between different actors in a supply chain and may include a broader set of actors than in supply chains. Value can be reflected by a range of terms:

- Economic - where value chains describe the flow of profit or income between actors in the supply chain. For example, the flow of income to different actors based on the input and output costs.
- Environmental/climatic – where value chains describe the flow of benefits to given environmental or climate objectives. For example, the greenhouse gas emissions avoided as a result of a bioeconomy value chain.
- Social – where value chains describe the flow of benefits to people and communities. For example, the jobs created in rural areas as a result of new supply chains.

Figure 2 shows an illustration of different actors involved in one bioeconomy value chain, food. Here the main economic benefits (profits/income) are concentrated with the relatively few actors present in the manufacturing, supply and retail part of the value chain, some of which operate outside of rural areas. In contrast the costs and risks for delivering food are concentrated with the producers. In a sustainable rural bioeconomy value chain, the flow of value, in this case economic value, should be more evenly distributed as a means of incentivising and engaging rural actors in new bioeconomy supply chains and supporting sustainable development.

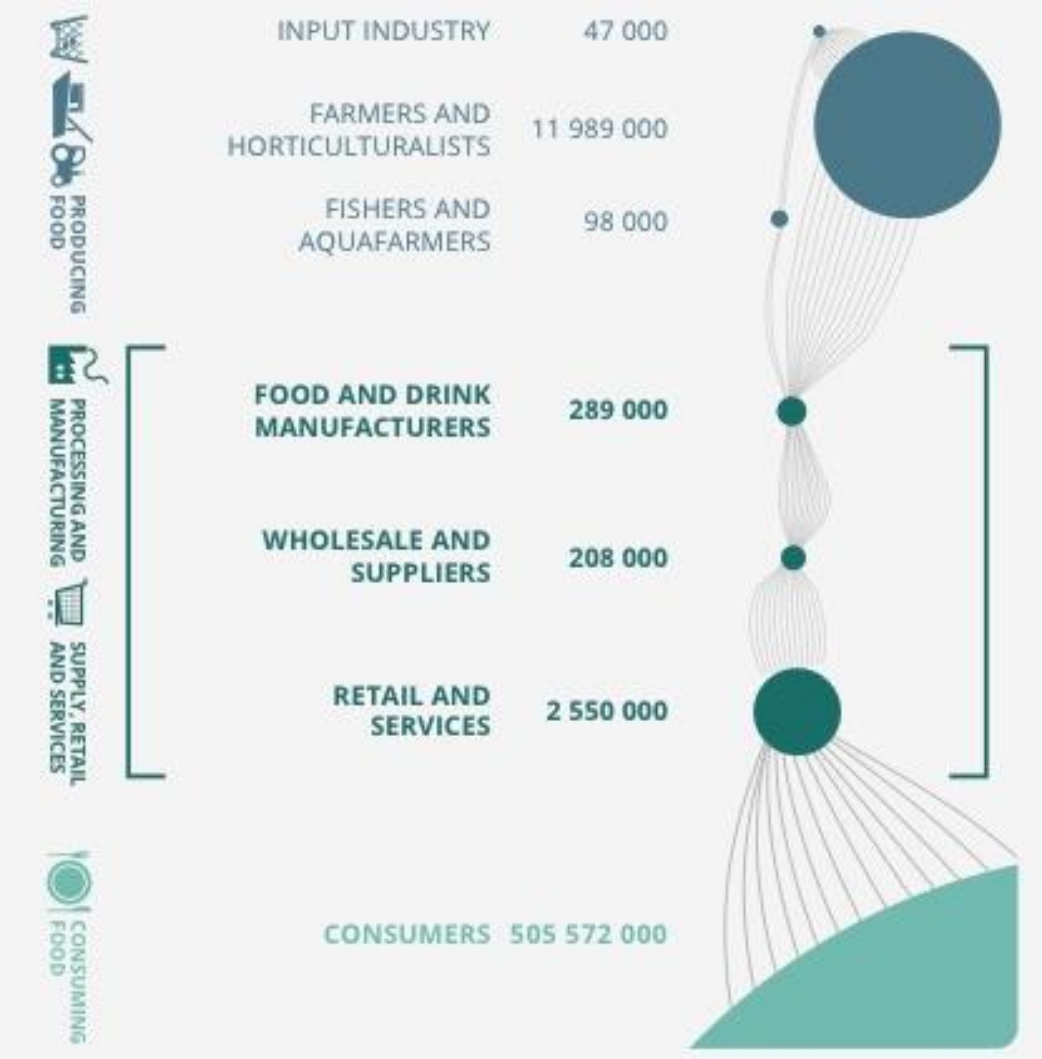
This flow of benefits is important for the environment and social aspects of sustainability. In environmental terms, bioeconomy supply chains lead to a flow of resources (such as nutrients) out of rural areas and currently lack the return of those resources to areas of production. This leads to both environmental pressures through the continued exploitation of natural resources and costs to the producers to support production through additional inputs. Social benefits are closely linked with economic benefits realised in the value chain, such as job creation and increased quality of life. In developing new sustainable rural bioeconomy value chains, it is important to explore the potential to increase jobs in rural areas, rather than focus on bioeconomy developments in the processing and manufacturing phase, often in urban areas.

Across all sustainability aspects of rural bioeconomy value chains, the Thematic Group should consider both:

- The potential to generate added value at each stage of the value chain, and in particular for rural actors;
- The potential for developing circular bioeconomy value chains, where economic, environmental and social value can be generated in or return or flow to rural areas, even if they are generated outside of those areas. For example, the return of recovered nutrients from digestate or food waste.

Figure 2: Actors in the food chain

Source: Reproduced from EEA (2017) Food in a green light - A systems approach to sustainable food. EEA Report - No 16/2017 European Environment Agency, Copenhagen. **Notes:** There may be some double counting as some actors operate across the value chain. The input industry also includes some wholesale of grain. Data used are the number of enterprises in 2012 (input industry, aquafarmers, manufacturers, wholesale and suppliers and retail and services), number of holdings in 2012 (farmers and horticulturalists), number of vessels in 2013 (fishers) and population in 2013 (consumers).



Annex I - Overview of bioeconomy and related strategies in Europe

Country	Strategy	Timeframe	Type	Goal	Priority areas	Relevance to rural development
European Union	Innovating for Sustainable Growth: A Bioeconomy for Europe (2012)	2020	EU Bioeconomy Strategy	It aims to reconcile food security with sustainable use of renewable resources, while ensuring environmental protection.	Agriculture Forestry Fisheries Aquaculture Processing industries	The Strategy seek to achieve synergies and complementarity with other policy areas, including the CAP, energy and environmental policies. EAFRD and cohesion funds can contribute to foster innovation and the development of sustainable supply chains and facilities within rural areas, including through better linkages to EIP-AGRI Operational Groups and Horizon 2020.
	Review of the 2012 European Bioeconomy Strategy (2017)	2020	EU Bioeconomy Strategy review	To assess progress against the objectives and priorities set in EU Bioeconomy Strategy	Agriculture Forestry Fisheries Aquaculture Processing industries	Same as above. It is explicitly mentioned that the CAP can contribute to achieving food security (SDG 2). CAP can also support better monitoring and assessment framework by feeding into the design of relevant indicators.
Austria	Research, Technology and Innovation Strategy for Bio-based Industries in Austria (2014)	2030	Research and Innovation	Further develop the bio-based industry by promoting research, technology and innovation projects. The following product groups are prioritised: insulation and building products; biogenic composite materials, biopolymers; biofuels, biogenic fertilisers, and enzymes and pharmaceutical products.	Food industry Chemicals industry Pharmaceutical industry Timber industry	The Strategy aims to support action in relation to the efficient use of biomass and assess the economic and ecological impact of bio-based products. Rural development is not explicitly mentioned. However, it is relevant to the production and value added of primary components of bio-based products. EAFRD could be used to support further research and innovation, which is generally called by the Strategy.
	Policy Paper on the Bioeconomy (2013)					
Belgium	Bioeconomy in Flanders (2014) and Action Plan	2030	Regional Bioeconomy Strategy	Green growth; job creation, and development of a circular economy	Agriculture Forestry Fishing Food industry Wood-processing sector Pulp and paper industry Environmental technology sector	However, it is relevant in that the Strategy calls for: • Policy coherence by removing regulatory barriers and policy cooperation; • Capacity building, research and innovation (e.g. training and pilot projects); • Efficient and sustainable use of biomass; • Market development and awareness creation; • Interregional cooperation.

Country	Strategy	Timeframe	Type	Goal	Priority areas	Relevance to rural development
					Construction and infrastructure sector	
					Energy sector	
					Industrial sectors (textile, chemical, biotechnology)	
Denmark	Growth Plan for Water, Bio and Environmental Solutions (2013)	n/a	Green Economy	Both plans aim to foster economic growth, employment and exports	Water resources	Rural development is relevant in that, in relation to bio-based products, the plan discussed Denmark's strengths and potential of the agricultural sector concerning the production of biomass. Biofuels from crops are considered a future market for suppliers.
					Bio-based products	
					Air	
					Resource efficiency and waste	
					Horizontal (research; knowledge transfer; market promotion; marketing; expert; investments)	
	Growth Plan for Food (2013)	n/a	Green Economy		Resource efficient food production	Rural development is relevant in that the plan refers to the efficient use and sustainable production of biomass. New business models focused on processing food wastes and residues are emphasised. The importance of developing new bioeconomy value chains (i.e. biorefineries) is highlighted and supported through research, technological and know-how development.
Finland	The Finnish Bioeconomy Strategy (2014)	2025	National Bioeconomy Strategy	Growth and competitiveness	Forestry (timber market or diversification of wood products, including for energy)	Rural development is relevant in that the Strategy aims to foster regional self-sufficiency in energy by using the raw material supply of the countryside as an energy source. In a decentralised bioeconomy, this can in turn create job opportunities.
					Biotechnologies (health and pharmaceutical research)	
					Water (efficiency and recycling)	
					Agriculture	
					Services (tourism)	

Country	Strategy	Timeframe	Type	Goal	Priority areas	Relevance to rural development
France	A Bioeconomy Strategy for France (2017) and the related action plan 2018-2020 (2018)	2030	National Bioeconomy Strategy	Sustainable economic growth; Increased employment and improved trade balance and international competitiveness; Self-sufficiency. The Strategy is intended to contribute to the sustainable and efficient production and use of bioresources.	Supply chains in relation to: • Biomass for food production; • Materials; • Bio-based molecules; • Bioenergy; • Ecosystem services.	With relevance to rural development, the Strategy aims to promote sustainable resource management (including via precision farming) and innovation in crop production systems (including via organic farming, agroecology and agroforestry). It also emphasizes the use of waste and residues from primary sectors, and the use of industrial waste for energy production. The Strategy also highlights that the development of a bioeconomy has a major regional and local component. In fact, within the objective of self-sufficiency, the Strategy strives to foster regional and rural development and food sovereignty by converting locally produced biomass into bio-based products, e.g. biomaterials and bioenergy. In order to develop the bioeconomy, the Strategy aims to achieve sustainable production. Beyond knowledge creation on biological systems, the Strategy aims to gather best practices of production systems that are applicable. The Strategy suggests to investigate how the CAP and other policy frameworks (e.g. forestry) apply and shape the production systems.
	National Strategy for the Ecological Transition towards Sustainable Development 2015-2020 (2015)	2020	High Tech	Development of key sectors for the bioeconomy, i.e. industrial biotechnology and renewable energy	Energy production from renewable sources Chemical and plastics more ecological	Rural development is not explicitly mentioned. EAFRD can provide support to innovation and research in relation to the production and use of bioresources. Also, more synergies around the research agendas and upskilling of primary producers and value chain actors.
Germany	National Policy Strategy on Bioeconomy (2013)	n/a	National Bioeconomy Strategy	Set priorities for a knowledge-based bioeconomy	All bioeconomy value chains. Cross-sector areas: Coherent policy framework Information and dialogue with society	Rural development is relevant to many areas, including sustainable production of resources, land use and the international context (food security). The implementation of the CAP as well as action to foster climate protection, sustainable use of plant-protection products and fertilisers was highlighted to contribute to the sustainable production of bio-resources.

Country	Strategy	Timeframe	Type	Goal	Priority areas	Relevance to rural development
					Training Thematic areas: Sustainable production and provision of resources Growth, innovation and technologies Value adding networks Competition among uses of land International context	Although not explicitly mentioned, CAP and EAFRD funding can also contribute to balance out land uses for food production and provision of renewable materials in Europe, as well as in third countries.
	National Research Strategy BioEconomy 2030 (2010)	2016	Research and innovation	Reinforce the innovation ability of research organisations and businesses; Support the formation of research alliances between science and business	Funding programmes include: Renewable resources Global food security Sustainable agricultural production Plant breeding and animal health Biomass-based energy carriers Biotechnology	Rural development is not explicitly mentioned. However, among several, opportunities for value creation and employment potential in rural areas through domestic production of bioenergy are to be investigated.
	Bavaria's Bioeconomy Strategy	n/a	Research and innovation?	Support to research and innovation on the bioeconomy (e.g. creating a competence centre; a joint graduate programme)	Biogas Lignocellulose materials Algae	Support and alignment to research, innovation and upskilling in the primary sectors (agriculture and forestry)
	Baden-Wurttemberg's Bioeconomy Strategy	n/a	Research and innovation?	Support to research and innovation on the bioeconomy; Establishment of an Expert Advisory Board on the Bioeconomy	Sustainable use of food and biomass Development of bio-based products	As above
Ireland	National Policy Statement on the Bioeconomy (2018), attached to which there is the Action	n/a	National Bioeconomy Statement	Move toward a low-carbon, bio-based and circular economy; Regional/rural development; Employment growth; Energy security;	Farming and the agri-food business Marine and maritime industries Forestry	The policy statement recognises that the bioeconomy can contribute to decarbonisation, sustainable growth and job creation in the agricultural, industrial and technological sectors in rural areas.

Country	Strategy	Timeframe	Type	Goal	Priority areas	Relevance to rural development
	Plan for Rural Development (2017)			Maintaining natural capital; Technologies to produce value added bio-based products; Biotechnologies	Novel protein production Water and water management Energy Biopharmaceutical products	Rural development measures include the valorisation of agricultural waste and the production of bio-energy from biomass/biogas.
	Harnessing Our Ocean Wealth (2012)	n/a	Blue Economy	Strengthen sustainable growth; Optimise economic benefits from marine resources	Marine resources for renewable energy and health applications	Rural coastal and island communications could benefit from future development potential of marine and coastal tourism and leisure services
	Delivering our Green Potential (2012)	n/a	Green Economy	Identify business opportunities for companies resulting from the green economy. The bioeconomy is mentioned as a research area, which could be expanded by investing in research institutions.	Wide range of sectors, including agriculture, marine and forestry; renewable energy and efficiency; waste and water management; transport.	Relevant to rural development is highlighted in relation to the following subjects. Agriculture and forestry: • Increase of food and drink industry, while minimizing impacts on GHG emissions and land use, by fostering research and innovation; • Minimisation of carbon footprint of livestock industry; • Diversification of wood products and services; • Forest wood for energy Energy: • The development of biomass energy encourages the establishment of new rural enterprises and support job creation Tourism • Increasing Ireland's rural and green tourism
	Towards 2030: Teagasc's Role in Transforming Ireland's Agri-Food Sector and the Wider Bioeconomy (2008)	2030	Research and Innovation	Contribute to coping with challenges such as food and energy security; Help achieving social goals, including public health, improved food products and enhanced rural development	Food production and processing Value-added food processing Agri-environmental products and services Energy and bio-processing	Rural development is seen as a strategic sector within the developing bioeconomy in Ireland. The bioeconomy is foreseen to contribute to enhancing rural development.

Country	Strategy	Timeframe	Type	Goal	Priority areas	Relevance to rural development
Italy	Bioeconomy in Italy: A unique opportunity to reconnection economy, society and environment (2017) and Action Plan	2030	National Bioeconomy Strategy	Increased competitiveness and promotion of green growth. Reduce fossil fuel dependence and promote rural and coastal development.	Agriculture Forestry Marine Agri-food sector Bio-based industry	Government's support to the agriculture and forestry sectors will focus on boosting sustainable and resilient primary production, i.e. sustainability potential of different agriculture and forestry models; the role of urban and peri-urban agriculture; need to improve forest management. EAFRD is recognised as having an important role to play to foster new value chains for agro-energy and bio-based industries, i.e. promoting next generation biofuels and bioplastics, bio-based building materials, bio-fertilisers and cosmetics.
Latvia	Latvian Bioeconomy Strategy 2030 (2017)	2030	National Bioeconomy Strategy	Support the UN 2030 agenda (SDGs 2, 7, 8, 12, 13 and 14) Promotion of rural development and increased per capita income. Development of high value-added bio-based products and services	Agriculture Forestry Fisheries Food and feed industry Wood industry Chemical and pharma industry Textile industry	Relevance to rural development is highlighted in relation to the following objectives: • Sustainable resource management practices; • Improved land use efficiency; • Increased R&D on environmental protection, climate resistant crops and tree species, organic farming and animal health and welfare. Rural areas can also contribute to the production of advanced biofuels, chemicals, biodegradable plastics and bio-based lubricants.
Lithuania	National Industrial Biotechnology Development Programme (2011-2013)	2013	High Tech	Industrial biotechnology research development programme accounting €0.7 million. The main aims were: • Technology development; • Pilot and demonstration projects; • infrastructure investment and commercial use of by-products and waste.	Bioplastics Second-generation biofuels Biopharmaceuticals and animal drugs Bio-based materials	Rural development is relevant in that it is a primary sector in producing and processing local biomass resources used for a variety of applications.
	Smart specialisation (2014)	2020	Research and Innovation		Energy and sustainable development	Coherence between the use of EAFRD and structural funds 2014-2020 in priority areas, including energy and

Country	Strategy	Timeframe	Type	Goal	Priority areas	Relevance to rural development
				Foster growth and competitiveness through identifying R&D and innovation solutions. 20 priority areas are identified, alongside procedures for monitoring and an overarching action plan for the development of the Strategy.	Inclusive and creative society Agro-innovation and food technologies New production processes, materials and technologies Health technologies and biotechnologies Transport, logistics and information and communication technologies	fuel production; agro-biological resources and safe food; processing of biological raw materials (biorefinery).
Netherlands	Green Growth: for a strong, sustainable economy (2013)	n/a	Green Economy	Strengthen green growth and international competitiveness The bio-based economy is considered a priority of future economic activities, especially through promoting R&D and demonstration projects	Cascading use of biomass	
	Green Growth – From Biomass to Business (2012)	n/a	Biobased Economy	Strengthen competitiveness and create new business	Bio-based materials Bioenergy and bio-chemicals Integrated biorefineries Optimised cultivation and biomass production Recovery and recycling of water, nutrients and soil Economy, policy and sustainability	
	Framework memorandum on the Bio-based Economy (2012)	n/a	Green Economy	Coping with societal challenges, including climate change, energy security and resource scarcity. This is promoted via enhanced knowledge infrastructure; regional private-public clusters; and policy.	Efficient use of biomass for food, industrial products and energy	EAFRD are relevant in that they could support the extraction and processing of biomass and residues for relevant bio-economy applications, including biorefineries, bioenergy/biofuel production, and chemicals. EAFRD can also support upskilling and training, as well as pilots and demonstration projects.

Country	Strategy	Timeframe	Type	Goal	Priority areas	Relevance to rural development
Portugal	National Strategy for Oceans (2013-2020)	2020	Blue Economy	Valorise the ocean and its coastal areas by setting up sectoral and cross-sectoral projects; Support economic growth and generate employment	Aquaculture Blue biotechnology Blue energy	EAFRD could provide support to prevent events and saline intrusions that destroy agricultural soils and contaminate land aquifers.
Spain	The Spanish Bioeconomy Strategy: Horizon 2030 (2016)	2030	National Bioeconomy Strategy	Global perspective: • Climate change; • Food security. National/regional level: • Increase competitiveness and economic growth; • Diversified and more environmental sustainable economy.	Agri-food Forestry Bio-based industry (i.e. biorefineries, bioenergy, production of biomass from non conventional sources)	Within the objective to diversify and promote a more environmental sustainable economy, the bioeconomy is seen to contribute specifically to rural development and stronger territorial cohesion. This is driven by innovation and technological development. Agri-food sector: improved cropping systems through sustainable intensification or precision farming; improved processing, packaging and cold chain technologies to reduce waste through the supply chain. Forestry sector: extending wood products lifecycle; development of high-tech materials. Bio-tech sector: use of residues and by-products; production of biofuels from waste and residues.
	Extremadura 2030 (2017): Strategy for Green and Circular Economy	2030	Regional Bioeconomy Strategy	Improved resource management; Development of agro-ecological practices; Development of new 4.0 business models	Agri-food Forestry and wood processing Clean energy Green tourism Health sector	The Strategy foresees changes to the Common Agricultural Policy and within the Rural Development Programme in order to support the green and circular economy
	The Andalucía Bioeconomy Strategy (under development)	2030	Regional Bioeconomy Strategy	Support the creation of bio-products value chains in relation to: • Production of biological raw materials or biomass; • Technological processing;	Agriculture Forestry Fisheries Food and pulp and paper production	To be investigated

Country	Strategy	Timeframe	Type	Goal	Priority areas	Relevance to rural development
				• Consumption patterns.	Chemical, biotechnological and energy industries	
Sweden	Swedish Research and Innovation Strategy for a Bio-based Economy (2012)	n/a	Research and Innovation	Identify research gaps and develop a strategy for investments that are needed in research, development and innovation for the bio-based economy	Increased biomass production Creation of smarter products by refining biomass (waste and residues) Consumption patterns Policy instruments guiding and impacts of biomass production	The CAP and rural development are not explicitly mentioned. However, such funding could be directed to support knowledge and skill development on the advantages of a bioeconomy for farmers, and support mechanisms to adapt existing or establish new value chains for biomass production and commercialisation.
United Kingdom	UK Synthetic Biology Strategy Plan 'Biodesign for the Bioeconomy' (2016)	n/a	High Tech	Stimulate sustainable economic growth; create jobs and strengthen productivity and competitiveness; Capacity building and mullti-stakeholder partnerships (All) Encourage R&D into technologies (Strategy Plan) Reduce environmental pollution and GHG emissions; R&D support in the field of biotechnologies and biorefineries (Waste strategy) Encourage sustainable manufacturing and innovative products through R&D support for biorefinery development and consortia formation (Roadmap)	Sustainable materials Chemicals Energy	The Strategy Plan calls for agricultural policies that are able to support the translation to markets of innovative new technologies.
	Building a high value bioeconomy: opportunities from waste (2015)	n/a	Circular Economy		Residues and wastes	The Strategy supports the use of waste and residues/by-products from agriculture, forestry, fisheries and aquaculture for high value applications. EAFRD could contribute to upskilling rural actors, while ensuring balanced use of primary resources for various types of applications.
	Biorefinery Roadmap Scotland (2015)	n/a	Bioenergy		Co-products and residues of timber Household waste; commercial and industrial waste Macroalgae	To be investigated
	A Bioeconomy for the Baltic Sea Region (2014)	n/a	Regional Bioeconomy Strategy	Portraying efforts on the bioeconomy across the Baltic Sea region and scoping interest among stakeholders to develop a regional bioeconomy strategy	Food and feed Bio-based non-food, including bio-materials, bio-chemicals, enzymes	EAFRD can be used to demonstrate opportunities and share best practices linked to the bioeconomy, as well as provide training and upskilling rural stakeholders.

Country	Strategy	Timeframe	Type	Goal	Priority areas	Relevance to rural development
Baltic Sea Region[16]					Bio-based energy	
Danube Region[17]	Bioeconomy for the Danube region (2017)	n/a	Regional Bioeconomy Strategy	Mapping bioeconomy related initiatives in the Danube Region and supporting the initiation of bioeconomy strategy for the region	In order to development a bioeconomy, governance needs include: Political support Involvement of regions and local actors Multi-stakeholder dialogue and knowledge exchange Awareness raising and education	EAFRD can support knowledge exchanges and upskilling in the agricultural sector, as well as pilots and demonstration activities. The position paper: • Highlights sustainable intensification, smart breeding and precision farming as priority areas in the agricultural sector; • Calls for support for the development of technologies in relation to climate, soil fertility, biodiversity and water use.
West Nordic Countries[18]	Future Opportunities for Bioeconomy in the West Nordic Countries (2014)	n/a	Regional Bioeconomy Strategy	Boost green growth and create added value through the use of natural resources	Fisheries Agriculture, by means of expanded research on soil conservation, grazing pressure and new crop variants.	The Strategy aims to establish an interdisciplinary centre of excellence which focuses on issues relevant to the region, including rural development and energy production. The centre should further bundle existing local and national expertise and knowledge by creating a virtual knowledge network.

Source: Own adaptation based on German Bioeconomy Council (2018) Bioeconomy policy (Part III) Update Report of National Strategies around the World. URL: http://biooekonomierat.de/fileadmin/Publikationen/berichte/GBS_2018_Bioeconomy-Strategies-around-the_World_Part-III.pdf

[16] Including Denmark, Estonia, Finland, Latvia, Lithuania, Poland, Sweden and the northern parts of Germany, as well as partner countries such as Norway, Belarus and the northwest regions of Russia

[17] Including Austria, Bulgaria, Croatia, Czech Republic, Germany, Hungary, Romania, Slovakia, Slovenia, alongside Bosnia and Herzegovina, Montenegro, Serbia, Moldova and Ukraine

[18] Including Iceland, Greenland and the Faroe islands