

BRANCHES

Boosting RurAl bioeconomy Networks following multi-actor approaCHES

Deliverable

D4.2 Good practices in policy for bioeconomy value chains in European regions

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Executive summary

This deliverable is presenting the findings of Task 4.2 in the BRANCHES project and collects good policy practices and regulatory and political barriers as well as drivers for bioeconomy development on the regional level. The BRANCHES project, in which it is embedded, has a particular focus on the sustainable development of regional and rural bioeconomy and the dissemination of this knowledge. Task 4.2 is part of WP4, which identifies conditions at the regional level that enable bioeconomy development. The focus of the investigations of this WP is on five selected regions in Europe: Northern Finland (North Ostrobothnia, Kainuu, Lapland), Central Germany (Saxony-Anhalt, Saxony, Thuringia), Central Italy (Abruzzo, Latium, Marche and Tuscany), Warmia and Mazury in Poland and the Ebro Valley region in Spain (Aragón and Catalonia).

At first, an overview of the policy framework in the EU and policy instrument types, that can regulate and stimulate bioeconomy development, is given. This introduction is followed by a description of the methods used and key concepts, on which this report is based.

After that, a description of the present national and regional policy frameworks in all the selected European regions and their national bioeconomy markets is given. This literature review from all BRANCHES partners is supplemented by examples of policy practices, which are implemented in the regions and were selected as "good policy practices" fostering a typical value chain in the region.

The next section analyses why policies can be considered as "good" for bioeconomy development, how the specific examples gathered here are characterized and what subjects they address. These policies can serve as inspirations for policy development in other European regions.

In the fifth chapter, results from interviews and a survey are presented, which were conducted in the European target regions. The main focus of both methods was on regulatory and political barriers on the regional level but covered also drivers and perceptions on necessary future policies for bioeconomy. During the interviews also several advices for regional policy makers were collected. The findings from the literature review, interviews and survey were analysed and the most significant overlaps were summarized.

Finally, conclusions are given about the findings of good policy characteristics and the most common political barriers in European regions identified in this project. These obstacles are faced recommendations to overcome them in a compact way, which may be used by regional policy makers.

This report is complementing the results of a SWOT analysis carried out in Task 4.1. As a next step in WP4, regional determinant factors for transition towards successful bioeconomy will be identified and consolidated with regional experiences (Task 4.3) to develop strategic actions tailored to the regions (Task 4.4) e.g. to implement good practices also from WP2 and WP3.



BE	Bioeconomy
BMEL	Federal Ministry of Food and Agriculture
BMBF	Federal Ministry of Education and Research
DE	Germany
EC	European Commission
ES	Spain
EU	European Union
FI	Finland
GDP	Gross domestic product
ICT	Information and communications technology
IT	Italy
NTN	National Thematic Network
PAs	Practice Abstracts
PL	Poland
RES	Renewable Energy Sources
R&D	Research and development
SME	Small and medium sized enterprises
SWOT	Strengths, Weaknesses, Opportunities, Threats.
WP	Work Package

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1 Introduction

1.1 Aim and context

The bioeconomy across different countries and regions encompasses a diverse set of sectors and numerous value chains. As defined in the EU Bioeconomy Strategy (European Commission, 2018, p. 4), *"The bioeconomy covers all sectors and systems that rely on biological resources (animals, plants, micro-organisms and derived biomass, including organic waste), their functions and principles. It includes and interlinks: land and marine ecosystems and the services they provide; all primary production sectors that use and produce biological resources (agriculture, forestry, fisheries and aquaculture); and all economic and industrial sectors that use biological resources and produce food, feed, bio-based products, energy and services". As exemplified by this definition, the bioeconomy covers a complex interaction of systems which undoubtedly requires a complex set of policies that are tailored for specific sectors, value chains, and regions.*

Within the larger context of the BRANCHES project, the objective of WP4 is to identify the enabling regional conditions for bioeconomy-based sustainable development. This report (Deliverable 4.2) is focusing on the regulatory and political conditions that facilitate or hamper the development of the bioeconomy. In large, the BRANCHES project puts a specific emphasis on regional and rural sustainable development of the bioeconomy, likewise, this report presents policy drivers and barriers on the regional level from selected European regions. According to the findings assembled throughout this task, recommendations are delivered.

A key element within the EU's commitments to development and innovation in the field of bioeconomy is the creation, sharing, and dissemination of knowledge (exemplified in the "EU Bioeconomy Strategy" or the "Horizon Program"). This aspect is also a central part of the BRANCHES project using both top-down and bottom-up approaches. This report is following the same logic, aiming to bring forward effective regulatory practices and describe successful policy frameworks that foster the development of regional bioeconomies. While the topics of research, development, and innovation often receive a high level of attention, policy and regulation are at times overlooked. Nonetheless, the arena of policy and regulation is just as important for the successful implementation of innovations and development as such. At the same time, regulation can also hinder specific desired effects, effectively, serving as barriers to regional development. This work draws on former EU project results, as well as other initiatives in the selected countries and regions reflecting a topdown approach stream of knowledge. Further, a bottom-up approach was reflected by performing interviews and surveys with regional stakeholders, among other methods, to collect information regarding the policy framework from a regional practitioner perspective.

In the introductory chapters, a brief overview of the bioeconomy and its policies in the EU is given alongside a description of policy instruments types that are characteristically used in environmental policymaking. In chapter 2, the methodological approaches that were used for this report are detailed, as well as, key definitions of concepts that are used in this report. Chapter 3 lays the foundational information about the bioeconomy policy framework for each specific partner country; giving an overview of national economies, as well as, selected regions within the countries. In chapter 4, the results regarding the "good policy practices" are presented. Further, chapter 5 describes the results concerning regulatory and policy barriers summarizing data collected from interviews and questionnaires. Finally, conclusions and recommendations can be found in chapter 6.



1.2 The bioeconomy policy landscape in the EU

While this report is focused mostly on the national and regional levels of the bioeconomy, it is important to contextualize this information in the European bioeconomy landscape. A short overview of the European bioeconomy is provided along with a summary of the main policies and measures that drive the bioeconomy.

I.2.1 Overview of Europe's bioeconomy landscape

The bioeconomy as a whole represents an important part of the EU's sustainability agenda both in the past and the foreseeable future. Currently, in the post-Brexit EU (EU-27), the bioeconomy represents about 4.7 % of the EU's GDP and 8.9 % of the workforce employed in the EU. In total, the bioeconomy generates a turnover of around \notin 2.2 trillion and an added value of \notin 657 billion, the workforce employed by the bioeconomy is about 17.4 million people. As seen in Figure 1-1 the manufacturing sectors are responsible for the highest share of value added (mostly in food and feed production) while the agriculture sectors employ the highest amount of people (Ronzon et al., 2022).

When considering past trends, the overall number of employees in the bioeconomy fell from 20 million people in 2008 to 17.4 million, at the same time, the added value increased from €514 billion to €658 billion. The decrease in employees and increase in added value are attributed to gains in labour productivity in all sectors (Ronzon et al., 2022).

Beyond the significant market forces, the EU sees

EU BIOE \geq EMPLOYMENT (MILLION JOBS) VALUE ADDED (BILLION EUR) 17.4 657 EMPLOYMENT MILLION JOBS) VALUE ADDED (BILLION EUR) VALUE ADDED (SHARE TOT) **\$** AGRICULTURE 8.8 29% FORESTRY 0.5 25 4% FISHING AND AQUACULTURE 0.2 0.9% FOOD, BEVERAGES AND OTHER AGRO-MANUFACTURING **BIO-BASED TEXTILES** 0.8 25 4% AND FURNITURE 1.3 50 8% 48 PAPER BIO-BASED CHEMICALS AND PHARM CEUTICALS. PLASTICS AND RUBBER 10% LIQUID BIOFUELS **____)** BIOELECTRICITY 0.03 0.8% DATA 2019 EU-27

Figure 1-1: Summary of employment and value added in the EU bioeconomy (Ronzon et al., 2022)

the importance and relevance of the bioeconomy within the context of sustainable development. Driven by international agreements like the Paris Accord and the Sustainable Development Goals, the EU recognized the role that the bioeconomy has to play in almost all of the sustainable criteria and goals (European Commission, 2018). Moreover, in the light of the COVID-19 pandemic and the war between Russia and Ukraine, the bioeconomy is becoming ever more relevant to ensure food and energy security in the EU zone.

I.2.2 European policies

In 2012, the European Commission adopted the Bioeconomy Strategy that aimed for *"Innovating for Sustainable Growth: A Bioeconomy for Europe"* after recognizing the upcoming challenges of the 21st century (European Commission, 2012). A new version of the EU Bioeconomy Strategy was published in 2018 after the SDGs were published in 2015 and all the EU member states signed the climate objectives of the Paris Agreement. The main goals of this strategy are to (European Commission, 2018):



- Ensure food and nutrition security,
- Manage natural resources sustainably,
- Reduce dependence on non-renewable, unsustainable resources,
- Limit and adapt to climate change,
- Strengthen European competitiveness and create jobs.

In accordance with these goals, the strategy formalized an action plan with 14 concrete measures that should be implemented with 3 main objectives (European Commission, 2018):

- Strengthen and scale up the bio-based sectors, unlock investments and markets
- Deploy local bioeconomies rapidly across the whole of Europe
- Understand the ecological boundaries of the bioeconomy

In addition to the main objectives, the strategy also contributes to the European Green Deal, the Circular Economy Strategy, the Industrial Strategy, and the Clean Energy Innovation Strategy. In the last decade and beyond, the EU implemented numerous directives, regulations, and decisions that are affecting all sectors of the bioeconomy. In Table 1-1, a summary of the main European policies in the various sectors is given (adapted from the updated Bioeconomy Strategy).

Table 1-1: EU bioeconomy policies (European Commission, 2018)

Sectors mainly supplying biomass		
Agriculture	 Commission communications: Legislative proposals on the Common Agricultural Policy (CAP) beyond 2020 (COM/2018/392 final; COM/2018/393 final; COM/2018/394 final/2) Commission communication "Thematic Strategy for Soil Protection" (SEC(2006)620) 	
Forest-based sector	 Commission communication "A new EU Forest Strategy: For forests and the forest-based sector" Commission staff working document "Multiannual implementation plan of the new EU Forest Strategy" Blueprint for the EU Forest-based Industries (SWD(2013)343) 	
Fisheries, aquaculture and algae	 The Common Fisheries Basic Regulation (EU) No 1380/2013 Commission communication "Blue Growth: Opportunities for marine and maritime growth" Report on the Blue Growth Strategy, Towards more sustainable growth and jobs in the blue economy, SWD (2017) 128 final Commission communication "Strategic guidelines for the sustainable development of EU aquaculture" Joint communication "International ocean governance agenda for the future of our oceans" 	
Sectors mainly using biomass		
Food and nutrition security	 Commission communication "An EU policy framework to assist developing countries in addressing food security challenges" Commission communication "Increasing the impact of EU development policy: An agenda for change" Commission communication "Enhancing maternal and child nutrition in external assistance: An EU policy framework" Commission communication "The EU approach to resilience: Learning from food security crises" 	



Energy	 EU Renewable Energy Directive (2009/28/EC; revised: 2018/2001/EU, amendment: COM/2021/557 final) Commission communication "An energy policy for Europe" Commission communication "An European strategic energy technology plan (SET-plan) — Towards a low carbon future" Commission communication "Limiting global climate change to 2 degrees Celsius — The way ahead for 2020 and beyond" Commission communication "Energy 2020 — A strategy for competitive, sustainable and secure energy" Commission communication "Energy roadmap 2050" Commission communication: "A policy framework for climate and energy in the period from 2020 to 2030" Commission communication: "Accelerating Europe's transition to a low-carbon economy" Clean Energy Package (2016) Commission communication "The role of waste-to-energy in the circular economy"
Bio-based industries	 Commission communication "A lead market initiative for Europe" Commission communication "Preparing for our future: developing a common strategy for key enabling technologies in the EU" Commission communication: "A stronger European industry for growth and economic recovery" Commission communication "For an European industrial renaissance" Future strategy on plastics use, reuse and recycling
Cross-cutting po	licies relevant for the bioeconomy
Environmental protection and climate change	 EU Action Plan for Nature, People and the Environment (COM(2017)0198 final) EU Biodiversity Strategy (COM/2011/0244 final) EU Strategy on adaptation to climate change (COM/2013/0216 final)
Environmental protection and climate change Circular economy — Waste	 EU Action Plan for Nature, People and the Environment (COM(2017)0198 final) EU Biodiversity Strategy (COM/2011/0244 final) EU Strategy on adaptation to climate change (COM/2013/0216 final) Commission communication "Towards a circular economy: a zero waste programme for Europe" Commission communication "Closing the loop — An EU action plan for the circular economy" Commission communication "The role of waste-to-energy in the circular economy" Future strategy on plastics use, reuse and recycling Waste package 2018 Fertiliser Regulation (Regulation (EC) No 2003/2003) A European Strategy for Plastics in a Circular Economy
Environmental protection and climate change Circular economy — Waste Waste Regional policies — Smart specialisation	 EU Action Plan for Nature, People and the Environment (COM(2017)0198 final) EU Biodiversity Strategy (COM/2011/0244 final) EU Strategy on adaptation to climate change (COM/2013/0216 final) Commission communication "Towards a circular economy: a zero waste programme for Europe" Commission communication "Closing the loop — An EU action plan for the circular economy" Commission communication "The role of waste-to-energy in the circular economy" Future strategy on plastics use, reuse and recycling Waste package 2018 Fertiliser Regulation (Regulation (EC) No 2003/2003) A European Strategy for Plastics in a Circular Economy Commission communication "Strengthening Innovation in Europe's Regions: Strategies for resilient, inclusive and sustainable growth"
Environmental protection and climate change Circular economy — Waste Waste Regional policies — Smart specialisation Research and innovation	 EU Action Plan for Nature, People and the Environment (COM(2017)0198 final) EU Biodiversity Strategy (COM/2011/0244 final) EU Strategy on adaptation to climate change (COM/2013/0216 final) Commission communication "Towards a circular economy: a zero waste programme for Europe" Commission communication "Closing the loop — An EU action plan for the circular economy" Commission communication "The role of waste-to-energy in the circular economy" Future strategy on plastics use, reuse and recycling Waste package 2018 Fertiliser Regulation (Regulation (EC) No 2003/2003) A European Strategy for Plastics in a Circular Economy Commission communication "Strengthening Innovation in Europe's Regions: Strategies for resilient, inclusive and sustainable growth" Commission communication "Europe 2020 flagship initiative — Innovation union"

In addition to European-wide policies, many of the nations in the EU-27 are implementing national bioeconomy strategies. Currently, 11 countries already published dedicated strategies for the bioeconomy and 9 other countries have national strategies under development (Sanchez Lopez et al., 2020).



Many other countries and regions have their dedicated policies and regulations that are tackling different sectors in the bioeconomy and in this report, a more detailed overview is provided for the countries that are involved in the BRANCHES project.

1.3 Overview of the types of policy instruments addressing the bioeconomy

The bioeconomy oversees a variety of sectors and numerous fields of research and it affects all parts of the population. Consequently, when considering policies to regulate and promote the bioeconomy, a diverse set of policy instruments can be used. In their book chapter "environmental policy instruments", Huppes & Simonis (2009) presented a methodology to allocate policy instruments according to the actor relations, object influenced and operating goal. They concluded that instruments should be assigned depending on the level of influence distinguishing between private and public actors and between international, national or local levels. Huppes & Simonis later characterized a typology of environmental policy instruments as seen in Table 1-2.

Mechanism-based instrument specifications	Examples
Prohibiting instruments	No cadmium stabiliser allowed in PVC as a building material
Prescriptive instruments	Legal obligation for separate waste collection
Option-creating instruments	Multiple waste containers for separate collection
Economic instruments	Volume: auctioned car ownership rights
	• Price: energy tax, SO ₂ tax
Cultural instruments	Normative: ecolabel on products
	Relate organic solvents to summer smog
Structural instruments	Liability rules
	Public decision-making safeguards
Procedural instruments	Obligatory environmental officer in firm
	 ISO 14001 audit

Table 1-2: A typology of environmental policy instruments accord	cording to Huppes and Simonis (2009)
--	--------------------------------------

As such, some regulatory measures are binding instruments that are relying on prohibiting or "command and control" regulations, while other instruments are working with societal and economic tools. In the project POWER4BIO the list of the following instruments was classified as policy instruments to "support bio-based business models" (Elbersen et al., 2020), which for the purposes of this report was shortened and simplified:

- 1. Direct regulation / regulatory (binding) instruments,
- 2. Economic / financial instruments,
- 3. Voluntary initiatives,
- 4. Information and advisory instruments,
- 5. Market-based signalling instruments and
- 6. Other instruments such as vision documents, road maps, strategies.

This classification of instruments was adapted for this report and was used to classify the good policy practice examples in chapter 4. Regulatory instruments include binding regulations like quotas, targets, product standards, permitting instruments, etc. The economic/financial instruments include financial grants like



subsidies, loans, tradable certificates, tax incentives, and research and innovation funds, etc. So, the first two categories include among others all "hard measures" or binding instruments and the remaining categories are considered "soft" or non-binding measures (Pelkmans et al., 2016), which are all based on voluntariness. The third category covers codes of good practice, and self-regulation and can include financial incentives, which are not obligatory but encourage people or industry to the wished behaviour. Also, networks are included in this category. Information and advisory instruments can be either programs or education to raise awareness. Market-based signalling instruments include often information provisions like labels, traceability, and voluntary certification schemes. To the other instruments category belong, for example, strategies or other visionary documents, which provide a guideline (Elbersen et al., 2020).



2 Methodological approach

2.1 Approach

The aim of Task 4.2 is to describe the policy landscape in the various partner countries of the BRANCHES project (Finland, Germany, Italy, Poland, and Spain) with a focus on the regional level, as well as deriving "good practices in policy" as examples from the different regions. Furthermore, obstacles and barriers are identified to deliver recommendations for appropriate policy mechanisms for sustainable rural bioeconomy development. To carry out this aim, a mixed methodology was used to collect data from the various regions of the BRANCHES project and the collaborating consortium partners. Data collection methods included: Literature review, reporting through templates, surveys and interviews.

The work started with a literature review to outline the bioeconomy status and the policy landscape in the project's partner countries. After describing the current situation in the EU and the selected countries, each partner was asked to provide a review focusing on regional regulation in their country and to highlight "good policy practices" that facilitate the market uptake of specific value chains and sustainable development. To complement the data collected in the literature review a survey was composed to collect further data about different regions and to identify regulatory barriers that hinder the development of the bioeconomy. Finally, selected expert interviews were administered to further sharpen the understanding regarding good policy practices and obstacles concerning the bioeconomy in general and more specifically in the selected regions.

Data collection was done with various tools (templates, online collaborative board, online survey, desk research, and interviews), as shown in Figure 2-1. The data was analysed and reported to produce results and recommendations for policy mechanisms for sustainable bioeconomy development.





2.2 Data collection

Below, a brief explanation of the different data collection methods and the tools used during the process is given.



2.2.1 Literature review

As a first step, it was important to have a good overview of the current status of the bioeconomy and the regulatory landscape in each of the countries of the BRANCHES project. This approach was important to review the state of the art in the EU and the specific project member countries before focusing on the regional level in each country. The reviews relied on scientific publications, former EU projects results, reports, and strategies published by governments/institutions, and other media sources like press releases or articles.

Each consortium country team was asked to perform a short literature review to provide a snapshot of the current situation in each of the countries regarding national/regional bioeconomy policies and strategies. To achieve a more uniform set of data from the project's partners, a template guideline was distributed. The template (



Annex II: Literature review guideline template) focused on 3 main aspects:

- Overview of the national bioeconomy market,
- Overview of the national bioeconomy policy landscape and an
- Overview of regional bioeconomy policies and their implementation.

In Task 4.1 of the BRANCHES project, each country was asked to highlight one region and the prominent value chains within it. To select "good policy practices", it was requested to concentrate on one value chain from that region that is well established and developed. The BRANCHES team collected at least three policies from each of the focused regions aiming to identify policy measures preferably existing on the regional level, or at least influencing the regional level, and the selected value chains. Again, a template (Annex I: Good policy practice examples) was provided to ensure uniformity of the results collected from each country. It was specified that the selection should provide diverse policy measure types, which influence different stages of value creation. Each country team performed its own desk research according to the requirements in the template.

2.2.2 Involvement of stakeholders through an online survey

An online survey was distributed among stakeholders in the National Thematic Networks (NTN) from each of the partner countries, which were established within the BRANCHES project. During the COVID-19 pandemic, the survey served as a valuable tool to reach stakeholders across different countries. The questions were first formulated in English and then translated by native speakers into Finnish, German, Italian, Polish and Spanish so that participants could choose the most suitable language for them.

The survey was distributed via email communication and social media posts and was open for participants for 5 weeks from June to July 2022. Each country team was responsible to distribute the survey to the local NTN and other relevant stakeholders. No person-specific data was collected and stored and questions were answered anonymously. However, the participants indicated to which stakeholder group they belong (public administration, politician, business, research & development, NGO, other) and in which bioeconomy sector they work. The survey was conducted using soscisurvey.de¹ and structured in a way that qualitative questions and data were collected and processed. Before publishing the survey online, two internal pre-tests rounds were different from country to country, it was not possible to aim for full representativeness from each bioeconomy sector and stakeholder group. Questions were subdivided into 4 main thematic blocks around the topic of bioeconomy policy (Table 2-1).

Block number	Title and main question topics
Block 1	Background information - questions about participant's role and region, as well as, experiences in the field of bioeconomy
Block 2	Obstacles in the legislative and policy framework of bioeconomy
Block 3	Drivers and trends in the legislative and policy framework of the bioeconomy
Block 4	Future bioeconomy legislation and policies

Table 2-1: Survey structure and subdivision of topics

The full survey is detailed in Annex III.



2.2.3 Interviews of regional stakeholders

A short series of selected experts and stakeholders' interviews was conducted in an online format. The interviewees were selected according to recommendations from the project's partners and their level of involvement in the field of bioeconomy in general, and more specifically, their knowledge regarding bioeconomy policy in their respective countries. Experts from the following institutions were interviewed:

- Finland Natural Resources Institute Finland (LUKE)
- Germany BioEconomy Cluster e.V. Central Germany
- Spain Innovation Technology Centre (CIRCE)

The interview was conducted in a semi-constructed way with a general guideline of questions (for a full outline of the interview see Annex IV) – the first line of questions was used to get familiarised with the interviewees and their field of expertise. Later a list of the following questions was asked to which the interviewees could respond freely:

- Do you know of any good policy practices in the bioeconomy (on a regional level) in your region? If yes, why do you consider it/them as "good"?
- What specific amendments or changes in the legal and political framework of bioeconomy would you welcome? Why? On the other hand, why have these changes not been implemented yet?
- What (other) kind of legislative or political obstacles do bioeconomy enterprises face in your region?
- Did the legislative and political obstacles change in the last 5 years? If yes, can you give examples?
- Do bioeconomy-related enterprises in your region face bureaucratic hurdles and, if so, what kind of?
- Is there anything you would like to add, which is important for you, e.g. something policy makers should know?

The interviews were conducted in June and July 2022 and lasted between a half and full hour. The results of the interviews were transcribed and documented for further analysis. Unfortunately, it was not possible to arrange an interview with representatives from all partner countries and therefore perceptions of stakeholders from Warmia and Mazury in Poland and Central Italy are solely included in the survey.

2.3 **Definition of relevant concepts**

In the scope of this report there are reoccurring concepts that are important to properly define in order to establish a common understanding.

2.3.1 Good policy practices (working definition)

Terminologies like "good practice" or "best practice" are used in various disciplines. In many standardized guidelines (e.g. ISO 14001 and others) these definitions are used to streamline protocols and provide a typical set of procedures for specific problems (Nash & Ehrenfeld, 1996). "Good practices" in an area of policy-making are often hard to attain because the regulatory landscape varies greatly from one place to another. Therefore, this work assembled policies from a range of sectors and countries aiming to highlight "good policy practices" that facilitated and promoted the bioeconomy in the specific BRANCHES regions.

For that purpose, it was important to create a working definition of what is a "good policy practice" in the context of the BRANCHES project that can help to identify, filter and select specific practices. A collaborative



online concept-board² was used to collect impressions from project partners in order to rate the most important aspects of good policies for the bioeconomy. The concept-board included open questions and interactive figures. The following subjects were addressed:

- What makes a specific policy a "good policy"?
- Ranking of the most important criteria to evaluate a policy

In chapter 4.1 the results collected in the concept-board are presented.

2.3.2 Value chain stages

In the scope of this report, "good policy practices" were collected referring to a specific value chain in each of the selected BRANCHES regions. Depending on the sector, technologies and products, value chains can differ greatly from one another, therefore, a different set of policies is required to address them. Moreover, differentiation in policies is also needed to address different elements within the value chain – the complexity of a value chain can manifest in many potential bottlenecks related to anything, from the supply of materials, manufacturing technologies, funding, or working force.

Nevertheless, bioeconomy value chains commonly display a similar general structure of stages; from the biomass creation, through the production and consumption of products, until the end of life. The structure presented in Table 2-2 was regarded throughout the process of data collection for this report to enhance the comprehensiveness of data collected in an attempt to gather policy recommendations that will cover a wide range of value chain stages.

Value chain stage	Description
Biomass provision	Mobilisation of biomass, improve harvesting methods, biomass production in primary bioeconomy sectors like forestry, agriculture, fishery; but also mobilization of biomass residuals
Logistic	Infrastructure for biomass distribution, transportation
Conversion	Processing of biomass into products like food, biochemicals, etc.
Consumption	Market for bio-based products, convince consumers to use them (public acceptance, price)
End of life	Waste management, recycling, reducing environmental burdens (like emissions)
Enabling environment	Create conditions, in which the system bioeconomy functions over all sectors; can be research, networks, creation of acceptance of bio-based economy, monitoring activities

Table 2-2: General structure of a bioeconomy value chain used for the purpose of this report



3 Current policy frameworks and good policy practices for the bioeconomy in European regions

This chapter aims to map current policy landscapes and to identify good practices of successful policy frameworks that facilitated the market uptake of the value chains in European regions. Many projects commissioned by the EU covered the topic of regulations in the bioeconomy (among others POWER4BIO, S2BIOM, BioSTEP...), nevertheless, commonly there is a gap in the knowledge when it comes to regional policies and policies targeted for rural development are underreported. This report aims to target this gap and also pay special attention to the regional resolution. Below, for each of the BRANCHES partner countries, an overview of the bioeconomy market is given, sketching the policy landscape nationally and focusing on prominent regional measures. In addition, a summary of the reported "good policy practices" is provided at the end of each country's chapter.

3.1 Finland

3.1.1 Overview of Finland's bioeconomy landscape

The bioeconomy sector's output, value added and exports in Finland have grown and the number of people it employs has slightly decreased during the years 2011-2020. In 2011, the bioeconomy output was \notin 60.5 billion and the value added was \notin 20 billion, whereas in 2020 the output was \notin 68.3 billion and the value added was \notin 24 billion at current prices (Table 3-1). The bioeconomy accounted for 16 % of the total national output and 12 % of the value added. In the 2010s, the output and value added generated by bioeconomy sectors have changed almost at the same rate as the national economy on average. Bioeconomy products account for about one-third of Finland's goods exports. Within the bioeconomy, forest products totalled \notin 18.8 billion. In 2020, the bioeconomy sectors employed a total of 294,400 people, or 11 % of the total employed persons in Finland). When looking at the table, it should be noted that year 2020 was exceptional due to the pandemic.

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019*	2020*
Output of BE	60.5	62.3	61.7	62.6	63.0	64.5	68.8	72.5	73.2	68.3
Value added of BE	20.0	20.4	20.3	21.0	21.5	22.4	23.8	25.1	25.8	24.2
Exports of BE goods	16.4	16.6	17.2	16.4	17.3	16.8	18.5	19.9	18.8	**
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019*	2020*
Employed persons in BE, 1,000 persons	321	318	312	309	306	302	302	303	301	294

Table 3-1: Output, value added and investments of BE in Finland at current prices in billion € (LUKE, 2022)

*Preliminary data, ** not available

The development stage of the bioeconomy can be stated high in Finland. The share of the bioeconomy sector's output is 16 % of the Finnish national economy's output which is significant compared e.g. to many EU countries. Of the Finnish bioeconomy sectors, the forest sector produces high-innovation products for the global market. The importance and technology level of other bioeconomy sectors has also increased over the last ten years (Aula research, 2020). The first Finnish Bioeconomy Strategy was published in 2014, one of the first bioeconomy strategies in Europe. The strategy was updated in 2022 (Ministry of Agriculture and Forestry Finland et al., 2022). Strategies and their broad participatory preparation processes are important tools for networking, innovation and political decision making (government programs, public funding, legislation).



The most important sectors of the bioeconomy in Finland are the forestry sector (forestry, wood-products industries, pulp and paper industries), food sector (agriculture, fishing, hunting, food industry), wood construction and energy sector (Table 3-2 and Figure 3-1). The share of the forest sector is over 30 %. And as mentioned earlier, the forest products account for more than 70 % of the value of bioeconomy exports. In the 2010s the Finnish forest industry has gone through a transformation. Digitalization changed the demand for pulp-based products, as online trade required more packaging materials and the demand for printing paper continued to decrease (Ministry of Agriculture and Forestry Finland et al., 2022).

Value added Output % % Investments % 15.9 30 Food sector, total 23 4.5 18 1.7 Forest sector, total 24.2 35 7.7 32 1.2 21 **Other industries** 7.9 12 3.4 14 0.5 9 Energy 4.1 6 2.0 8 1.1 19 Construction 12.1 18 4.6 19 0.4 6 Water treatment and supply 0.9 1 0.5 2 0.6 10 **Bioeconomy services, total** 3.2 5 1.4 6 0.3 5 68.3 100 24.2 100 5.9 100 Bioeconomy, total National economy 204.1 57.6 435.5 _ Share of bioeconomy, % 12 10 16 --

Table 3-2: Output, value added and investments of BE sectors 2020* at current prices in billion € (LUKE, 2022)

* Preliminary data



Value added of bioeconomy, 2020*

Figure 3-1: Value added of BE sectors, 2020 (preliminary data) (LUKE, 2022)

At the end of the 2010s, the transformation continued. The European Green Deal and related proposals for policy agendas, e.g. European Climate Law, Biodiversity Strategy, the Renovation Wave Strategy, from Farm-to-Fork-Strategy, EU Taxonomy for sustainable activities, EU Forest Strategy and the reassessment and review of the LULUCF regulation and the RED II directive have caused some concern and uncertainty among bioeconomy actors. The importance of the circular economy in the measures was strengthened. Regarding bio-based products, concerns have been voiced on the impacts of their production on biodiversity and the adequacy of raw materials for products replacing plastics, which in Europe has also turned public debate partly against bioeconomy (Ministry of Agriculture and Forestry Finland et al., 2022).



3.1.2 Overview of national bioeconomy policies

The bioeconomy's operating environment is determined by the national, EU-level, and international operating environment and the related legal and policy environments. The Bioeconomy Strategy has interfaces with several other government strategies and policy programmes that outline, for example, the use of national forest resources, safeguarding biodiversity, climate and energy policy and industrial policy (Figure 3-2).



Figure 3-2: Finland's Bioeconomy Strategy under EU review, especially in comparison to the EU Bioeconomy Strategy, but also for a considerable number of other strategies, programmes and funding instruments (Ministry of Agriculture and Forestry Finland et al., 2022)

EU regulation is an important part of the Finnish bioeconomy's regulatory environment. Areas such as financing, industrial policy, research and development policy and agricultural and environmental policy are subject to EU regulation. New biorefinery investments and the development of existing plants are important so that high value-added products can be brought to the market. The following measures for creating a competitive operating environment can be identified:

- Examination of the characteristics and possible incentives of the sector related to the commercial use of ecosystem services and entrepreneurship,
- Continue the streamlining of permit processes for bioproduction plants by strengthening cooperation between authorities to attract investments,
- Promoting the use of public funding instruments for the various stages of the development of bioeconomy value chains,
- Increasing the impact of sustainable funding and new performance-based funding models and
- Encouraging cross-border cooperation.

Bioeconomy plays a key role in supporting the green transition of society. A sustainable bioeconomy is a solution to many climate and biodiversity issues. The active role of the bioeconomy in the green transition is contributing to ensuring socially and regionally just and economically sustainable change (Ministry of Agriculture and Forestry Finland et al., 2022). The Bioeconomy Strategy extends to 2035. The strategy's main objective is to increase the value added by the bioeconomy. The aim is to create economic growth and jobs based on sustainable solutions by producing the highest possible added value products and services. The



value added to the bioeconomy was € 26 billion in 2019. The objective of the strategy is to accelerate the annual growth of the bioeconomy's value added from 3 % to 4 %. If the objective of the Bioeconomy Strategy is realized, the bioeconomy's value added will be € 50 billion in 2035 (Ministry of Agriculture and Forestry Finland et al., 2022). At the same time, the Bioeconomy Strategy also aims to:

- Create competitive and innovative bioeconomy solutions to global problems,
- Generate business that promotes renewal both to the domestic and international markets, which will bring well-being to Finland as a whole,
- Increase the resource-wise use and recycling of materials and utilize side streams,
- Reduce dependence on non-renewable raw materials, especially those that are fossil based,
- Ensure ecological sustainability, social justice, and the renewal capacity of renewable natural resources and to strengthen broad-scoped competence in the bioeconomy and
- Improve and reform the technology base.

Finland's biodiversity policy

A process to prepare a new National Biodiversity Strategy and an action plan for 2030 related to this is currently underway. In addition to national objectives, the strategy considers the objectives of the UN Convention on Biological Diversity and the new EU Biodiversity Strategy. This process should be completed in autumn 2022. The strategy will enhance the protection of biodiversity and promote the restoration of degraded ecosystems. In addition, methods to measure the actions and their impacts will be developed. The strategy and action plan will be linked to the objectives set internationally and within the EU. A new Biodiversity Strategy will be needed as the biodiversity of Finnish natural environments continues to decline. The decline is even faster than before if measured by the number of threatened species. The aim of the strategy is to halt the loss of biodiversity and turn the trend towards recovery by 2035 (Finnish Ministry of the Environment, 2022).

Energy and Climate Strategy

The Energy and Climate Strategy is controlled by the Ministry of Economic Affairs and Employment of Finland. Finland's long-term goal is a carbon-neutral society. Approximately 80 % of greenhouse gases causing global warming result from the production and consumption of energy, including transport. Thus, energy and climate policies are closely connected (Huttunen, 2017). Energy policy also covers other matters that are not directly included in climate policy, such as the security of energy supply, the functioning of the energy market and the promotion of renewable energy sources and energy efficiency. The preparation of the new Energy and Climate Strategy will consider and coordinate the government program's energy and climate policies, the long- and medium-term climate change policy plans referred to in the Climate Change Act, and the EU's energy and climate targets for 2030. In addition, the National Energy and Climate Strategy outlines the actions that will enable Finland to attain the targets specified in the Government Program and adopted in the EU for 2030, and to systematically set the course for achieving an 80–95 % reduction in greenhouse gas emissions by 2050 (Huttunen, 2017). The above-mentioned strategy documents are based on Finland's Energy and Climate Roadmap 2050. The roadmap focuses particularly on energy production and energy systems/infrastructures, energy consumption, other sectors, and cross-sectoral activities, researching the alternatives for reducing carbon emissions and the impact of these alternatives on cost-effectiveness of emission reductions and competitiveness of the society (Vapaavuori et al., 2014). Spurred by these strategies and roadmaps, the project "Carbon neutral Finland 2035 – measures and impacts of the climate and energy policies" (HIISI), coordinated by VTT, was conducted to serve research and survey needs parallel with national climate and energy strategies and the preparation of a mid-term climate policy (KAISU). The project aimed



to assess how Finland could sustainably achieve the climate and energy targets 2030, 2035, 2040 and 2050 set nationally and by the European Union (Koljonen et al., 2021).

Waste legislation

Finnish waste legislation covers all kinds of waste except certain special types such as radioactive waste, which is covered by separate laws ("Jätelaki 2011"). The waste legislation is monitored by the Ministry of the Environment. Finnish waste legislation is largely based on EU legislation, but in some cases includes stricter standards and limits than those applied in the EU as a whole. Finland also has legislation on some issues related to waste that have not yet been covered by EU legislation (Finnish Ministry of Justice, 2022).

Wood construction programme

Climate and societal needs call for broader use of wood and the development of construction systems based on wood. The wood construction programme ("Puurakentamisen ohjelma 2016-2022") aims to particularly increase the use of wood in urban construction. At the same time, it is possible to support the sustainable and smart utilization of forests. Using wood is an effective way to decrease the carbon footprint of construction when the whole life cycle of a building is concerned (Finnish Ministry of the Environment, 2022).

3.1.3 Regional policies (Northern Finland)

The BRANCHES target region "Northern Finland" consists of three subregions: Kainuu, Northern Ostrobothnia and Lapland (Figure 3-3). Each subregion follows the National Bioeconomy Strategy 2022 described in the previous chapters and in addition to this the regions have their own regional smart specialization strategies.

The regions of Northern Finland cover almost half of Finland's total area. The population density of the area is low, but on the other hand, about 45 % of the inhabitants of Lapland, North Ostrobothnia and Kainuu are packed in the six largest cities in the region. Both, the population and industry, are strongly centred near the Gulf of Bothnia. The leading industries in Northern Finland, known for Arctic conditions and large wilderness, are largely formed around natural resources through the bioeconomy, mining and metal industries, food production, tourism and energy production. In addition, the ICT sector is a significant employer, especially in Oulu, but increasingly also in Kainuu and Lapland (Korkia Ltd, 2022). Northern Finland is characterized by reindeer husbandry. The area covers the Northern parts of Kainuu, Eastern parts of North Ostrobothnia and most of Lapland.



Figure 3-3: The regions in Finland and the target regions in Northern Finland underlined: Lapland, North Ostrobothnia, Kainuu (Palander & Vesa, 2022)

Regional councils are the essential organization in the coordination of regional research funds use. Figure 3-4 presents the regional key themes and main industries.





KEY THEMES

In Kainuu there are growing and competitive export companies in several industries, the locomotives of their industry sectors. They are accompanied by thriving business ecosystems where companies and R & D organisations work together successfully with research, development and innovation. Substantial investments in production have been made in Kainuu. The share of industrial jobs in employment and labour productivity in Kainuu have risen to the level of the national average. Exports and processing of goods and services continue to arow.



KEY THEMES

The Oulu Region operates environmentally, socially, economically and culturally sustainably. We can solve complex and globally significant problems in an agile manner. We invest in vitality, support the emergence of an inclusive civil society and the collective, interactive engagement of all actors. We recognise and value both human and material resources. We trust ourselves and others.



KEY THEMES

Regional strategic programme, The Lapland Agreement, resulting from a phenomenon-based review, has identified cross-cutting themes with visible impact which are extensively considered in the development of the region and in all strategic priorities. The cross-cutting themes include Arctic and internationality, the green transition and the related Lapland Green Deal, the region's attractiveness and ability to keep its inhabitants, well-being and security, digitalisation, inclusion and equality. MAIN INDUSTRIES

MAIN INDUSTRIES

The key industries in Lapland are metal industry and other basic industries, forestry and bioproduct industries, extractive industry and fourism. Wholesale and retail trade, construction, transport and storage, bioeconomy, circular economy, business services, service and welfare industries, cold and winter testing are also important industries.

The ample natural resources and clean nature in the province provide an excellent framework for the growth of enterprises in

the region. Kainuu also has high expertise in ICT, metal industry, bioeconomy, tourism and well-being, physical activity and sport

The priorities for smart specialisation in Northern Ostrobothnia include digital services and products, health and well-being, renewable and low-emission industries, sustainable construction and mobility, innovative bio and circular economy and smart food production.

Figure 3-4: The Barents regions of Finland identify certain key themes and industries in their regional strategies (Korkia Ltd, 2022).

Korkia (2022) presents three current trends related to bioeconomy and economic development in the target region:

Bioeconomy

Forest companies such as Metsä Fibre and Stora Enso invest in production efficiency. Kaicell is planning a new bioproduct mill investment in Kainuu. The timber industry also invests significantly. In general, the development themes are higher downstream production, low carbon production and side stream recovery. At the same time, a balance is sought in the protection and exploitation of forests.

Circular economy

Circular economy emerges as a key theme in the goals set by the regions. In particular, the circular industrial economy and its potential are highlighted. Other themes include circular economy in sparsely populated areas and biogas production from side streams and waste. The Kemi Centre for Circular Economy is Finland's first centre of expertise in the field and one of the leading experts in the country.

Low carbon and biodiversity

All regions, as all of Finland, aim to reduce emissions significantly. Nature is a significant attraction and a valuable resource for all three regions. On the other hand, there is a constant balancing act between nature conservation and exploitation of natural resources, between industry and energy production. The region's wind power capacity and plans have a significant impact on the low carbon performance nationally.

Regional regulations affecting bioeconomy in the sub-regions

The state-owned northernmost land form a specific area for reindeer husbandry. Any land use causing significant harm to this livelihood is forbidden. Disposition or renting of land there is possible only for landowners or tenants who have no right to apply for compensation caused by reindeer (Finnish Ministry of Justice, 2022). This is also stated in an agreement between the Finnish State Forest (Metsähallitus) and Reindeer Herder's Association (Paliskuntain Yhdistys) (Metsähallitus, 2021). Nature Conservation Act regulates and limits land use and economy in conservation areas such as national parks and nature reserves (Finnish Ministry of Justice, 2022). More than 74 % of Inari's land area is preserved. There are two large jointly



owned forests (Ylä-lappi and Inari) that face constant pressure from nature conservation organizations to abstain from cuttings because of considerable areas of old forests.

Kainuu

The bioeconomy policy landscape is bound by the Finnish National Bioeconomy Strategy and Lapland's smart specialization strategy. Bioeconomy is one of Kainuu's key businesses and the largest private-sector industry in Kainuu in terms of turnover and human resources. The region's ample natural resources and skilled labour provide opportunities for increasing both domestic and international demand and promoting local production, such as wood construction, local energy and locally sourced food.

The strategic bioeconomy goals are described in the Kainuu region Bioeconomy Strategy 2015-2020 (Kainuun liitto, 2015). The specific goals of the strategy are the following bioeconomy development objectives:

- 1. Industrial investments in bioeconomy amounting to a total of approximately € 1 billion by 2021,
- 2. More sustainable use of wood and forests,
- 3. More efficient processing of renewable resources as well as by-products and waste,
- 4. Stronger bioeconomy business ecosystems,
- 5. More efficient and extensive infrastructure,
- 6. Higher profitability of farming and growth of natural resources businesses and
- 7. Adoption of low-carbon renewable resources and recycled materials (circular economy).

Bioeconomy is a key cluster in Kainuu. Bioeconomy sectors in Kainuu are a forest-based bioeconomy, renewable energy, food, blue bioeconomy (sustainable use of waters), nature-based tourism and well-being services. The bioeconomy networking goals are set in the Kainuu Smart Specialization Strategy (RIS3) (Kainuun liitto, 2022). In RIS3 strategy, bioeconomy is developed by R&D activities. Objectives of Kainuu RIS3 strategy are:

- 1. Improving the productivity of investment / R&D financing: growth based on innovation and know-how;
- 2. R&D expenditure / inhabitant increasing,
- 3. Kainuu's attractiveness for investment and return on investment will improve (gross capital formation in Kainuu increases);
- 4. A more skilled workforce and better functioning labour market: increase of demand for more skilled and more educated labour; increase of demand for researchers working in industries;
- 5. Exports and the degree of processing of production increase;
- 6. Increasing the commercialization of innovations and the transfer of innovations to production and
- 7. The number of growth companies is increasing.

Regional forest programme:

Because forestry is such a central part of Kainuu's economy, as it is in Finland, a specific forestry program for 2021-2025 was made for the region. It aims to advance the low-carbon economy and sustainable use of natural resources and the environment. Objectives include advancing the biodiversity of nature, multipurpose forests and businesses based on natural resources and ecosystem services (Suomen metsäkeskus, 2020b).



Funding and investment projects:

The bioeconomy investment outlook for Kainuu for 2020 - 2021 is in total \notin 990 million. The biggest project Kai Cell Fiber bioproduct mill to Paltamo alone is \notin 900 million. Other key investments include Pölkky Oy \notin 30 million and St 1 \notin 90 million.

Research activities, knowledge transfer, demonstration projects: The ongoing projects are listed below (Kainuun liitto, 2022):

- Smart Specialization Partnership BERRY+
- BRIDGES Bridging competence infrastructure gaps and speeding up growth and jobs delivery in regions
- e-MOPOLI project aims at promoting alternative fuel and e-mobility as ways to reduce the carbon footprint of economic activities in urban and extra-urban areas.

Northern Ostrobothnia (Oulu Region) – Bioeconomy Strategy 2015-2020

The bioeconomy policy landscape is set by the Finnish National Bioeconomy Strategy and the regional smart specialization strategy. The goal of developing the bioeconomy in Oulu Region is to promote well-being in the region and produce added value to customers in the global market. The Bioeconomy Development Strategy of Oulu Region in 2015–2020 is titled "Towards a sustainable economy mission is to develop biobased products that create added value to customers both in Finland and in the global market" (Council of Oulu region, 2014). The bioeconomy goals in Northern Ostrobothnia (Oulu Region) are:

- The bioeconomy as a source of well-being,
- A pioneer region in the bioeconomy,
- An attractive target for investment,
- A healthy SME sector in the bioeconomy and
- The northern location as a marketing advantage.

If progress is made on all strategic objectives, the annual turnover of the region's bioeconomy will increase by \notin 2 billion and 4,000 new jobs will be created by 2030. The greatest quantitative growth is expected to occur in the value chain of wood processing, for example in the field of wood structure products. However, innovative products that make it to the international market will enjoy the fastest growth, irrespective of value chains (Council of Oulu region, 2014). The strategic bioeconomy objectives in Northern Ostrobothnia (Oulu Region) are:

- An attractive target for investment,
- Utilization of ICT expertise in bioeconomic value chains,
- Emphasis on the traceability of foods and natural products,
- Diverse production of large wooden structures,
- Selective industrial production and processing of natural products,
- Renewable use of peat resources and high added-value products and
- Closed nutrient and material cycles.

Networking initiatives include:

- Northern Ostrobothnia Climate Roadmap 2021–2030. Towards a carbon neutral Northern Ostrobothnia
- Oulu Region's smart specialization strategy 2021–2024



Regional Forest programme:

The forest programme of North Ostrobothnia 2021-2025 is a development programme for the whole forestry sector in the region, drawn up in cooperation with all important stakeholders. It provides guidelines for silviculture and protection of forests, wood utilization and processing as well as other use of forests. The programme extends over fields of operation and administration (Suomen metsäkeskus, 2020a). The main emphases are:

- To enhance the growth of forests, carbon sequestration and the state of nature and waters,
- To use the region's forests and ecosystem services actively, economically, and sustainably and
- To acquire the latest information through research, new methods for development, and to strengthen skills of forestry professional, forest owners and the youth.

The main investment projects include the following:

- Junnikkala Oy new sawmill Oulu (2021) € 75 million
- Haapavesi Ha-Sa new sawmill line (2021)
- Nordfuel biorefinery Haapavesi (€ 300 million).

Stora Enso is starting a feasibility study for the possible conversion of an idle paper machine at its Oulu site in Finland for a high-volume consumer board line. Upon successful completion of the feasibility study, an investment decision could be made by the end of 2022 with start-up in 2025. Capital expenditure is estimated to be \notin 900–1,000 million during 2023–2026. The investment would include the conversion of the former paper machine and the sheeting facility. It would also include investments in wood handling, the bleached chemi-thermomechanical pulp (BCTMP) plant, the biomass boiler, and the effluent treatment plant. There is a lot of potential for biogas production in the region. Only a few smaller projects have been realized so far, however.

Research activities, knowledge transfer, demonstration projects:

- Northern Ostrobothnia Climate Roadmap (POPilmasto) project
- Canemure Towards Carbon Neutral Municipalities and Regions (EU Life)
- Development of skilled food business in Northern Ostrobothnia, Finland (Luke)
- Several rural development projects by Pro Agria Oulu

Lapland

The bioeconomy policy landscape is bound by the Finnish National Bioeconomy Strategy and Lapland's smart specialization strategy. Arctic bioeconomy has four main themes: food and natural products, blue bioeconomy (fisheries), decentralized renewable energy and wood construction. The smart specialization strategy 2018 – 2022 in Lapland is titled "Lapland an Arctic and international highflier". The roadmap for the implementation of the strategy has three priorities (Regional Council of Lapland, 2018):

Priority 1:

- Advanced Arctic business foundation for the growth of Arctic circular economy,
- Arctic sustainable tourism,
- Growth in business by increasing the refining of natural resources and
- Emerging industries as new platforms for business.



Priority 2:

- Arctic expertise, renewal and innovations strengthening the growth and international business activities,
- Arctic innovation and development environments as drivers for the growth,
- Educational solutions supporting the economic growth and internationalization and
- Internationally strong and attractive area.

Priority 3:

- Regional ecosystem as the base for internationalisation,
- Renewing the regional ecosystem supporting economic growth,
- Clusters strengthening the regional value chains development and
- Interregional collaboration to develop the whole region.

Lapland's Arctic Bioeconomy Development Programme 2018-2025 is a vision, formed in broad-based cooperation, of the current situation in Lapland's bioeconomy, its business potential and development objectives. The measures described in the development programme aim at realizing the potential for new businesses, jobs and well-being of the people in Lapland. The programme's objective is to safeguard the vitality of rural areas in Lapland (Häyrynen & Asiala, 2018).

The main vision of the development programme is "Unbeatable pure products from Lapland – promoting sustainable business!" The vision will be achieved by producing the world's cleanest food and renewable energy in an economically and socially sustainable manner, using resources wisely in compliance with circular economic principles. Entrepreneurs in sparsely populated areas play a key role in all activities. All actions aim to create a new kind of entrepreneurship in Lapland, enabling even existing companies to develop their businesses.

Regional Forest Programme

The regional forest programme of Lapland 2021-2025 covers the whole forestry sector and region, having an overarching vision: The sustainable management and use of Lapland's forests is a source for growing wellbeing. With this vision, it contributes to the national forest strategy. The main development areas include:

- Forest inventory data and platform economy,
- Interaction and communication in all forestry,
- Resource efficient and sustainable forest management,
- Nature management and forest biodiversity,
- Climate friendly forestry,
- Forest roads and accessibility of forests,
- New wood-based products,
- Nature tourism, natural product economy and nature services,
- Know-how and training and
- International forest politics and active EU interaction.

Funding / investment projects

Metsä fibre Kemi (€ 1.6 billion), the Metsä Fibre Kemi bioproduct plant and related infrastructure are currently being built, and commissioning will take place in 2023. The plant will operate completely without fossil fuels and is intended to produce a variety of bioproducts and bio-based electrical energy in addition to pulp. Any



surplus electricity will be transferred to the national grid. This is the largest single investment in the history of the forest industry in Finland. In addition, the confirmed investments in tourism comprise \leq 127 million investments, and \leq 1,251 million investments are in a planning phase (Korkia Ltd, 2022).

Research activities, knowledge transfer, demonstration projects

In Lapland, the Arctic Smartness concept is the leading initiative for implementing smart specialization (Regional Council of Lapland, 2018). The implementation of Arctic Smartness is based on regional cooperation, and it works like an ecosystem, where the actors share common goals to develop Lapland. Arctic Smartness Clusters act as engines for regional development. Networks support the activities of the clusters and projects act as instruments for carrying out individual activities.

The natural resources institute of Finland (Luke) has taken a lead in establishing a demonstration platform for forestry methods in Finnish Lapland, aiming to establish forest management demonstration areas. In the project they will study the effects of different forest management methods on forest regeneration, biodiversity and economic efficiency.

3.1.4 Good policy practices

DESCRIPTION OF THE REGIONAL VALUE-CHAIN

Traditional wood supply chain in Northern Finland:

The supply chain operates in the forestry sector. The initial feedstock of the supply chain is wood from the forest and the final product is pulp, paper and lumber. The supply chain can cover both regional and national geographical areas. The value chain selected for this evaluation covers the value chain in Northern Finland.

The phases of the value chain include:

- 1. Biomass generation or recycled material
- 2. Pre-treatment
- 3. Conversion
- 4. End product
- 5. Customer/entry to market

SUMMARY OF GOOD POLICIES

Policy 1 - Regional forest programmes 2021-2025

- Main aim of the policy: The regional forest programmes 2021-2025 are statutory provincial forest sector development plans and work programs.
- Year of implementation: Current programmes cover period 2021-2025
- Type of instrument: Information and advisory instruments
- Influence level of policy: Regional
- Funding body: Ministry of Agriculture and Forestry of Finland

Policy 2 - National Forest Strategy 2025

- Main aim of the policy: National Forest Strategy aims for growth of welfare and overall sustainability
- Year of implementation: Current programmes cover period 2015-2025
- Type of instrument: Other instruments such as vision documents (national strategy)

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- Influence level of policy: National
- Funding body: Ministry of Agriculture and Forestry of Finland

Policy 3 - National support scheme for private forest owners

- Main aim of the policy: Support private forest owners e.g., in management of seedling stands and management of young stands
- Year of implementation: Continuous support
- Type of instrument: Financial, voluntary initiative
- Influence level of policy: National
- Funding body: Ministry of Agriculture and Forestry of Finland

For more information on good policy practices see Annex I: Good policy practice examples.

3.2 Germany

3.2.1 Overview of Germany's bioeconomy landscape

The bioeconomy plays an important role in Germany accounting for 10 % of the total economy with a total turnover of \notin 464 billion in 2019 (European Commission, 2022). The gross share of value added was at 5-6 % of the entire economy in 2017 (around \notin 182 billion). Roughly half of the value added from the bioeconomy is generated by the manufacturing sector, followed by the food (17-19 %) and agriculture sectors (16-17 %). The construction and energy sectors account for roughly 7 % of the value added each (see Figure 3-5). The added value from the manufacturing sector is mostly contributed by the production of food and feed. In 2015 Germany produced 185 million tons of biomass (in dry mass). As such, the creation and cultivation of agricultural goods make up the bulk of Germany's biomass production (137 million tons) followed by forestry (48 million tons) (Bringezu et al., 2021).



Figure 3-5: Gross value added of bioeconomy in Germany in the years 2010 to 2017 (Bringezu et al., 2021)



When considering the contribution to employment in Germany, the bioeconomy has a significant impact. In 2017 the number of people employed by the bioeconomy across all sectors amounted to 4.4 million, which is around 9 % of the total workforce in Germany. Since 2010 there was a decline in the number of employees in the agriculture sector and a slight increase in other sectors, as such, the number of employees in the bioeconomy as a whole remained stable. Looking into future trends, it is expected that employment in the German bioeconomy would remain roughly the same, nevertheless, a slight decline is expected in the agriculture, forestry, manufacturing and construction sector, while a rise in employment is expected in the energy and research sectors (lost et al., 2019).

While some regions of Germany still present development potential, Germany can be considered to have a medium to high development stage of its bioeconomy. As mentioned above, the bioeconomy contributes a significant share of added value and employment to the national economy of Germany. Germany is positioning itself in a leading role in bioeconomy regarding technological proliferation and in R&D, providing significant sums through national strategies and research funds (Biooekonomie.de, 2022). Currently, there is a highly established research base that is covering all sectors of the bioeconomy spread across Germany with a total of 73 universities and 64 universities of applied sciences, as well as 156 non-university institutes such as those of the Helmholtz Association, the Fraunhofer-Gesellschaft, the Max Planck Society, and the Leibniz Association and 40 departmental research institution (BMBF & BMEL, 2022). Beyond the advancement of research, Germany was consistently implementing regulations and policies over the last decades that either directly deal with the bioeconomy or affect the bioeconomy. A good example of such a regulatory mechanism is the German National Bioeconomy Strategy which was first published in 2010 as a research strategy (latest update released in 2020). Apart from the national strategy, Germany put forward a collection of policies touching all sectors of the bioeconomy (see next chapter).

Germany is also making use of bioresources for energy generation, producing more than 8 % of its primary energy from bioenergy. Since 50 % of the renewable energy in Germany comes from bioenergy, this is the most significant source of renewable energy in the country. These trends are expected to continue with a potential share of 13 % of bioenergy as a primary energy source (Brosowski et al., 2016).



3.2.2 National policies

There are numerous examples of laws and regulations that explicitly and implicitly deal with the bioeconomy in Germany. Many of these regulations are derivatives of international law or EU directives. The sustainability development goals (SDGs) served as a base for many of the EU and national bioeconomy related policies. The National Bioeconomy Strategy directly refers to the SDGs as a major framework to achieve the goals Germany set for itself for 2030 and beyond.

Germany was one of the first countries in Europe to release a bioeconomy strategy; starting with the Bioeconomy Research Strategy in 2010 and followed by a National Policy Strategy on Bioeconomy in 2013. The latest version of the National Bioeconomy Strategy was published in 2020 (BMBF & BMEL, 2020). The strategy covers two main guidelines: (i) harnessing knowledge and innovation for sustainable growth and (ii) using biomass for a sustainable, circular economy. An overview of the strategy and the common goals for research and policy can be seen in Figure 3-6.



Figure 3-6: An overview of the German National Bioeconomy Strategy (BMBF & BMEL, 2020)

Policy is seen as a main driving force within the strategy and is expected to act in the following areas: "Reducing pressure on land use; ensuring the sustainable production and supply of biogenic raw materials; expanding and developing the supply chains and networks of the bioeconomy; designing instruments to establish and bring bio-based products, processes and services to the market; ensuring policy coherence; making use of the opportunities offered by the bioeconomy for the development of rural areas; and taking advantage of digital technology for the bioeconomy" (BMBF & BMEL, 2020, p. 4). So far, until 2017 \in 2.4 billion were provided by various federal ministries for R&D and other activities to pursue the goals set in the strategy (Biooekonomie.de, 2022).

As a part of the SYMOBIO project, Mittelstädt & Zeug (2019) provided a detailed review of the regulatory framework of the bioeconomy in Germany. They derived five different sectors of the bioeconomy (waste, bioplastics, forestry, energy and construction) and summarized all the judicial framework conditions that support the bioeconomy. The following tables are summarizing the most important national policies and regulations that are affecting each of the sectors:

Waste:

Table 3-3: Waste related policies in Germany

Strategies	National Research Strategy BioEconomy 2030 (2010)
Programs	National Policy Strategy Bioeconomy (2014)
	Waste prevention programme (2013)
	Resource Efficiency Programme



	ProgRess 2012, ProgRess II 2016, 2020
Laws	Circular Economy Act KrWG (2012)
	Waste Shipment Act AbfVerbrG (2012)
	Packaging Act (VerpackG) (2019) + Packaging Register LUCID
	Electrical and Electronic Equipment Act ElektroG (2015)
	Battery law BattG (2009) + Battery register (2009)
Regulations	Regulation on bio waste BioAbfV (1998, 2017)
	Waste Shipment Ordinance VVA (2006)
	Regulation on Waste Shipment Charges (2003, 2013).
	Commercial Waste Ordinance GewAbfV (2003, 2017)
	Sewage Sludge Ordinance DüMV (1992, 2017)
	Packaging Regulation VerpackV (1998)
	End-of-life Vehicles Ordinance (2002)
	Landfill Regulation DepV (2009, 2017)

Bioplastics:

Table 3-4: Bioplastics related policies in Germany

Strategies	National Research Strategy BioEconomy 2030 (2010)
Programs	National Policy Strategy Bioeconomy (2014)
	Waste prevention programme (2013)
	Resource Efficiency Programme ProgRess 2012 ProgRess II 2016 2020
Laws	Circular Economy Act KrWG (2012)
	Waste Shipment Act AbfVerbrG (2012)
	Packaging Act (VerpackG) (2019) + Packaging Register LUCID
Regulations	Ordinance on the Avoidance and Recovery of Packaging Waste (VerpackV) (1998)
Regulations	Ordinance on the Avoidance and Recovery of Packaging Waste (VerpackV) (1998) Regulation on bio waste BioAbfV (1998, 2017)
Regulations	Ordinance on the Avoidance and Recovery of Packaging Waste (VerpackV) (1998) Regulation on bio waste BioAbfV (1998, 2017) Waste Shipment Ordinance (VVA) (2006)
Regulations	Ordinance on the Avoidance and Recovery of Packaging Waste (VerpackV) (1998) Regulation on bio waste BioAbfV (1998, 2017) Waste Shipment Ordinance (VVA) (2006) Regulation on Waste Shipment Charges (2003, 2013).
Regulations	Ordinance on the Avoidance and Recovery of Packaging Waste (VerpackV) (1998)Regulation on bio waste BioAbfV (1998, 2017)Waste Shipment Ordinance (VVA) (2006)Regulation on Waste Shipment Charges (2003, 2013).Commercial Waste Ordinance GewAbfV (2003, 2017)
Regulations	Ordinance on the Avoidance and Recovery of Packaging Waste (VerpackV) (1998)Regulation on bio waste BioAbfV (1998, 2017)Waste Shipment Ordinance (VVA) (2006)Regulation on Waste Shipment Charges (2003, 2013).Commercial Waste Ordinance GewAbfV (2003, 2017)Packaging Regulation VerpackV (1998)

Forestry:

Table 3-5: Forestry related policies in Germany

Strategies	Forest Strategy 2020 (2008)				
Programs	Climate Protection Plan 2050 of the German Federal Government for Sustainable				
	Forestry and Wood use (2016)				
	Charter for Wood 2.0 (2018)				
Laws	Circular Economy Act KrWG (2012)				
	Timber Trade Security Act (2011) HolzSiG				
	Regional Planning Act (ROG) (1998, 2017)				
	Federal Forest Act (1975) BWaldG				
	Federal Nature Conservation Act (1976, 2010) BNatSchG				
	Renewable Energy Act (2000, 2018) EEG				
	Renewable Energy Heat Act EEWärmeG (2009, 2015)				
Regulations	Waste Wood Ordinance (2003, 2017) AltholzV				
	Commercial Waste Ordinance (2003, 2017) GewAbfV				



Energy:

Table 3-6: Energy related policies in Germany

Strategies Programs	Resource Efficiency Programme ProgRess 2012, ProgRess II 2016, 2020				
riograms	Climate Action Programme 2020 (2014)				
	Climate Action Plan 2050 (2016)				
	Integrated Energy and Climate Programme IEKP (2007, 2008)				
	National Action Plan Energy Efficiency NAPE (2014)				
	Market incentive programme MAP (2008)				
	7th Energy Research Programme of the Federal Government				
Laws	Environmental Appeals Act 2006				
	Renewable Energy Act EEG (2000, 2018)				
	Biofuel Quota Act (2007)				
	Renewable Energy Heat Act EEWärmeG (2009, 2015)				
	Combined Heat and Power Act KWKG (2002, 2016)				
	Energy Industry Act EnWG (2005)				
	Energy Saving Act EnEG (1976, 2013)				
	Energy Tax Act EnergieStG (1939, 2006, 2018)				
	Electricity Tax Act StromStG (1999, 2017)				
	Electricity Tax Implementation Ordinance (2000, 2018).				
	Energy-related Products Act EVPG (2011)				
	Energy Consumption Labelling Act EnVKG (2012)				
	Federal Immission Control Act BImSchG (1993)				
	Greenhouse Gas Emissions Trading Act TEHG (2011) Greenhouse Gas Emissions Trading Act Amendment (2018).				
	Allocation Act ZuG (2012)				
	Energy Performance of Buildings Act GEG (2019)				
Regulations	Biomass Ordinance BiomasseV (2001)				
	Biomass Sustainability Ordinance BioSt-NachV (2009)				
	Ordinance implementing the energy using Products Act EVPGV (2013)				
	Energy Consumption Labelling Ordinance EnVKV (2012)				
	Emissions Trading Ordinance 2020 EHV 2020 (2012)				
	Allocation Ordinance ZuV (2007, 2012, 2020)				
Federal Laws	Climate Protection Act of North Rhine-Westphalia (2013)				
	Climate Protection Act of Rhineland-Palatinate (2014)				
	Climate Protection Act of Schleswig-Holstein (2017)				

Construction:

Table 3-7: Construction related policies in Germany

Strategies Programs	Resource efficiency programme ProgRess 2012, ProgRess II 2016, 2020
Laws &	Renewable Energy Sources Act (2017)
Regulations	Energy Saving Ordinance (2013, 2016)
	Model building code 2002 Incl. M-FHHolzR
	Building Energy Act (2019) GEG
	Renewable Energy Act (2000, 2018) EEG
Federal Laws	Federal Climate Protection Laws
	Building Regulations of the Laender (federal states)



3.2.3 Regional policies (Central Germany)

Central Germany was selected as the target region in Germany for the BRANCHES project. Referring to the strengths of the region and the typical value chain selected for the SWOT analysis in this project (Garcia Laverde & Szarka, 2022), the focus lies on the forestry and green chemistry sector in Saxony-Anhalt. The Central Germany region includes the federal states Saxony, Saxony-Anhalt and Thuringia. Bioeconomy has a high priority in this region, as it is mentioned in several regional strategy and innovation papers as a field with economic growth.

There exists a high interest in the development of new bio-based value-chains based on regional resources. A large share of land is used for the cultivation of cereals like wheat, winter rape and sugar beet. The agricultural area accounts for 65 % and the utilized forest area for only 16 % of the region (DBFZ, 2022), therefore also wood residues are focused on as a resource. Agricultural residues, food waste and even algae (for biorefineries) etc. complete the diverse biomass resource portfolio (NAIK, 2021).



Figure 3-7: Central Germany region with its federal states Saxony-Anhalt, Saxony and Thuringia (Baars & Schlottmann, 2015).

Due to the coal phase-out of Germany in 2038, a transformation from a fossil economy to a bioeconomy offers diverse

opportunities but also major structural changes in Central Germany, especially in Saxony and Saxony-Anhalt, where 2019 around 2,000 people were employed in this sector (DBFZ, 2022).

Historically conditioned Saxony-Anhalt owns strong competencies and structures in food industries, plastics and chemicals industry, which offers a great potential for bioeconomy (Brödner et al., 2021). Wood and wooden residues like bark, sawdust, splinter and chips serve as a feedstock for future green chemicals and fibre products (DBFZ, 2021).

Strategies

Bioeconomy is supported by innovation and bioeconomy strategies, programs and regulations, which provide the framework also for sustainable development, circularity and waste management (NAIK, 2021). The most important strategies in Central Germany are summarized in Table 3-8.

Central Germany, especially Saxony-Anhalt is a pioneer in promoting the bioeconomy as it is part of the lead market policy of the government (Overbeek et al., 2016). The first "Regional innovation strategy" of Saxony-Anhalt from 2014 identifies "chemistry and bioeconomy" as well as "food and agriculture" as drivers of growth (MW, 2014). The region benefited from the national research strategy BioEconomy 2030 of Germany (BMBF, 2010), published in 2010, and published as the first federal state in Central Germany its own Bioeconomy Strategy paper in April 2021. It was provided by the federal government and the Bioeconomy Cluster e.V. and named: "Bioeconomy as a driver for value creation and innovation" (Mayer et al., 2021). The strategy promotes the region of Central Germany including (scientific) competencies, concepts, regional structures, typical industries and resources. Although the strategy includes Saxony and Thuringia, there is no governance set yet for the whole Central Germany region, which would facilitate integrative support (NAIK, 2021). Like all three federal states of Central Germany, there was also a sustainability strategy Saxony-Anhalt published in 2018 only implicitly including bioeconomy.


In 2020, Central Germany published a Technology field analysis, which defines 43 future technologies in the leading industries of the region. Bioeconomy and alternative raw materials are one central field, like algae biotechnology, bio-based and biodegradable polymers and the food and health industry (Conomic, 2020). This study is one of over 20 studies planned for the formulation of a structural change strategy in Central Germany based on the coal phase out.

Table 3-8: Selection of most important bioeconomy related strategies in Central Germany (DBFZ, 2022)

Name of policy	Federal state	Reference to bioeconomy
Technology field analysis innovation region Central Germany (2020) (Conomic, 2020)	All (Central Germany)	Explicit
Bioeconomy Strategy paper: "Bioeconomy as a driver of value creation and innovation" (2021) (Mayer et al., 2021)	Saxony-Anhalt	Explicit
Sustainability strategy of the federal state of Saxony-Anhalt (2018) (MULE, 2018)	Saxony-Anhalt	Implicit
Regional Innovation Strategy Saxony-Anhalt (2014) (MW, 2014)	Saxony-Anhalt	Implicit
Innovation Strategy of the federal state of Saxony (2013 / update 2020) (SMWA, 2020)	Saxony	Implicit
Sustainability Strategy Saxony (2013 / update 2018) (SMEKUL, 2018)	Saxony	Implicit
Regional Innovation Strategy for Smart Specialization and Economic Change in Thuringia - RIS Thüringen (2021) (TMWWDG, 2018)	Thuringia	Explicit
Thuringian Sustainability Strategy (2011 / 2018) (TMUEN, 2018)	Thuringia	Implicit

Saxony issued like Saxony-Anhalt an innovation strategy in 2013 (amended 2020), including bioeconomy in the future field of environment and resources with the important sectors agriculture, food, forestry, paper and pulp, biochemicals, biofuels and bioenergy from biogas. A sustainability strategy including the SDGs was published in 2013 and amended in 2018. Both strategies are not explicitly focused on the bioeconomy but implicitly include bioeconomy fields.

The potential of the bioeconomy is not yet identified in the policy of Thuringia. The latest strategy, which includes bioeconomy sectors, is the Thuringian innovation strategy 2021, as well as the sustainability strategy 2011 (amended 2018). It is oriented to the SDGs and the main points related to bioeconomy are "Climate, Energy and Sustainable Mobility" and "Sustainable consumption and sustainable management".

Funding, investment projects, networks, regional regulations

Especially the circular economy law, the forestry law and certifications of sustainable forestry ensure the sustainability of bioeconomy on the regional level respective the federal states (Ludwig et al., 2014). One of the acts, that have a great influence on Central Germany, is the national act on the coal phase-out and structural strengthening ("Strukturstärkungsgesetz Kohleregionen 2020"). It includes funding for coal regions like the one in Central Germany to mitigate the consequences of the phase-out of coal-fired power generation. It is transposed to programmes of the federal states like the directive "Saxony-Anhalt coal region 2038". Through that directive, the Bioeconomy Hub is financed, which is setting up demonstration facilities to help start-ups SMEs in developing innovations to industrial maturity (Annex I: Good policy practice examples).



There are also established facilities like Europe's largest bioethanol plant in Zeitz, which produced in 2012 77 % of bioethanol in Germany. It uses sugar beet and crops, but second-generation biofuels are in a development phase as well as several green chemicals (Overbeek et al., 2016). The Finnish company UPM is, according to its own statements, building with an investment of € 1.3 billion the world's first large scale industrial biorefinery in Leuna, which is scheduled to start production at the end of 2022 (UPM, 2022). It will produce Glycols and lignin-based functional filler from sustainably certified industrial hardwoods, which can be used for plastics, textiles, cleaning agents, cosmetics and rubber production.

The regional innovation and the Bioeconomy Strategy Saxony-Anhalt are promoting the Innovation Cluster BioEconomy e.V., which was established in 2012. The cluster connects stakeholders from business and research in Central and other parts of Germany and follows the vision to develop Central Germany into an international model region for bioeconomy (BEV, 2022). The cluster was one of the winners of the Federal Ministry of Education and Research's (BMBF) top cluster competition in 2012 and gained funding of \in 40 million from the state (Biooekonomie.de, 2022). Additionally, it is funded through the federal state government until 2026. The cluster focuses on coupling and cascade utilization of wood and supports cooperation between companies and institutes. Results from cooperation are the pilot plant for chemical digestion of lignocellulose operated by the Fraunhofer Centre for Chemical-Biotechnological Processes (CBP) and the settlement of the new biorefinery in Leuna (Biooekonomie.de, 2022). Beside this, there exist several other clusters in Central Germany in this field, like the Cluster Chemistry/Plastics Central Germany, the Network Polymer Synthesis and Polymer Processing, Cluster Biotechnology, Cluster Circular and Resource Economy or the Cluster Bioeconomy.

Research landscape, demonstration projects

The knowledge to develop new bio-based value chains from regional resources in Central Germany is provided by 41 universities and research centres, which are not equally distributed but more concentrated in the areas around cities. E.g. the Science Campus Halle holds holding four Leibnitz-Institutes as well as the Martin-Luther-University Halle-Wittenberg. The Fraunhofer Centre for Chemical-Biotechnological Processes CBP is one of the lighthouse facilities located in Leuna, where the corresponding high-tech infrastructure is given (DBFZ, 2021). Important actors are also the biodiversity research centre (iDiv), the Fraunhofer pilot plant centre for polymer synthesis and processing (PAZ) in Schkopau, Leipzig University, the German Biomass Research Centre (DBFZ) and the Helmholtz Centre for Environmental Research (UFZ) as part of the BRANCHES consortium, several Max Planck Institutes and the Federal Research Centre for Cultivated Plants etc. Research activities are orientated towards biotechnology, biological resources and chemistry.

R&D funding comes from the EU and national level and covers several areas related to the bioeconomy. Research activities on bio-based chemicals and upscaling of facilities were started in 2010 by the CBP with funding from the federal government of Saxony-Anhalt, the German Federal Research Ministry and the Fraunhofer Society (Overbeek et al., 2016). The state excellence offensive programme, followed by the framework agreement for research and innovation between the federal state government and the universities ("Rahmenvereinbarung Forschung und Innovation"), was promoting until 2015 the alliance research between research institutions. The Saxon State Ministry for Higher Education, Research and the Arts is part of the international research network ERA CoBioTech, which is an ERA-Net Cofund Action under H2020 and aims to strengthen the European Research Area (ERA) in the field of Biotechnology.



3.2.4 Good policy practices

DESCRIPTION OF THE REGIONAL VALUE-CHAIN

Production of biochemicals from lignocellulosic biomass in Central Germany

Residues that are rich in lignocellulose like wood and agriculture residues are used as the main feedstock in this value chain. The final products include a variety of biochemicals like sugars, polymers and resin products. There are numerous mechanical or thermochemical processes that are used to isolate and extract valuable compounds from biomass. These compounds help upgrade the value of biomass residues and serve as replacement products for existing chemicals that are traditionally produced from petrochemicals.

Typically, stages of this value chain include (i) Biomass production, (ii) pre-treatment e.g. pulping, (iii) Conversion in biorefineries, (iv) end product and entry to market.

SUMMARY OF GOOD POLICIES

Policy 1 - Forest directive 2019 Saxony-Anhalt ("Richtlinie Forst 2019")

- Main aim of the policy: Financial support for reforestation, soil protection and road construction. It is intendent to support forest owners in converting their forests into climate resilient forests.
- Year of implementation: 2019-2023
- Type of instrument: Financial, voluntary initiative
- Influence level of policy: Regional
- Funding body: Federal State government of Sachsen-Anhalt

Policy 2 - Innovation Hub "Future Wood and Climate" project

- Main aim of the policy: Ensure further development of bioeconomic processes between the regional forestry and lumber industry. Generate new sales markets with cross-regional cooperation and thus develop job perspectives.
- Year of implementation: 2022
- Type of instrument: Information and advisory instrument, financial (support for research), voluntary initiative
- Influence level of policy: Regional
- Funding body: Federal Republic of Germany, Federal State of Saxony-Anhalt

Policy 3 - BioEconomy HUB

- Main aim of the policy: Setting up a pilot facility for wood-based biotech processes, creating a platform where start-ups and small companies can scale up their technologies and produce first tonnage of desired products
- Year of implementation: 2021
- Type of instrument: Information and advisory instrument, financial, voluntary initiative
- Influence level of policy: Regional
- Funding body: Federal Republic of Germany, Federal State of Saxony-Anhalt

For more information on good policy practices see Annex I: Good policy practice examples.



3.3 Italy

3.3.1 Overview of Italy's bioeconomy landscape

In 2020, the bioeconomy (use of biomass for production of goods and energy) generated an output of € 317 billion, employing a little less than two million people and accounting in terms of production for 10.2 % of the entire economy (10 % in 2019 and 9.9 % in 2018) (Studies and Research Department of Intesa Sanpaolo et al., 2021).

The bioeconomy has shown greater resilience to the pandemic shock than the total economy, in Italy as well as in the other EU countries. Its development potential, in a circular perspective, is high and widespread throughout the national territory. Estimates of its added value at the macroregional level highlight a driving role in the north-east and southern regions with a regional added value of 8.2 % and 6.7 % respectively (in 2018). While in the north-west of the country and in Central Italy the weight of the bioeconomy is less than the Italian average (6.4 %), accounting respectively for 5.3 % and 5.7 % (Studies and Research Department of Intesa Sanpaolo et al., 2021).

The agri-food sector has always played a leading role in the bioeconomy in all geographical areas, with a weight that varies from about 50 % in the central regions to almost 80 % in the southern regions. The biobased system also significantly affects the bioeconomy in the various geographical areas, with growing attention to sustainability issues that are involving the production chain of the entire peninsula (Studies and Research Department of Intesa Sanpaolo et al., 2021).

But there are also other relevant territorial specializations: in the north-west, the sectors with the highest technological content are highlighted, such as pharmaceuticals and bio-based chemistry. In the north-eastern regions emerges the importance of the wood and furniture supply chain, while the central regions are characterized by the importance of paper and pharmaceutical industries. In the south, the agri-food sector represents almost the entire bioeconomy, but there are also experiences in sectors with higher technological content, as confirmed by the specialization of some provinces in the pharmaceutical sector (Studies and Research Department of Intesa Sanpaolo et al., 2021).

The production sector characteristics in the different regions are also reflected in the interest in the new frontiers of bio-based chemistry. Recent studies in the sector highlighted a dynamic and complex system, with more than 830 stakeholder bodies, from 84 universities and research centres (public and private) to about 730 companies (with more than 500 start-ups), flanked by other institutions and associations with a support and promotion role. As far as companies are concerned, a diverse world emerges in which a few large companies are joined by numerous small and medium-sized companies and a significant number of innovative start-ups and subjects operating in the sector upstream of R&D (Studies and Research Department of Intesa Sanpaolo et al., 2021).

Many bio-based chemicals are not only derived from raw materials that have lower emissions (particularly when using by-products from other wastes or waste processes) but are also biodegradable and compostable at the end of their life cycle, in line with international standards. Bio-based chemistry makes an important and driving contribution to the efforts of the entire chemical industry to reduce the impact on the environment and increase the circularity of its products for a better quality of life for the benefit of society as a whole. In addition to the important role played by chemical companies, which make up more than 40 % of the companies surveyed net of start-ups, it is worth highlighting the important contribution made by companies in the agri-food chain, utilities, fashion and wood and paper industries. The growing involvement in bio-based chemistry projects by other sectors is also remarkable, from mechanics (based upon research



projects aimed at the development of machinery capable of using the new compounds) to the automotive sector, becoming increasingly involved in environmental issues, including through the replacement of fossil materials with bio-based matrix products (Studies and Research Department of Intesa Sanpaolo et al., 2021).

3.3.2 National policies

Three documents were produced by the European Commission's Experts on Bioeconomy:

- "Future transitions for the Bioeconomy towards Sustainable Development and a Climate-Neutral ٠ Economy"
- "Bioeconomy opportunities for a green recovery and enhanced system resilience" •
- "Foresight Scenarios for the EU bioeconomy in 2050" •

Insights into the European market for bio-based chemicals

A study carried out in 2019 by the JRC of the European Commission provides a detailed description of 10 categories of bio-based chemicals with related application markets. The study focuses on bio-based products already marketed and represents a first concrete step towards the description of a market with high potential. It is an interesting document for the purposes of analysing and understanding trends in the industry.

In January 2018, the European Commission adopted the European Strategy for Plastics in a Circular Economy (COM (2018) 28 final). In the set of implementing measures, the strategy also includes actions aimed at investigating and better understanding the life-cycle impacts of the use of alternative feedstocks for plastics production

National Bioeconomy Strategy

Under the coordination of the Presidency of the Council of Ministers and in agreement with the European Commission, the representatives of four ministries (MATTM, MIPAFF, MISE, MIUR) prepared in 2016, together with the Conference of Regions and Autonomous Provinces, the Agency for territorial cohesion and National technology clusters, ALISEI, SPRING and BIG, the Italian National Bioeconomy Strategy. After a period of public consultation, the document was officially presented on 20 April 2017 at the headquarters of the National Research Council in Rome. Following the update of the European Bioeconomy Strategy (European Commission, 2018) in October 2018, it was necessary to make some updates and implementations to the National Strategy in order to align its objectives and actions. The presentation of the updated version of the National Bioeconomy Strategy was held on May 14, 2019, at the headquarters of the Presidency of the Council of Ministers (CNBBSV, 2019). In January 2021, the Action Plan (2020-2025) was published for the implementation of the Italian strategy for the bioeconomy aimed at implementing the related national strategy (CNBBSV, 2021).

Fourth report on the state of natural capital in Italy

In 2021, the "Fourth report on the state of natural capital in Italy" was officially launched in the presence of Minister Cingolani who underlined how fundamental it is to focus on monitoring natural capital, but also on decarbonization, the circular economy, the stop of land consumption and the recovery of degraded areas (Comitato Capitale Naturale, 2021).



3.3.3 Regional policies (Central Italy)

Local strategies for bioeconomy

Each Italian region has its own specificities in the agricultural and natural landscape, caused by the diversity of cultivated plants, fauna and ecosystem services and the different cultural tradition. Recent work for the drafting of a position paper on the bioeconomy (6/129 / CR08b / C11), developed by the Conference of Italian Regions, analysed the strategic positioning of the regions with respect to the three pillars of the bioeconomy: marine bioeconomy, agri-food and bio-based industry. The study paves the way for interregional cooperation on the bioeconomy, in particular between neighbouring territories, also establishing the necessary dialogue with national programs and strategies. As far as forest regulations are concerned, the regions of Abruzzi, Latium, Marche and Tuscany have adopted a regional forest law. Latium and Abruzzi also have a regional forest plan.

Networking initiatives (clusters)

National technology clusters are networks that include public and private entities operating on the national territory in sectors such as industry research, training and technology transfer. They act as resource catalysts to respond to the needs of the territory and the market and coordinate and strengthen the link between research and businesses. Each cluster refers to a specific technological and application area considered strategic for the country and whose authoritative contact for competencies, knowledge, structures, networks and potentials it is. The two clusters of the topics covered by the BRANCHES project are Agri-food and Green Chemistry.

Regional regulations and funding

There are no specific policies other than the regional variations of the European and national funds dedicated to the sector. Funds for the bioeconomy come from the European Structural Funds and from the National Recovery and Resilience Plan.

Research activities, knowledge transfer, demonstration projects

Many studies have been promoted by the Italian regional administrations on the issues of the bioeconomy using mainly European funds. Marche region has developed some interesting INTERREG ITALIAN-CROATIAN projects. The Abruzzi Region, through the provision of funding from the Ministry of Agriculture, has promoted the GESTA project " Gestione Eco-Sostenibile del Territorio in Abruzzo" (Eco-Sustainable Land Management in Abruzzo) which - in line with the recent project "Testo Unico in materia di Foreste e Filiere Forestali (Tuff)" (Consolidated Law on Forests and Forestry Supply Chains) - intends to promote forms of active management of the woods, with particular attention to those falling under the collective ownership of a large Abruzzi Mountain area. In Tuscany, the COBRAF ("Co-products for biorefineries") project was carried out, which is an object of a PA in the BRANCHES Project.

3.3.4 Good policy practices

DESCRIPTION OF THE REGIONAL VALUE-CHAIN

Upgrading biomass products across sectors in Tuscany, Italy

The considered value chain has been developed in Tuscany and involves the whole rural sector including forestry and agriculture, but also waste and energy. It is particularly relevant in those areas of the region where farms are closing down and because of these effects, the agricultural area has decreased by 12 % in the last 10 years. Hemp, Futura 75 variety, with the aim of using the whole plant. The final products are several and include bio-oil, nutraceutical products and cosmetics from seeds. In addition, from the remaining



of the primary process can also be obtained several other products including wood adhesives from seed residuals, CBD and terpenes, from inflorescences, fibres and composites for the motorhome industry from straws, and building materials from sheaves.

SUMMARY OF GOOD POLICIES

Policy 1 - EIP AGRI

- Main aim of the policy: The European Partnerships for Innovation (EIPI) were introduced by the European 2020 flagship initiative "The Innovation Union" (EU Commission, 2010) to implement a new approach in defining research paths and innovation in EU to support the needs of local producer and their production systems.
- Year of implementation: 2010
- Type of instrument: Financial (funding), voluntary initiative
- Influence level of policy: Regional, national, EU level
- Funding body: Regional administration of Tuscany

Policy 2 - Italian strategy for bioeconomy

- Main aim of the policy: The Strategy offers a shared vision of the environmental, economic, social and international cooperation opportunities and challenges connected to the development of an Italian bioeconomy strongly related to the needs of the country.
- Year of implementation: 2021
- Type of instrument: Other instruments such as vision documents (national strategy)
- Influence level of policy: National
- Funding body: Local administration and national funding

Policy 3 - Rural Development Plan for the Tuscany Region - European Fund for Rural Development (EAFRD) - Measure 16

- Main aim of the policy: In the administrative region of Tuscany, the aim is to support, through cofinancing, the activities related to the implementation of the Strategic Plans of Operational Groups (SP-OG) that were established after the selection of proposals submitted to the regional administration, with the purpose to identify concrete solutions in support of main issues faced by agricultural and forestry companies or to support them in taking opportunities that may materialize.
- Year of implementation: 2013
- Type of instrument: Voluntary initiative, financial (funding)
- Influence level of policy: Regional
- Funding body: Regional administration of Tuscany, EU

For more information on good policy practices see Annex I: Good policy practice examples.

3.4 Poland

3.4.1 Overview of Poland's bioeconomy landscape

Bioeconomy in Poland is becoming an increasingly appreciated area of interest by politicians and regulations. It is commonly understood to be a complex of issues related to the safety and security of food and energy, climate change and environment protection, as well as many social and cultural changes. It also includes the



traditional sectors of the economy which produce bio-products and services by using biotechnologies (Woźniak & Twardowski, 2018).

Bioeconomy aims to create the foundation for a more innovative, resource saving and competitive society, in which ensuring food security does not collide with the rules of the sustainable use of renewable resources for industrial purposes while ensuring environmental protection (Adamowicz, 2020; Skorwider-Namiotko, 2015). The bioeconomy is cross-sectoral. It includes sectors consisting mainly of producers of biomass, which is a raw material for processing into food, feed, energy, biomaterials and bio-based products (Kasztelan et al., 2021).

In Poland, the bioeconomy is based mainly on traditional areas of primary production: agriculture, forestry and food production, and to a lesser extent on the chemical, biological and energy industries (Pink & Wojnarowska, 2020). Gross value added generated in the bioeconomy sector in 2019 in Poland amounted to € 36,649 million, which was the sixth place among all EU-27 countries. At the same time, in Poland, there were changes in the gross value added of individual sectors of the bioeconomy. In two sectors there was a decrease, i.e. wood products and furniture and bio-based textiles, while in the latter it was relatively high and amounted to over 18 %. The electricity bioenergy sector showed the highest dynamics of gross value added growth (increase of 125.5 %).

The potential of the bioeconomy can be also assessed in terms of turnover value. It corresponds to market sales of goods or services supplied by bioeconomy sectors and is therefore in most cases higher than gross value added. In Poland, the value of turnover in the bio-based economy in 2019 amounted to \notin 146.88 million and was higher than in 2018 by \notin 6.28 million.

In Poland, the bioeconomy provides about 20 % of jobs. In 2019, it employed 2.37 million people. This employment is showing a downward trend. In 2019, it was lower by 2.9 % than in 2018 (Figure 3-8). The declining number of people employed in the bioeconomy is mainly due to the outflow of workers from agriculture. Employment in the chemical, pharmaceutical, bioplastics, biomaterials, bioenergy and forest sectors showed an upward trend from 2015-2019. Nevertheless, the vast majority of people employed in the bio-based economy were agricultural workers (59.9 %). Employment in the non-agricultural bioeconomy sector remains a small percentage. Sectors that rely more on innovation - biochemicals, pharmaceuticals, biomaterials, bioenergy and biofuels - are practically a labour niche compared to the traditional ones.



Figure 3-8: Employment in Poland in the bioeconomy and the dynamics (Source: Own study of University of Warmia and Mazury based on data from Statistic Poland)

BRANCHES | GA n.10100375 D4.2 Good practices in policy for bioeconomy value chains in European regions



The most important areas of bioeconomy in Poland are agriculture and food and feed production. Moreover, Poland also has a great potential for biomass, which can be used to produce energy or converted into biofuels and raw industrial materials (Denisiuk & Piechocki, 2005; Gostomczyk, 2015; Woźniak & Twardowski, 2018). The following could be used as substrates: municipal waste, sewage sludge, animal droppings, maize silage and grass (Igliński et al., 2015).

According to data from the Energy Regulatory Office production of bioenergy in 2021 was carried out in 346 biogas plants with a total power of 257 MW. The average capacity of a biogas plant in Poland is 0.7 MW. There were 113 agriculture biogas plants whose power amounted to more than 130 MW in 2020 (URE, 2022). The technical potential of biogas in Poland is estimated to be 2.5 million m³ or 39.44 PJ. The use of all of Poland's biogas potential could result in meeting 7.5 % of Poland's energy demand (Igliński et al., 2015).

Biotechnology is an important area of the bioeconomy. This activity is still emerging in Poland. The number of companies operating in the field of biotechnology increased in 2016-2018, but has been decreasing since 2019. In 2020, 177 enterprises in the field of biotechnology operated in Poland (Figure 3-9).



Figure 3-9: Number of biotechnology companies in Poland (Source: Own study of University of Warmia and Mazury based on data from Statistic Poland)

Internal expenditure of Polish enterprises on biotechnology in 2018-2020 remained at a stable level and in 2020 amounted to PLN 1,220.7 million (Figure 3-10). In addition to biotechnology, opportunities for innovation and research are concentrated in Poland in the following areas: agriculture, food and feed production, medicine and pharmaceutical industry, environmental protection (waste use), energy production from biomass, biogas, biofuels and biomaterials (Woźniak & Twardowski, 2016). Several dozen clusters operate in these areas in Poland (Pink & Wojnarowska, 2020).





Figure 3-10: Internal expenditure incurred by Polish enterprises on activities in the field of biotechnology (in million PLN) (Source: Own study of University of Warmia and Mazury based on data from Statistic Poland)

3.4.2 National policies

In Poland, there is no single, complex and strategic document dedicated to bioeconomy (Mikielewicz et al., 2020). The process of raising awareness about the importance of bioeconomy and building a coherent economic sector is in the initial phase. Poland's obligations resulting from its membership in the EU contributed to the dynamics of this process. The Bioeconomy Strategy at the national level is currently under development in Poland, while references to the bioeconomy can be found in various documents. They are mainly based on supporting activities aimed at sustainably developing the country, which is one of the principles of bioeconomy. The principle of sustainable development is the most important issue during drawing up various concepts and spatial development plans for the country and individual regions, as well as development strategies for these regions.

- Strategy for sustainable development of rural areas, agriculture and fisheries 2030 the main aim of this strategy is the economic development of rural areas, which will enable a sustainable increase in the income of its inhabitants while minimizing economic, social and territorial stratification and improving the condition of the natural environment,
- **Poland's Energy and Climate Plan to 2030** the key priority of this Plan is to present a national strategy for achieving jointly agreed targets within the EU. The current draft of the document does not meet this objective. The Ministry forecasts that emissions in the emission trading scheme in Poland will decrease by approximately 9 % (compared to 2005). Poland's Energy and Climate Plan to 2030 sets a target of a 23 % reduction in primary energy consumption by 2030, although at the same time it forecasts that it can be reduced by a maximum of 18.6 % by 2030,
- The draft of Energy Policy of Poland until 2040 its goal is energy safety maintaining the competitiveness of the economy, energy efficiency and decreasing the environmental impact of the energy sector, with optimal use of own energy resources,
- The 2030 National Environmental Policy the Development Strategy in the Area of the Environment and Water Management an important issue which will result from this Strategy is the adaptation of agriculture and fishery to climate change and their contribution to the prevention of these changes,



- The Strategy for Responsible Development for the period up to 2020 (including the perspective up to 2030) - it determines basic conditions, objectives and directions for the country development in social, economic, environmental and spatial terms in the perspective of 2020 and 2030 and defines a new model of development - responsible development as well as development socially and territorially. The main objective of this Strategy is to create conditions for increasing the incomes of the Polish citizens along with increasing cohesion in the social, economic, environmental and territorial dimensions. The Strategy is oriented towards an inclusive social and economic development. It was assumed that the main driving force and public priority will be social cohesion. It subordinates actions in the economic sphere to achieving objectives related to the standard and quality of life of the Polish citizens. Emphasis is put on those ordinary citizens and areas, which have been left outside of the development policy so far but may benefit from the economic development to a larger extent. It is expected in the long-term that the implementation of the Strategy will enable the citizens to benefit from increased income and the enhanced quality of life, understood as the creation of friendly housing conditions, in particular for families, the provision of an adequate quality of education, increasing employment and better-quality jobs, better access to infrastructure, the provision of adequate health care strengthening the citizens' health, the satisfactory condition of the environment and the sense of security.
- National Strategy of Regional Development, which assumed innovative development of regions and improvement of the approach based on Regional Smart Specializations.

Moreover, a List of National Smart Specialization has been compiled. The current list is in effect from January 17, 2022. National Smart Specializations include industries which, if developed, will help Poland to create:

- Innovative social and economic solutions, •
- Increase the economy's value added and •
- Improve its competitiveness international.

In Poland 13 National Smart Specializations were identified, which were grouped into the following five areas:

- 1. Healthy society,
- 2. Agri-food, forestry-timber and environmental bioeconomy,
- 3. Sustainable energy,
- 4. Natural resources and waste management and
- 5. Innovative technologies and industrial processes (in a horizontal approach).

Smart specialization strategy is also one of the key elements of forming the EU regional development policy (Grądziel, 2014; Kogut-Jaworska & Ociepa-Kicińska, 2020). The policy of regional smart specialization, promoting the transition to a resource-efficient and low-carbon economy, is an important factor in forming the model of sustainable endogenous growth of the regions. Smart-specialization also stipulates the intraand inter-regional inclusive growth, thus boosting territorial cohesion, supporting structural changes and offering new and better jobs and social innovations (Storonyanska et al., 2021).

Another important document with regard to the development of the bioeconomy in Poland is Road Map towards the Transition to Circular Economy, which was adopted by the Council of Ministers in 2019. Circular economy is an economic development model in which the following basic assumptions are met while maintaining the productivity condition: added value of raw materials (resources), materials and products is maximized or the amount of waste generated is minimized and the resulting waste is managed in accordance with the waste hierarchy. The aim of the Road Map towards the Transition to Circular Economy is, on the one BRANCHES | GA n.10100375 Page 47 | 131



hand, to indicate horizontal actions which would affect the largest possible section of social and economic life. On the other hand, it prioritizes the areas whose development will make it possible to take advantage of the opportunities facing Poland, and at the same time will address the currently existing or expected threats. One of such areas indicated in the document is the bioeconomy (GOZ, 2019).

Closed-loop economy i.e. a biological cycle in the economy, is one of the two pillars of circular economy, alongside the technological cycle. The biological cycle in the circular economy is related to the management of renewable resources - the so-called biomass - throughout its life cycle. This includes their processing, production of goods (e.g. food, feed, bioenergy), sale of goods, the use phase and bio-waste management. Bioeconomy is the basis for the functioning of the first sector of the economy, which consists of agriculture, forestry and fisheries, as well as many branches of the second sector, including industries such as food, fodder, forest and wood, pulp and paper, pharmaceuticals, textiles, furniture, construction, biotechnology, cosmetics, fuel and organic recycling. Bioeconomy presupposes the management of renewable resources in an optimal, responsible and sustainable way. This means that these resources should be used in the most economically and environmentally beneficial way, considering the principle that food is the most important product. In addition, they should be managed in a way that resources, including soil, surface water and air, are fully recoverable. The Circular Economy Road Map focuses, on the one hand, on general actions aimed at creating conditions for the development of bioeconomy in Poland and, on the other hand, on activities concerning the development of bioeconomy in selected areas, i.e. creating local value chains, in the industry in general and in the power industry in particular (GOZ, 2019).

The responsible authorities include at the national level (Sartorius et al., 2021):

- The Energy Regulatory Commission. The Renewable Sources Department of this Office carries out tasks related to the production of electricity from renewable energy sources, the production of agricultural biogas, and also prepares draft decisions on granting, changing, withdrawing or revoking the promise of concessions/licenses for conducting business activity in the field of electricity production from biomass, bioliquids, biogas or agricultural biogas.
- The Ministry of Climate and Environment. Undertaking sustainable development activities at the international level, implementation of tasks resulting from Poland's membership in the organization for Economic Cooperation and Development. Raising the level of ecological awareness and shaping the ecological attitudes of society by promoting the principles of sustainable development.
- The Ministry of Agriculture and Rural Development. Activities undertaken by the Ministry of Agriculture and Rural Development in cooperation with the Ministry of Energy were aimed at maintaining the current level of use of agricultural raw materials for the production of biofuels. As part of promoting the use of agricultural biomass, educational activities are also undertaken, as well as the dissemination of knowledge about possible solutions.
- The Ministry of Development, Labour and Technology. The Department of Innovation of this Ministry deals with the implementation of tasks related to the transformation of the economy towards a circular economy, including issues related to the ecological footprint and access of industry to raw materials. Preparation and implementation of projects for activities in the area of energy efficiency of buildings, development and use of renewable energy sources and transformation of the energy industry towards low-emission energy.

3.4.3 Regional policies (Warmia and Mazury)

The Warmia and Mazury Region is located in the east part of the Polish South Baltic Area and consists of 116 municipalities. The population is approximately 1,443,967 inhabitants and the region covers a land area of



2,417,300 ha (7.7 % of the area of Poland). The number of farms is approximately 41,700 and the area with arable land is 994,569 ha. The average agricultural farm size in Poland is 10.5 ha. Warmia and Mazury farms are 22.9 ha and these are respectively the first and second biggest farm sizes in Poland. The proportion of forest area in the Warmia and Mazury region is 773,692 ha with coniferous trees being the dominant species, accounting for approximately 60.7 % of the forest area. Forests cover 31 % of the total land area in the region, which is close to the national average of 29.4 % (9,197,900 ha). The same statistical data for the Warmia and Mazury region indicates that 433,237 people were employed in 2015. Agriculture, forestry and fishing industries employed 70,442 people which is about 16.3 % of the total employment in the Warmia and Mazury region. After 2015 there were still 11 vacancies in these industries while 370 jobs had been newly created. The average monthly salary in the Warmia and Mazury region in agriculture, forestry and fishing industries was 4,396.52 PLN.

Warmia-Mazury undoubtedly belongs to one of the most attractive regions of Poland in terms of tourism. The region's natural assets, clean environment and well-developed hotel and accommodation base favour the growth of tourism in Warmia and Mazury.

Local strategies for bioeconomy

Each of the 16 regions (voivodeships) of Poland, also Warmia and Mazury, has a separate, dedicated development strategy, which focuses on one territory and is oriented in such a way that it is possible to introduce changes on which individual local governments have a real impact, and this will subsequently be translated into the development of the whole country. These strategies take into account the specificity of individual territories within a given region and indicate that each challenge may have different nature and be easier or harder to perform (Mikielewicz et al., 2020).

The economic growth of the Warmia and Mazury region relies upon so-called regional smart specializations, listed in the Strategy for Socio-Economic Development of the Warmian-Masurian Voivodeship Until 2025. Currently, the leading sectors of the economy of Warmia and Mazury include tourism, healthy food production, wood industry, machinery manufacture, where clean industrial technologies and renewable energy sources are used, pro-ecological forestry, yacht manufacture and eco-tourism.

Smart specializations mean to focus on a few selected areas of the economy, based on the region's natural resources. Smart specializations, and thus leading areas of the economy of Warmia and Masuria, include:

- 1. **Water Economy** (including tourism, ecotourism and economic activity related to the wealth of water in Warmia and Mazury lakes, rivers, and the Vistula Lagoon, with tourism, yacht industry, etc.);
- 2. **High Quality Food** (food industry focusing on the production and processing of healthy and highquality food). Regional agricultural traditions and favourable natural conditions for the growth of agriculture and fishery enjoying adequate scientific and research facilities nowadays allow for the establishment of a network of large food production cooperators. The existing food industry producers guarantee agricultural producers and breeders a stable market for their supplies.
- 3. Wood and Furniture Industry (pro-ecological forest management furniture and wood industry, production of machinery and equipment, where clean industrial technologies are applied and renewable energy sources are used). The region's favourable climatic conditions, an adequate base of own raw materials and the proximity of voivodeships with large forest complexes allow cooperation of producers, as well as cooperators; advanced technical infrastructure for the wood industry (many sawmills, furniture plants, etc.) and decades of tradition have made this branch of industry become the pride of the region.

Networking initiatives (clusters)



Baltic Ecoenergy Cluster (BKEE) is a joint initiative of the Institute of Fluid-Flow Machinery of the Polish Academy of Sciences, the University of Warmia and Mazury, the Gdańsk University of Technology and the Koszalin University of Technology as well as Marshals and Local Governments of the Pomeranian and Warmia and Mazury Voivodeship, as well as business entities and associations based in these provinces. It covers the area of northern Poland from Koszalin through the Pomeranian Voivodeship to the eastern ends of the Warmia and Mazury Voivodeship. Cluster activities are aimed at: reducing the share of fossil fuels as primary energy sources, stimulating the development of new technologies in the area of green energy and training specialists, supporting the production of equipment for bioenergetics, promoting and supporting energy saving technologies, developing ecological awareness and professional activation of the population from rural areas (Sartorius et al., 2021).

Masurian Windows Cluster (KMO) is created by enterprises, business support institutions and research institutes from the Warmia and Mazury region and the northern part of the Podlaskie Voivodeship operating in the wood joinery sector or cooperating with it. The cluster includes: micro, medium and small enterprises dealing with the production of windows and doors and enterprises from associated sectors such as wooden elements, window shades, windowsills, windows, windowpanes, window fittings, metal element, antiburglar protection, gates and motorized garage door openers. The cluster operates in the regional, national and foreign markets. To make it easier for enterprises to succeed in foreign markets, a special offer was created, which encompasses the best cluster products. The products, which obtained names associated with the Warmińsko-Mazurskie Voivodeship (e.g. Skanda Windows, Goldap Doors, etc.), are distributed through a network of business that is at the disposal of members of the cluster. The promotion of cluster products promotes both natural and geographical Warmia and Mazury. Each cluster member has the ability to incorporate promoted products into their offer. The cluster's activity was supported by the purchase of modern machines and the launching of an innovative production line for window blinds and mosquito nets, as well as a veneering line. Machines can be used by all entrepreneurs who are members of the KMO. Being a member of the cluster goes hand in hand with the requirement to fulfil the highest norms of quality imposed by an independent certifying centre. The ways of production and technologies employed by the companies are suited to state of the art technological achievements (PARP, 2012).

Mebel Elbląg Furniture Cluster (Elbląg Furniture Cluster Association, 2022) is a local initiative encompassing Elbląg and the surrounding area. The initiators of the cluster were local authorities of the city and the Elbląska Chamber of Industry and Trade. The cluster gathers not only enterprises dealing with furniture production or their components, but also companies performing services for the sector. The main aim of the cluster is consolidation and turning competitors from the furniture sector into cooperating companies. The Mebel Elbląg Furniture Cluster Association is equipped with appropriate technical and organizational potential. Cluster's activity focuses among other things on the promotion of the furniture sector. Joint promotional and informational materials are created and a cluster catalogue is regularly distributed promoting the companies and the city of Elbląg. Members of the cluster include companies which deal with export both to eastern and western markets. One of the companies has even a branch in the United States. The cluster itself operates however on a national scale. In 2012, the cluster was planning to expand its operations into European markets (PARP, 2012).

Cluster initiative of **the Beef Cluster from Warmia and Mazury** was conceived within the project "Support for the development of cluster initiative in Warmińsko-Mazurskie Voivodeship in the beef producing sector in order to increase enterprises' innovativeness, exchange of knowledge and technologies and their competitiveness". The cluster is interested in three groups: enterprises – mainly beef producers, processors (abattoirs) and trade and service companies, R&D units as well as local government units. The cluster is coordinated by the Polish Association of Beef Cattle Producers, which is the only agricultural sector



organization representing the interests of beef cattle producers in Poland. The aim of the cluster is (PARP, 2012):

- Create a permanent framework for cooperation between entrepreneurs from the area of beef production and research units,
- Create a network of links between local businesses in the area of beef production, local government, research and scientific institutions, business support institutions,
- Implementation and dissemination of innovative technologies among enterprises and R&D institutions,
- Implementation of joint research projects, export, education,
- Support the development of high-quality beef sales of Warmia and Mazury,
- Support export activities, promotion of regional brands and the industry in which cluster members operate in international markets and
- Promote the idea of clustering among entrepreneurs.

Regional regulations affecting bioeconomy

The responsible authorities include at the regional level (Sartorius et al., 2021):

• The Marshal's Office. It defines the regional development strategy. Among the activities there are: ecological education, climate policy, international aspects of sustainable development, air protection, Polish energy policy, national Energy and Climate Plan for 2021-2030 and renewable energy sources - monitoring.

Funding / investment projects

Business environment institutions play an important role in supporting companies operating in the region of Warmia and Mazury. However, only some of them actively support the development of the bioeconomy. They should be sought among entities supporting the implementation of innovations (Godlewska-Majkowska & Buszko, 2014). These undoubtedly include: The Science and Technology Park in Olsztyn, the Ełk Science and Technology Park and the Technology Park in Elbląg.

The Olsztyn Scientific and Technology Park (OSTP, 2022) was established within the project co-financed by the European Regional Development Fund within the Operational Programme Development of Eastern Poland 2007-2013. Its main purposes include:

- Create the ability by companies to compete on the global marketplace,
- Use human capital in the region for the development of smart specializations and
- Involve young people and children in the area of science, entrepreneurship and creativity.

Currently, 65 companies, being at different stages of development and technological advancement, have their registered offices within the OSTP. These are primarily companies operating in the following industries: geo-IT, IT and biotechnology. There is, among others, the Food laboratory for the youngest.

The main task of **the Elbląg Technology Park** (EPT, 2022) is to create favourable conditions to make business, investment and research. The modern complex provides businesses the ability to rent available office space, as well as to use infrastructure and professional consulting services, technology transfer and assistance for financial resources, including EU funds.

The heart of the Elblag Technology Park is a Research and Development Centre that includes:

- Advanced environmental analysis laboratory,
- Laboratory for working environment and emissions research,



- Metallurgy laboratory,
- Centre for information technology transfer and
- Wood technology and furniture centre.

The Ełk Science and Technology Park focuses on supporting entrepreneurship and broadly-based innovative processes (Ełk Science and Technology Park, 2022). It is best suited for innovative companies which continue to implement state-of-the-art technological solutions. The aim of the Ełk Science and Technology Park is to expand the economic potential and competitiveness of the city of Ełk by creating optimal conditions for the transfer and commercialization of technology, the establishment and development of small innovative companies and the development and marketing of new products; to generate new, more promising ways of economic development in the Ełk region; to provide employment support and create conditions for the creation of new jobs; and to provide new production, investment and administration facilities. The Ełk Science and Technology Park has a fully equipped laboratory colour specializing in research related to quality control of colour. The most common tests may include validation studies, discolouration and formulation of colours.

Research activities, knowledge transfer, demonstration projects

The University of Warmia and Mazury in Olsztyn makes a significant contribution to the development of the bioeconomy in the region of Warmia and Mazury. It educates students, incl. in the field of biotechnology. The University's structure also includes the **Centre for Bioeconomy and Renewable Energy** (CBEO), established by a resolution of the UWM Senate on November 24, 2006. The mission of the Centre is to integrate the activities of the scientific, local government and economic environment in the creation and implementation of new technologies in the field of bioprocesses and renewable energy. The aim of the Centre's activity is to conduct scientific research on new technological solutions for the bioeconomy and renewable energy and to create model technologies and pilot installations for biomass processing and using renewable sources, which at the same time constitute a research workshop, educational base and functional patterns of energy and matter circulation in the circular economy. The development strategy of the Centre assumes creating a region of knowledge about innovative technologies of bioeconomy and renewable energy, environmentally friendly, in which the results of scientific research find a practical application and get translated into commercial success of the involved business entities.

3.4.4 Good policy practices

DESCRIPTION OF THE REGIONAL VALUE-CHAIN

Biogas and fertilizer production from agricultural residues in the region of Warmia and Mazury

Manure and corn silage are used as the main feedstocks. So the substrate of the biogas plant comes from own or local resources. The gained electricity and heat energy are wholly or partly consumed at the farm and sold to the local heating system and national power operator.

There are two main systems of value chains. The one associated with big biogas plants (>1 MWel) is "business-oriented" and the second associated with micro biogas plants (<100 kWel) is "prosumer-oriented", i.e. when the biogas plant is fully integrated within a given agricultural production and the whole power and heat is consumed in the production and other farm energy needs.



SUMMARY OF GOOD POLICIES

Policy 1 - Support for renewable energy provision in the region of Warmia/Mazury

- Main aim of the policy: Improvement of energy efficiency and building a non-emission economy in the region of Warmia and Mazury
- Year of implementation: 2014-2020
- Type of instrument: Financial (grants), voluntary initiative
- Influence level of policy: Regional
- Funding body: EU: Regional Operational Programme for the Warmia and Mazury for the years 2014-2020 (Action 4.1)

Policy 2 - Priority Programme "Agroenergy"

- Main aim of the policy: Financial support for new ventures related to the production of energy from renewable sources on farms (e.g. biogas plants)
- Year of implementation: 2021-2027
- Type of instrument: Financial instrument (subsidies, loans), voluntary initiative
- Influence level of policy: National
- Funding body: National Fund for Environmental Protection and Water Management

Policy 3 - Energy Policy of Poland until 2040

- Main aim of the policy: Framework for the energy transition in Poland. Energy security, while ensuring the competitiveness of the economy, energy efficiency and reducing the impact of the energy sector on the environment.
- Year of implementation: 2021
- Type of instrument: Other instruments such as vision documents (national strategy)
- Influence level of policy: National
- Funding body: n/a

For more good policy practices see Annex I: Good policy practice examples.

3.5 Spain

3.5.1 Overview of Spain's bioeconomy landscape

The Spanish Bioeconomy Strategy aims to reinforce stakeholders' competitiveness and sustainability, increasing economic activity and wealth, especially to those actors related to biological resources employment, knowledge and its appliance within R&D, through collaborations between science, technological entities and Spanish public and private institutions.

The Spanish bioeconomy market represented, in 2015, nearly 6.5 % of GDP, and 9 % of total national employment. In fact, the agri-food industry takes itself 2.5 % of GDP whereas the food industry occupies 2.7 % of GDP share. Further, fishing and wood, pulp & paper industries take an overall of 0.2 % and 0.6 % GDP share, respectively. Regarding JRC data, the Spanish bioeconomy market turnover was \notin 204 million by 2015. The upward growth trend of the bioeconomy in Europe was translated to \notin 219 million turnover in the Spanish bioeconomy market by 2017 and \notin 236 million by 2019, according to most recent data available (European Commission, 2022). The agriculture and food & beverage industry remain the biggest sectors in



the Spanish bioeconomy, with both nearly \in 187 million. Agroforestry industries (including agriculture, marine sector, food elaboration and commercialization and farming), the forestry industry and other valueadded bioproduct industries, were identified to have the greatest potential in the national market and as those to address technological and scientific innovation. In fact, the biotechnology sector represented in 2020 0.8 % of national GDP, with almost \in 12 million in turnover. 3,585 private entities play a role in biotechnology innovation, which has perceived an increase of 50 % in private investment and near \in 940 million of public investment (near 6 % of R&D total national investment). The main non-sanitary biotechnology purposes of private entities are: animal health, food value chains, agriculture and forestry, environment and industry (AseBio, 2019).



Figure 3-11: Development of turnover in Spain, 2008-2019 (Ronzon et al., 2022)

The Spanish Economy and Competitiveness Ministry launched in 2015 the "Spanish Bioconomy Strategy: Horizon 2030", as the main driver to address the development of the national bioeconomy. For this, main agro-industries and sectorial organizations were contacted by the National Research Institute and promoted to participate in the elaboration of this manuscript (Ministerio de Economía y Competitividad, 2015).

Regarding social tasks and barriers, major social challenges in the Spanish bioeconomy have been recognized:

- Securing food value chains,
- Address climate change,
- Sustainable resources utilization,
- Competitiveness and employment and
- Fossil resources dependency.

Finally, the Spanish and European bioeconomy are already targeting future opportunities to develop and enrol social awareness and compromise toward the bioeconomy. Main economic opportunities, that bioeconomy seem to offer in the foreseeable future, are:

- Efficient use of wood and forestry resources, aiming to develop economic activities regarding production, management, processing and preparation of chemical by-products downstream the value chain;
- Biological non-forestry resources utilization as farming and harvesting;



- Ecological and environmental proper regulations, management technologies and carbon/hydric footprint control;
- Tourism and rural development contributing to cultural and environmental objectives and natural areas conservation and
- Art & design sourcing from wood and biomass natural resources such as engineering, artistic and construction goals.

3.5.2 National policies

There are two clear European initiatives to support the bioeconomy: Bioeconomy Strategy (European Commission, 2018) and Joint Technology Initiative on Bio-Based Industries (European Commission, 2014). Altogether, both aim to finance and promote bioindustries and bioeconomy development of country members. Particularly, several communications such as COM (2012) 60 final (European Commission, 2012) tend to encourage measures for environmental management and sustainable use of natural resources, addressing climate change and European competitiveness.

The Spanish government has translated those regulatory frameworks to national strategy plans and legislations to overcome bioeconomy and circular economy. Principally, "National Research and Innovation Agrofood and Forestry Programme" (2015), "National Rural Development Programme" (2015), and previously named "Spanish Bioeconomy Strategy" (2015) are those policy packages that support potential biomass utilization to address technological challenges in the near future.

Bioeconomy Strategy objectives are clearly defined within these documents, which consider as a key factor to meet the needs of an on-growing population under critical climate change circumstances, where improvement of sustainability and effectiveness of production related to bio-products demand must guarantee environmental sustainability.

Strategic Improve competitiveness and internationalization of companies enrolling new economic activities Knowledge and scientific/technological results production Remark bioeconomy as an essential part of Spanish economy and as a strategic innovation area Contribute to release full bioeconomy development potential on the next decades Knowledge adaptation to scientific and technological answers to production and consumptions actors needs Operative Promote bioeconomy through collaborations between administrations and production sectors with society Promote the interactions between R&D Spanish and international system and companies to create multidisciplinary teams addressing technology and effectiveness goals Facilitate knowledge production and its application to market and innovation Identification of barriers and limitations to propose regulatory, administrative or adequate measurements Integrate knowledge production support tools in order to coordinatively concentrate efforts and resources to bioeconomy Facilitate internationalization of companies in terms of technology and market barriers Develop required educational tools to capacitate workers in new sectorial technologies and adequate professional profiles to new requirements Facilitating knowledge, dialogue and social diffusion around the bioeconomy considering all scientific, social, economic and financial actors, as well as society in general Promote economic rural development and productive activities diversification New market developments for waste and effectively biological sources valorisation

 Table 3-9: The strategic and operative objectives listed in the Spanish Bioeconomy Strategy



Specific sectorial legislation has been largely concrete to establish policies and regulatory framework for various and many bioeconomy value chains (Ministerio de Agricultura, 2022). Remarkably, the institutional framework for agriculture, property and economic agricultural activities, farming, and phytosanitary health (BOE, 2022b, 2022c, 2022e, 2022f, 2022g). Furthermore, agroindustry and quality policy frameworks have been introduced (BOE, 2022d). Productive sectors have been also framed under BAT and best practices policies such as breweries, dairy, oil, fish, meat, and hunt activities (BOE, 2022a, 2022h, 2022i, 2022j, 2022k, 2022l).

Several other related policies regarding environmental issues and different bioeconomy activities have been implemented. Waste management, disposal, transportation, energy valorisation, and soil pollution are a recent hot spot for policymakers' activities (Ministerio para la Transición Ecológica y el Reto Demográfico, 2022). Moreover, energy efficiency in building construction is another priority on action plans and policies (BOE, 2021).

As shown, not only have directly bioeconomy strategies and policies been displayed, but also other bioeconomy related policies not explicitly impacting on bioeconomy market have been established, such as those playing a leading role in waste management, waste to energy processes, construction and climate change.

3.5.3 Regional policies (Ebro Valley region)

Castilla y León is an example of an advanced Spanish region in terms of bioeconomy and market deployment. Specifically, the region displayed the bases for a Regional Bioeconomy Strategic Programme which established as main priority agrofood industry and natural resources. This includes forestry production, especially for those products, bioindustries, biorefineries and activities related to the "Regional R&D Strategy for Smart Specialization" (Red de Emprendimiento e Innovación, 2022).

Castilla y León is recognized with great potential to contribute to the Spanish bioeconomy, as it represents 18.6 % of the overall national surface, where 96.1 % of which is rural area and concentrates 58 % of its population.

Main guidelines address:

- 1) Promote R&D regional projects by means of knowledge production, biotechnology solutions and their implementations in market and industry;
- 2) Social awareness and sensibilization of different stakeholders and agents participating in Regional Science and Technology System, involving different entities and organizations;
- 3) Promote new economic activities and industries, based on biological transformations and new products/services designs and
- 4) Maximize biomass and bioeconomy potential market in rural areas.

For all of these, the regional government is offering financing opportunities and R&D strategic plans, to remark:

- From € 20,000 to € 1 million for R&D projects concerning small cap and SMEs that address experimental research, industrial development and/or viability studies;
- Strategic R&D programmes disposing of € 2 million minimum budgets for those sectors involved in "Regional R&D Strategy for Smart Specialization";



- Specific R&D calls for big caps and large companies financing € 150,000-250,000 projects for industrial research and experimental implementation and
- € 100,000 financing calls for knowledge transferring projects and activities.

Furthermore, the regional government and municipalities have initiated clustering and collaborating relations between different and various agents on the market:

- Regional congresses, symposiums and/or seminars to expose good practices achieved, experts and leads among companies and value chain actors;
- Regional Bioeconomy Committee composed of public administrations such as the Economy and ٠ Treasury regional ministry and several other instruments and institutions.

Andalusia is also identified as one of the most powerful regional bioeconomies in Spain, which main features are its abundant biomass production, concentrating great part of the agriculture, olive, wheat and corn national market; it is also worth to remark the notorious and developed industrial sector within bio and agroindustry and finally its strong research and knowledge production among regional universities and technological centres. Logically, Andalucía's regional government also performed in 2018 its Regional Circular Bioeconomy Strategy (Bioeconomía Andalucía, 2018). Andalusia's region is mainly predominated by rural areas, with almost 98 % of its municipalities and 59 % of its population, which limits the possibilities of economic development. Furthermore, Andalusia also represents 26 % of the overall national surface designated for agriculture. Several actions have been considered and displayed, as integrated systems to guarantee long-term sustainable production whilst introducing biological and chemical control methodologies, Ecological Production Regional Plan Horizon 2020 (Junta de Andalucía, 2020) and management, research, transferring and administration measurements.

In this case, it is useful to understand what potential rural development and bioeconomy activities have for the region. For all these, agriculture and farming, bioenergy, environmental activities, natural resources logistics and R&D are identified as the most competitive economical activities and projects to be undertaken in the region. For these purposes, regional administration is disposing of funding opportunities through different structural budgets such as FEDER and FEADER and such as various European funding instruments to enrol research, development and innovation projects. However, difficulties and barriers are reported by SMEs and business associations to successfully achieve funding possibilities.

In order to strictly follow the implementation of the regional strategy, a Monitoring Committee was created, to perform periodic evaluations of the degree of achievement of the objectives and strategic measurements undertaken. Moreover, a Technical Office for Regional Circular Bioeconomy Strategy was implemented to design and coordinate the instruments, tools and documents to guarantee the flow of information and report required by the Committee. The competence of this office is attributed to the regional agriculture, fishing and rural development related administration.

Some initiatives and projects are worth highlighting in terms of innovation and implementation of bioeconomy regional development. For example, ICT-Biochain was created under Andalucía Agrotech Digital Innovation Hub, to work as a nexus between biomass logistics, technological solutions and information and communication technologies, and to help improve the feasibility of biomass for transition to new economic models.



3.5.4 Good policy practices

DESCRIPTION OF THE REGIONAL VALUE-CHAIN

Wine production and utilization of organic by-products in the region of the Ebro Valley region in Aragón and Catalonia

The value chain of wine production includes operations such as stemming, crushing, fermentation and storage. Here, the grape is transformed into wine, by first becoming the must and then, through the fermentation process, the wine. Operations included in the clarification of wine comprising racking, fining, filtration and refrigeration are also an important part of this step, in order to purify the output, i.e. the wine. Finally, the wine is stored in order to be aged. Just as for grape production, during the grape processing different by-product or sub products are obtained which can be further valorised for biochemical applications (pharmacy, flavouring, etc.).

Concerning the wine pruning, the main steps of the value chain include biomass collection, transport to an intermediate storage site, chipping, storage distribution and combustion. Nevertheless, different types of machinery have been developed that allow for instance to collect and chip on site. Additional steps can also be included to perform a palletization on site or at the logistic centre or even carry out a torrefaction, although this pathway is unusual.

SUMMARY OF GOOD POLICIES

Policy 1 - Wine CMO 2019-2023 programme

- Main aim of the policy: National support programmes have played a key role in improving the competitiveness of EU wine producers and products.
- Year of implementation: 2019-2023
- Type of instrument: Financial, voluntary initiative
- Influence level of policy: EU-National
- Funding body: EU: Funding allocated per country 2019-2023 programme. At National level the 3 entities involved are: Agriculture, Fishery and Food Ministry FEGA and autonomous communities

Policy 2 - Aragón Circular

- Main aim of the policy: Aragón Circular is the circular economy strategy that has been developed by Aragón region government in order to reach the sustainable objectives settled in 2030 agenda aiming to create and appropriate politic, economic and social framework for the transition towards circularity.
- Year of implementation: 2020
- Type of instrument: Other instruments such as vision documents (regional strategy), financial (funding)
- Influence level of policy: Regional
- Funding body: Aragón region Government Economy, planning and employment department

Policy 3 - Cataluña Bioeconomy Strategy 2021-2030

• Main aim of the policy: The main objective of the strategy is to promote the development and growth of a sustainable economy in the region through the increase of the biological resources and local and renewable developments



- Year of implementation: 2021
- Type of instrument: Other instruments such as vision documents (regional strategy)
- Influence level of policy: Regional
- Funding body: Catalonia region Government Climate action, food and rural agenda department

For more good policy practices see Annex I: Good policy practice examples.



4 Good policy practices

The selected regions of the BRANCHES partner countries are characterised by some well or newly established bio-based value chains. The establishment of these value chains is accompanied by policies, which foster them specifically or bioeconomy development in the region in general. These policies can be very helpful for other regions to develop their own policy framework for a bio-based economy.

4.1 What is a good policy practice?

There is no common definition of what "good political practice" means. Therefore, an attempt was made to identify criteria that characterise good political practices and to uncover why the examples in chapter 4.2 were chosen.

CRITERIA TO SELECT GOOD POLICY PRACTICES

In a collaborative concept-board, the BRANCHES country teams were asked to decide which criteria could be used to choose examples of good policy practices influencing value chains on a regional level. The criteria were condensed into three most important features (Figure 4-1). To choose good policy practice examples, they must:

- Include sustainability safeguarding,
- Formulate clear targets,
- Be transferable to other regions.

In the case of some countries, it is favourable, if the policies are tailored to a specific value chain or region. This is for example the case for the very specific residue biomass of vine production in Spain.

Since the project's aim is to disseminate knowledge between European regions, it is not surprising, that the transferability of the policies is an important criterion. Dependent on the available biomass feedstocks, it should be possible to transfer and adopt the policies to another country or region. The use of biomass instead of fossil-based materials is not sustainable per se. Considering that, sustainability safeguarding must be included in the policies. Sustainable biomass production and processing as well as regionality and circularity should be a prerequisite in strategies, policies, etc. A typical criticism of current policies and laws is that they are vague (see barriers in chapter 5.2.2). Therefore, clear targets are a strong criterion for good practices.



Figure 4-1: The three most important criteria to choose examples of good policy practices for the project partners were, that: 1) the policy is transferable to other regions, 2) the policy includes clear targets and 3) the policy reflects sustainability

OBJECTIVES OF GOOD POLICY PRACTICES

Besides the criteria, the BRANCHES country teams were also asked to give statements about why they choose certain policies as good examples. From these statements, six main objectives were derived (Figure 4-2). The colours of the boxes indicate each country team, which gave the answer. It can be summarized, that good policies:

• Create networks,

safeguarding.

- Provide information,
- Promote innovation (research),
- Support investment,
- Mobilise biomass and
- Implement lessons learned and create a future vision.



You were requested to report 3 policies that supported a value-chain in your region. Would you consider those policies reported examples of 'good policies'? If so, what makes them good policy examples?



Figure 4-2: Objectives of good policy practices for regional value chains. The BRANCHES partners provided their thoughts on what makes a policy practice "good" to promote bioeconomy development. These answers have been organised by six general objectives.

WORKING DEFINITION

A wide range of instruments can be considered as good political practice from non-binding voluntary measures to binding regulations (see chapter 4.2). Good policy practices in the framework of BRANCHES are supposed to

- promote bioeconomy development in regard to one of the following six main objectives: create networks, provide information, promote innovation (research), mobilize biomass, support investments and implement lessons learned & create a future vision,
- be transferable and can therefore serve as examples in other regions and
- contain sustainability safeguarding and clear targets.

4.2 **Overview and characterisation of examples**

From all five country teams, in total 19 examples of good policies with a focus on the regional level and the selected value chains were collected.

OVERVIEW

The following Table 4-1 provides an overview of the collection of good policy practices in the selected regions.



Table 4-1: Overview of all collected good policy practice examples. Detailed explanations can be found in Annex I.

Short title	ID	Main objective	Level of
			policy
Pagional forast	1	The regional forest programmes 2021 2025 are statutory provincial	Influence
nrogrammes 2021-2025	1	forest sector development plans and work programs	Regional
(FI)			
National Forest	2	National Forest Strategy aims for growth of welfare and overall	National
Strategy 2025 (FI)		sustainability. It specifies the main objectives for forest-based business	
	_	and activities until 2025.	
National support	3	It supports private forest owners e.g., in management of seedling	National
forest owners (EI)		stands and management of young stands.	
iorest owners (FI)			
Forest directive 2019	4	The directive offers financial support for reforestation, soil protection	Regional
Saxony-Anhalt (DE)		and road construction. It is intendent to support forest owners in	
		converting their forests into climate resilient forests.	
Innovation Hub "Future	5	Ensure further development of bioeconomic processes between the	Regional
Wood and Climate"-		regional forestry and lumber industry. Generate new sales markets	
project (DE)	6	with cross-regional cooperation and thus develop job perspectives.	
BIOECONOMY HUB (DE)	6	Setting up a pliot facility for wood-based blotech processes, creating a	Regional
		technologies and produce first toppage of desired products	
FIP AGRI (IT)	7	The European Partnerships for Innovation (FIP) were introduced by	FU
	ľ	the European 2020 flagship initiative "The Innovation Union" (EU	
		Commission, 2010) to implement a new approach in defining research	
		paths and innovation in EU to support the needs of local producer and	
		their production systems. The agricultural EIP aims to fund projects,	
		that connect practitioners and researchers to achieve more	
		sustainable and competitive farming and forestry.	
Italian strategy for	8	The Strategy offers a shared vision of the environmental, economic,	National
bioeconomy 2021 (IT)		social and international cooperation opportunities and challenges	
		connected to the development of an Italian bioeconomy strongly	
Rural Development	٩	The rural Development Programme (RDP) for Tuscany outlines	Regional
Plan for Tuscany 2014-		priorities for using EU and national funding. It is focusing on	Regional
2020 (IT)		environment/climate friendly farm and forest ecosystem investments.	
		It is establishing numerous cooperation projects, supporting farmers	
		for restructuring and modernisation of management methods and	
		local action groups.	
Support for renewable	10	Improvement of energy efficiency and building a non-emission	Regional
energy provision in the		economy in the region of Warmia and Mazury. One aim was to	
region of Warmia /		improve the renewable energy production capacity in the region (e.g.	
Mazury (PL)		with blogas plants) and thus to increase the share of electricity	
Priority Programme	11	Financial support for new ventures related to the production of energy	National
"Agroenergy" (PI)	1 **	from renewable sources on farms (e.g. biogas plants)	National
Energy Policy of Poland	12	Framework for the energy transition in Poland. Energy security while	National
until 2040 (PL)		ensuring the competitiveness of the economy, energy efficiency and	
		reducing the impact of the energy sector on the environment.	
PhD Programme in	13	Flexible education in various bioeconomy-related disciplines at the	Regional
Bioeconomy (University		University of Warmia and Mazury in Olsztyn.	1



of Warmia and Mazury, PL)			
Environment, Agriculture and Forestry - research programme BIOSTRATEG (PL)	14	Main objective of the strategic research and development programme is the development of knowledge in the programme areas, leading to an increase in the international position of Poland in scientific research and development works in this field, and the transfer to the socio- economic environment of innovative solutions developed under the programme.	National
Wine CMO 2019-2023 programme (ES)	15	National support programmes have played a key role in improving the competitiveness of EU wine producers and products. This measure fosters innovation in the wine sector aiming the development of new products, processes and technologies concerning wine products.	EU
Aragón Circular (ES)	16	Aragón Circular is the circular economy strategy that has been developed by Aragón region government in order to reach the sustainable objectives settled in 2030 agenda aiming to create an appropriate politic, economic and social framework for the transition towards circularity. An associated funding scheme aims to promote the industrial development and research, boost the sustainable and circular economic model and improve competitiveness while increasing employment in the region.	Regional
Cataluña Bioeconomy Strategy 2021-2030 (ES)	17	The main objective of the strategy is to promote the development and growth of a sustainable economy in the region through the increase of the biological resources and local and renewable developments.	Regional
Digital Europe Programme (ES)	18	Digital Europe Programme is the first EU programme that aims to accelerate the recovery and drive the digital transformation of Europe.	EU
2021 OIV research grant program (ES)	19	OIV (International Organisation of Vine and Wine) grants research scholarships in priority programme fields on a yearly basis.	National

Besides these examples from the country teams, there were also more general good policies mentioned in the interviews with experts from the following three regions:

- Northern Finland region:
 - Green public procurement policy (North Karelia: municipalities councils made a decision to change from oil to biomass in heating of public premises) sends a signal to companies, that there is a demand
 - Regional bioeconomy strategies are an important tool, that is guiding the use of EU funds to develop a region
- Ebro Valley region (Aragón and Catalonia, Spain):
 - The new PAC (European CAP common agricultural policy) policy addresses climate and environmental objectives leading to an establishment of the terminology of bioeconomy in Aragón
 - o Regional strategies create a vision and a clear pathway
 - A strong focus on bioeconomy in research in Aragón, creates networks between universities
- Central Germany region:
 - Regional bioeconomy strategies for federal states and regional innovation strategy based on chemistry and bioeconomy (Saxony Anhalt) allows innovation and is a basis of funding (R&D)



CHARACTERIZATION

To characterise the good policy practices, they were categorized by the measure types (see also chapter 1.3). The categorisation is inspired by the project POWER4BIO and covers the following six categories (Elbersen et al., 2020):

- 1. Direct regulation / regulatory (binding) instruments,
- 2. Economic / financial instruments,
- 3. Voluntary initiatives,
- 4. Information and advisory instruments,
- 5. Market-based signalling instruments and
- 6. Other instruments such as vision documents, road maps and strategies.

In Table 4-2, good policy examples are listed including the measure type and general information on the bioeconomy sector, the value chain stage and the type of biomass, which they affect. It also indicates, if the policies are either directly derived from an EU policy or following general objectives of them like the Bioeconomy Strategy or not.

Table 4-2: Categorisation of all collected (regional) good policy practice examples

1-direct regulation/regulatory instrument, 2-economic/financial instrument, 3-voluntary initiative, 4-information and advisory instrument, 5-market-based signalling instrument, 6-other instruments (vision documents, road maps, strategies...)

ID	Measure type	Bioeconomy sector	Addressed value chain stage	Type of biomass resource	Following EU policy
1	4	Forestry	Biomass provision	Wood	yes
2	6	Forestry	Biomass provision	Wood	yes
3	2, 3	Forestry	Biomass provision	Wood	no
4	2, 3	Forestry	Biomass provision	Wood	yes
5	4, 2, 3	Forestry	Enabling environment	Wood	no
6	4, 2, 3	Biochemicals	Conversion, enabling environment	No specific, lignocellulosic biomass	no
7	2, 3	Agriculture	Enabling environment	Agricultural biomass	yes
8	6	All (strategy / roadmap)	Enabling environment	No specific	yes
9	3, 2	All (research & innovation)	Biomass provision	Agricultural biomass, wood	yes
10	2, 3	Energy	Conversion	Bioenergy	yes
11	2, 3	Energy	Conversion	Bioenergy	no
12	6	Energy	Enabling environment	Bioenergy	yes
13	2, 3	All (research & innovation)	Enabling environment, conversion	No specific	yes
14	2, 3	All (research & innovation)	Enabling environment	No specific	no
15	2, 3	Agriculture	Biomass provision	Agricultural (vine plants)	yes
16	6, 2	All (strategy / roadmap)	Enabling environment	No specific	no
17	6	All (strategy / roadmap)	Enabling environment	No specific	yes



18	2, 3	All (research & innovation)	Enabling environment	No specific	yes
19	2, 3	All (research & innovation)	Biomass provision	Agricultural (vine plants)	no

If a measure is a voluntary approach or provides information and includes subsidies, in most cases it is categorised as a financial measure first. In the case of research programmes, where several value chain stages and resources are impacted, it was checked if there is one affected the most or not. It is apparent, that the sectors are influenced by the selected value chains in the regions (IDs 1, 2, 3, 10, 11, 12). Almost all of the instruments, which are targeted at biomass provision (and conversion) are financial instruments. Voluntary instruments like strategies and information provision are mostly affecting the bioeconomy as a whole and are therefore part of an enabling environment (IDs 8, 12, 16, 17).

4.3 Summary of good policy practice examples

First of all, it has to be noted that the practices listed are examples, which should show a range of measures preferably on the regional level and for the most important value chain in the region. The examples give only a little insight into each region. But some commonalities can be seen through all the countries and are worth mentioning. Although the sectors, that the policies affect, are dependent on the regional value chains, the policies cover a wide variety of bioeconomy sectors (Figure 4-3).



Figure 4-3: Bioeconomy sectors supported by the good policy examples and their measure types. Lefthand side: Almost half of the measures are more generic like strategies and supporting all sectors. Righthand side: Half of the examples are associated with funding or subsidies. No examples for regulatory or market-based instruments were given as regional examples.

TYPE OF POLICY MEASURES

It is noticeable that more than half of the good policy practices can be classified as economic / financial instruments and the rest as non-binding instruments (Figure 4-3). The aims of the given financial instruments are to support biomass provision and conversion of biomass (IDs 3, 4, 10, 11). They belong in this regard to the most effective tools to solve the problem of SMEs to dealing with a low seed capital. This is also one of the most important barriers to starting a business in rural areas (Garcia Laverde & Szarka, 2022). Important financial instruments, that are also voluntary approaches, are also funding programs for research, which are less on the regional level but financed by the national or even EU government (IDs 13, 14, 19, 18).

On the other hand, no regulatory instrument can be found in the examples. One reason could be, that some of the countries don't have a distinct regulatory framework on the regional level, but on the national level like Italy. Instead of hard laws, there exist more voluntary approaches on the regional level like strategies



and networks (IDs 1, 5, 6, 9, 13, 16, 17). Central Germany with the federal states regulatory framework is an exception to this. Also, no market-based signalling instruments are mentioned. It could be either, because the regional level was focused, or because there is general a lack of market incentives for bio-based products, which is also mentioned as one of the barriers (see chapter 5.3).

Other instruments include mostly strategies on the regional or national level. Besides instruments, that are tailored to specific sectors and value chain stages, they are an important tool to influence the wider environment of functioning bioeconomy activities, shape a supportive environment and sketch out a general development direction (Elbersen et al., 2020). When looking at the different instruments it is apparent, that a mix of them is needed to cover all facets of bioeconomy and there already exist many good examples.

LEVEL OF POLICIES

The Figure 4-4 shows, that half of the policies are on the national/EU level although we asked for regional ones. This can be explained by the fact, that some countries have fewer policies directly tailored to bioeconomy on the regional level like Italy and Poland or, there is a lack of a supportive regional, political framework like in the Ebro Valley region in Spain (see interview, chapter 5.1.1). Most of the examples are directly or indirectly derived from EU policies (although it was no criterion from us). The same observation was made in the POWER4BIO project (Elbersen et al., 2020). It indicates, that EU policies are an efficient driver for developing national and regional policies for bioeconomy development.



Figure 4-4: Policy levels and connection to EU policies of good policy practice examples. Lefthand side: Half of the good policy examples are implemented on the regional level, while the other policies are examples on the national and EU level. Righthand side: Two thirds of the given examples are directly derived from an EU policy or are guided by them in their objectives.

TRANSFERABILITY

The transferability of good policy practices depends on the maturity stage of the bioeconomy in a certain region and its chosen bioeconomy perspective (Elbersen et al., 2020). A region that is focused on forestry and bio-based chemicals has other needs than a region, that is focussed on the usage of agricultural residues. For example, some good policy measures from Spain are very specific to the use of residues from wine production (IDs 15, 19). On the other hand, there are also universal measures on the list like research programmes, partnership initiatives and strategies, which can be flexibly adapted to a specific region (IDs 7, 8, 13, 14, 17). Since most of the policies directly or indirectly follow an EU policy, it is easy to transfer them to other regions in Europe.

SUPPORTED VALUE CHAIN STAGES

Unlike the bioeconomy sectors, which were given with the dominant value chains of the regions before choosing the policies, the supported stages of the value chains were not predefined (Figure 4-5). The policies are either supporting the biomass provision, conversion or are part of an enabling environment (for

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explanation of value chain stages, see chapter 2.3.2). Biomass provision and conversion are mostly fostered through financial incentives, while non-binding instruments like strategies, research programmes (if they are not tailored to a specific value chain part), networks and information provision instruments are imbedded as enabling environment and foster all bioeconomy sectors in general.

Logistics, consumption and end-of-life are not tailored specifically in the collected policies. That the lack of practices supporting end-of-life is not a coincidence due to the small selection of policies also becomes clear when looking at the current legislation in Germany on the subject of waste (Mittelstädt & Zeug, 2019). If the development is to move in the direction of a circular economy, there is still a lot of backlog demand here.

This deficit is also apparent in the consultation of the country teams through the conceptboard in Figure 4-6. In contrast to the evaluation of good practices, it becomes clear here that in some countries there is not yet enough support for the provision of certain biomass, like in the examples of Spain and Poland. But since both regional value chains are dealing with agricultural residues, it is also an issue of end-of-life treatment. That the consumption of bio-based products is seen as unsupported is also related to the lack of market-based signals, which could be observed in the overview of measure types of reported examples.





Figure 4-5: Overview of the collected good policy practice examples arranged by the value chain stages they address and the measure types





Figure 4-6: Value chain parts supported by policies in European regions



5 Regulatory and policy barriers

In this chapter, the results of the surveys and the interviews will be summarized. The focus of this is mainly on the barriers and adds in the data collection identified drivers and trends.

5.1 **Obstacles and advices for policies from interviews of regional stakeholders**

The interviews were conducted in June and July 2022 with stakeholders from Northern Finland, the Ebro Valley region in Spain and Central Germany, who are experts in bioeconomy policies (for methodology see chapter 2.2.1). Unfortunately, it was not possible in the timeframe to arrange an interview also with experts from Warmia and Mazury in Poland and Central Italy. But their expertise and experience are also included in the survey. The interview questions can be found in Annex II. As the answers reflect the personal experiences and impressions of the stakeholders, it was indicated to which region the statements belong.

As a short insight to the interview topics, a word cloud was created (Figure 5-1). The size implicates the frequency of each word in the transcription of the three interviews. The commitment of regional policy makers, public awareness and the key role of companies were discussed as well as financing, benefits of green transition, new businesses, cooperation, the power of regional bioeconomy strategies and political uncertainties.



Figure 5-1: Dominating words in the interviews about legislative and political obstacles for development of regional bioeconomy. Important topics are: commitment of regional policy makers, public awareness, the key role of companies, financing, benefits from a green transition, new businesses, cooperation, the power of regional bioeconomy strategies and political uncertainties.

5.1.1 Obstacles for policies on the development of regional bioeconomy

The results of the interview regarding political obstacles, which are hindering bioeconomy development in European regions, are summarised in Table 5-1. It is also aligned with insights from the SWOT analysis of European regions (Garcia Laverde & Szarka, 2022). Under the key messages, related main statements from



the regional stakeholders are collected. Although the regions are very different in their maturity stage, some general obstacles can be observed. The focus lies on the regional level, but most of the obstacles are transferable to the national or European level. The order of obstacles implies not any weighting. The statements are assigned to the regions, where E means Ebro Valley region (Spain), F Northern Finland and G Central Germany.

Table 5-1: Obstacles for policies on the development of regional bioeconomy derived from interviews with regional stakeholders. Assigned to them are shortened key statements from the interviews indexed by the regions to which they belong (E=Ebro Valley region in Spain, F=Northern Finland, G=Central Germany).

Obstacles	Statements	Region
Lack of information provision – insufficient communication to public	Politicians don't use their resources to disseminate knowledge about green transition or are not themselves familiar with the term "bioeconomy"	E
	Terminology of bioeconomy is unknown or too narrow (only focussed on agri-food and forestry sector, not products like paper)	E
Lack of public awareness & acceptance	Private and public side are not familiar with the benefits of BE; it is not possible to promote it if it is unknown	E
	Conservatism of certain sectors and no interest in change	E
	Not enough visibility of enterprises in the region / public awareness is low	G
Lack of commitment of authorities and policy makers to bioeconomy	Researchers are still trying to provide policy makers with hard data, to make them understand the potential of BE to invest in it	E
·····,	Although in Finland BE has a long tradition and authorities are very much committed to BE, they could e.g. favour green options in construction sectors more	F
Adaptation and development of regulations is too slow	Be quicker – regulations are not adapted parallelly to developments of potential industry interests for e.g. ecolabeling of products and are not sending signals to the market	E
	Administrative hurdles still the same as one decade ago	E
Unequal / adverse treatment of bio-based products	Authorities reluctant to favour more green options, because restricting competition on market is against the law	F
	Unfair treatment of product is a market entry hurdle, subsidies for fossil products create a price advantage	G
	Prices don't include environmental damage, which is a disadvantage for competitiveness of bio-based products	G
	E.g. there were legal barriers for wood as construction material, which will be removed in building regulations 2022 Saxony	G


Obsolete concepts in regulations / admission processes	Lack of adaptation to new paradigm, using old concepts of resources	E
	Regulatory apparatus is not able to deal with novel bio-based products and their facilities; e.g. if classification of businesses is unclear, funding gets difficult	G
	Use of residual materials must be rethought in legislation - idea of circularity	G
Long and complicated admission and approval processes	Paper works take long, permits, administrative elements don't support opportunity of BE	E
	More effort in permission and approval processes than conventional business, because it is new	G
	Often combination of various process steps from different sectors and getting permits to erect facilities is challenging for authorities à planning of plants is a long-time operation of 10 years	G
	Application for funding under the current regulatory and bureaucratic setup is time consuming and hindering fast implementation	G
Lack of clear regional management structures (ministries)	Unclear responsibilities for BE issues in regional government	E
(Responsibilities in decision making lie with various actors and different ministries that are not coordinated yet	G
Fragmentation of legislation	Very diverse political frameworks in federal states, no common bioeconomy strategy for Central Germany	G
Fast changes in policy landscape create uncertainty	Discussions in EU create uncertainty for local decision makers, e.g. if wood can be used for renewable energy in EU (in Finland no other renewable alternative in winter)	F
	A lot of uncertainty for bioeconomy due to geopolitical situation	F
Unstable investment conditions for entrepreneurs	Reliable environment for companies must be ensured in policy framework longer than governmental periods. Companies are in a key role, they are the ones making the change and taking things into praxis	F
	Investment subsidies are not sufficient	G
	Companies need investment security	G
Lack of systemic future planning	Many possible jobs in future, but too less people with know how or will leave if payment is too less	G

Besides these obstacles in policies, it was also mentioned, that cooperation of actors is a challenge because BE connects actors, which come from different worlds and are not used to communicating with each other. One of the interviewees noted, that too much harmonisation of regulations throughout Europe can be contra productive, because of geographical limitations. E.g. solar and wind power can only provide a fraction of energy for heating in the Finnish winter, while in summer the sun is shining much longer than in Southern



Europe. Another interesting comment was, that it would help to have a funded legal advice for bioeconomy enterprises for all administrative issues and obtaining of funding. Because for the production of bio-based products it is typical to have very high investment costs at the beginning and low capital, which leads to competition for funding.

5.1.2 Advices for regional policies

Besides the obstacles, the interviewees also provided advices for regional policies as summarised in Table 5-2. These are summarized and clustered below to the main advices. The order of advices implies not any weighting. The statements are assigned to the regions, where E means Ebro Valley region (Spain), F Northern Finland and G Central Germany.

Table 5-2: Advices for regional policy makers fostering the development of regional bioeconomy derived from interviews with regional stakeholders. Assigned to them are shortened key statements from the interviews indexed by the regions to which they belong (E=Ebro Valley region in Spain, F=Northern Finland, G=Central Germany).

Advices	Statements	Region
Prerequisite: policy makers should commit to bioeconomy	More commitment to green opportunities (of policy makers) is needed	F
	Motivation of people and public authorities is important	F
Create long-term certainty for companies	Green public procurement is signal to companies, that there is demand	F
	Create a positive operational environment for companies to try new things and to make investments for a green transition	F
	Secure the regulatory and policy framework for a longer timeframe than governmental period (5-10 years), because planning and construction phase of biotech plants need up to 10 years	G
	Introduce long-term investment funding	G
Create strategies well adapted to the region	Strategies create a vision and engage already the actors	E
	BE strategy should be well adapted to strengths of region	E
	Regional BE strategies are guiding funding	F
Establish networks and make actors known to each other	Actors need to know who is doing what to enter into cooperation	E
	Strong networks / clusters can identify hurdles and consult politics and academia	G
Better cooperation between local ministries / agencies	Create a round table for approvals with all responsible environmental agencies	G



Communicate the meaning and benefits as well as challenges of bioeconomy	Understand benefits /opportunities for society and new business opportunities	E
	Use the terminology of BE, disseminate, communicate, promote, explain	E
	Increase public acceptance and awareness (social science is key for BE development)	E
Participate in an international exchange of experience	Policy makers should participate more in international exchanges of information to get a broader view of the topic	E
	There exist already good practices all over in Europe	F
Create fairer competition of bio-based and conventional solutions	Be more creative and foster ecological favourable methods without permitting others, e.g. cap CO ₂ equivalents per square meter in construction sector	F
	Create a fairer competitive situation on market by pricing of environmental burdens	G
Simplify and accelerate processes	Faster implementation of new technologies is facilitated when funding applications and permission procedures are shortened	G

5.2 **Obstacles and drivers from online survey of regional stakeholders**

In total, the survey link was distributed to approximately 400 stakeholders from Finland, Germany, Italy, Poland and Spain. From these 70 valid responses were gained, which answered a minimum of questions in a sufficient manner. From the following results in the diagrams not all will be described in the text. Results in tabular form can be found in Annex III (Table A-1, Table A-2).

5.2.1 Background of responding stakeholders

The participants could indicate to which stakeholder groups they belong by picking a maximum of three answers (Figure 5-2). 47 % of the participants are researchers at institutions or universities, 31 % are working in a bioeconomy enterprise (some of them work as well in public administration), 23 % are in public administration and 16 % are active in NGOs. Others belong to associations, consortia and networks.

19% of the participants described themselves as experts in the bioeconomy. This suggests also the experience of the stakeholders, because 50% of them are following bioeconomy policies for more than 10 years, 30% between for 4 and 10 years, and only 17% for less than 3 years. 70% of stakeholders responded, that they feel well informed about policy developments affecting the bioeconomy on the national level, 65% on the EU level and 55% on the regional level. To track regulatory changes in the bioeconomy, a majority of 69% informs itself in networks (cluster, personal or business networks). Besides that, they mostly read online news, scientific reports and newsletters, while only few keep up to date via social media. Special sources mentioned were: Bioenergy Association of Finland, Italian biomass association (ITABIA), Bioökonomie.de and Biomasa News.





Figure 5-2: Stakeholder roles: The online survey participants could indicate which maximum of three stakeholder roles applies to them. The labels show the number of responses for each category.

Most of the respondents (40 %) indicated in a multiple-choice question that one thematic focus of their work is on agriculture, 26 % are dealing cross-sectoral with bioeconomy and 20 % with forestry (Annex III: Stakeholder online survey, Figure A-1). 27 % of overall participants stated, that biofuels are one of their foci and 26 % deal with heat and power as bioenergy. Other less common topics are treatment of organic wastes and residues and processing of biomass.

The contacted stakeholders are located in the five selected regions of this project. Stakeholders operating in Italy were the most engaged in the survey with almost 50 % of 70 participants, while the other four countries had about the same number of participants (Figure 5-3).

The most prominent bioeconomy sectors in the regions are in general agriculture, food production and forestry. Since the stakeholders were distributed all over different regions in their countries, there can be identified a specific country focus (ordered by share of responses):

- Finland: forestry, agriculture, heat and power provision, pulp and paper, other wood products
- Germany: agriculture, food, biotechnology, bio-chemicals, biofuels, waste treatment
- Italy: agriculture, food, bioenergy (heat and power)
- Poland: agriculture, forestry, food, feed, fishery
- Spain: agriculture, food, forestry, bioenergy (heat and power), biofuels, pulp and paper



Figure 5-3: Shares of participants operating in each country out of a total of 70 valid cases.

The maturity stages of the countries respective selected regions vary according to the stakeholders operating in the different countries (Table 5-3). Generally, regional maturity is rated slightly lower than national maturity, though it can vary greatly from region to region. According to the stakeholders, the highest maturity has the bioeconomy in Finland, followed by Germany, Italy, Spain and Poland.

Table 5-3: Maturity³ stages of bioeconomy development in the different countries and in regions of operation of the stakeholders.

Question	Answer supplement to question	Response option scale	Results Ø	FI	DE	т	PL	ES
What is the	in your country?	1 – Low maturity	3.1	4.2	3.1	3.0	2.4	2.8
stage of BE	in your region?	5 – High maturity	2.8	4.0	2.4	2.7	2.4	2.7

In all of the five countries exists either an explicit stand-alone national Bioeconomy Strategy or it is under development like in Poland (European Commission, 2022). On the regional level, the situation is more complex and, depending on the country, for on average 11 % of the stakeholders it is even unclear if there are regional BE strategies in their countries. In general, 31 % of respondents are stating, that there exist stand-alone regional strategies, in 33 % of cases bioeconomy is embedded in other strategies (implicit) and in 24 % of cases there is none of these (Annex III: Stakeholder online survey, Table A-2). In (Northern) Finland there exist explicit regional BE strategies, one of them is also mentioned as "good policy practice" in chapter 4.2. In Central Germany there are explicit as well as implicit strategies, the same is true for the Ebro Valley in Spain. In the Italian region exists a sustainable development strategy for Tuscany, but e.g. in Umbria, it is still under development. In Warmia and Mazury there is only an implicit strategy with a minimum content of bioeconomy (European Commission, 2022).

³ **Maturity stage**: In a low maturity stage of bioeconomy its development just started with creating the policy and R&D landscape for its establishment. Medium means, that the first competitive bioeconomy products are sold at the market, new companies are founded and can attract private and public funding. A high developed/mature bioeconomy is able to produce competitive products at a large scale. For sure there can be differences between sectors but for this question the average of the most important ones should be considered.



5.2.2 Obstacles

The second survey block aimed to identify the most important obstacles in the regulatory and policy framework of bioeconomy in the regions / countries. Results in tabular form can be found in Annex III, Table A-1.

Regarding different policy levels, Italian and Polish stakeholders responded, that for them EU policies have the highest impact on bioeconomy actors within their region, followed by national and regional policies (Table A-1) Differing from that, for the Finnish participants the national level has the highest impact and for German and Spanish stakeholders regional policies are the most important. For regions with explicit regional BE strategies, the influence of the regional policies is considered comparably high as EU policies on regions. This is also in line with the interviews, which explained their importance for the steering of (EU) subsidies.

Concerning the question of whether specific BE sectors need more attention in the legislative framework of their region, the stakeholder agreed in general. The most neglected sectors are construction, waste and biochemicals, which are less traditional/younger fields of bioeconomy and deal rather with the products from biomass and not the primary production (Figure 5-4). Surprisingly bioenergy is also relatively poorly rated, especially in Italy and Poland. Although at least on the EU level there exist many regulations, apparently, they cannot create enough incentives to develop bioeconomy on the regional level or they need improvements.



Figure 5-4: Responses to the question, whether the listed sectors need more attention in the legislative framework of the region of the stakeholders. From the bottom up, sectors are receiving decreasing attention.

General all value chain stages, with exception of collaborations, were rated as "hindered by policies" (Figure 5-5). Especially long-term strategies and monitoring need support on the regional level. But there are great differences between the regions/countries. In Finnish regions besides long-term strategies and monitoring, all stages are supported by policies. This supportive policy framework can also be seen in the graphs broken down by country. In German regions especially, the end of life as well as the monitoring and in Italian and Polish regions the biomass provision needs more support on regional level. The enabling environment is as well not supported in Polish, Spanish and Italian regions, as also indicated in Figure 4-6 in the chapter on good policies.





Figure 5-5: Stages of bioeconomy value chains supported and hindered by policies in European regions.

In four of five countries "Vague, not measurable policy goals" are seen as the highest barrier, followed by "Uncertainty due to frequent regulatory changes" (Figure 5-6). In Germany, the highest barrier is "Lack of collaboration (between government and value chain actors)". All barriers were on average rated as medium to high barriers. General the lack of certain regulations, like green public procurement legislation, is seen as a higher barrier the higher also the level is from regional to international. This and all other barriers reach a clearly higher score than in a survey in BE companies of North Western Europe in the project BioBase4SME (NNFCC Ltd, 2018). Overall the lack of a harmonized framework is lower rated, which supports the finding from the interviews, that too much harmonization can be contra productive and frequent changes lead to uncertainty. On the other hand, the lack of robust standards and methods like "Lack of international agreed sustainability criteria" is a higher barrier. Sustainability respective little environmental impact of products should be rewarded.





Figure 5-6: Legislative and policy barriers per country and all responses together. From the bottom up, barriers are rated higher.

The three highest rated barriers were repeated as highest barriers in the free text answers as well as lack of collaboration and lack of standards (Figure 5-7). Besides that, the slow adaptation of laws, financing problems and subsidies for fossil products were highlighted. One often mentioned barrier is also the absence of a course / long-term policy goals. Besides that, other answers highlighted the lack of political will and general lack of knowledge of BE from regional policy makers, administration and also the public, which is not a regulatory barrier but appears to be generally an important barrier for BE development. Also, long permission processes were named as a high obstacle.





Figure 5-7: Dominating words of the answers on the highest obstacles to bioeconomy development. They belong mostly to regulatory barriers: vague policy goals, uncertainty due to frequent changes in the regulatory framework, policies with conflicting goals and lack of end-user grants. Besides that, the lack of political will and a general lack of knowledge were highlighted.

Almost all stakeholders disagreed with the statement, that administrative processes are short and simple, that legislation ensures a cascading use of biomass and encourages the use of bio-based construction materials (Figure 5-8). Different than in a worldwide expert study from bioeconomy policy experts (Dietz et al., 2020), economic concerns were evaluated as being addressed worse and environmentally better. This probably represents more the regional perspective of the business stakeholder group, which mostly disagreed with the statement. In both surveys stakeholders agree, that social concerns are not well addressed by BE policies.



Figure 5-8: Statements about possible barriers in the stakeholder's regions of operation. From the bottom up, statements tend to be more likely barriers.

Getting building permissions and the admission procedures are rated as the highest bureaucratic barriers (Figure 5-9). According to the interviews, the planning and building of plants can take up to 10 years. In Finland, Germany and Spain all barriers are rated relatively low. As stated in the interviews, bureaucratic barriers are in general for BE companies the same as for others, but the admission procedures can be longer when there are no established routines yet in ministries for new types of companies.

Figure 5-9: Bureaucratic barriers. From the bottom up, barriers are rated higher.

5.2.3 Drivers, trends and future policies

The third question block was designed to identify current trends and the status of possible drivers like a bioeconomy monitoring, while the short fourth and last block focused on future perspectives of necessary bioeconomy policies. All results are summarized in Annex III, Table A-2.

Since in the evaluation the policy support was rated very low for the value chain stage of monitoring, it is not surprising, that around 60 % of the participants don't know about the monitoring of their national BE strategies, although for every country there exists a project or institution taking care of it (European Commission, 2022). The visibility of these activities seems to be not high enough even for an interested public.

Public awareness for sustainability and acceptance for bio-based products is rather high in the overall countries (Figure 5-10). But there are huge differences between countries and regions as it is very high in Finnish regions but low in Spanish and Polish regions. In the project Biobase4SME public perception is even rated as the second highest barrier and access to investment is the third highest barrier, which is also apparent here as poor accessibility of funding (NNFCC Ltd, 2018).

Apart from the first four bars in the figure, the stakeholders disagreed in general with the statements about current developments, which could be drivers for bioeconomy development. As stated in the interviews, an important enabling factor can be the commitment of policy makers to BE (Imperial College London et al., 2015), which is only given in Finland. Regional policy makers are even less committed to bioeconomy than on national level. Also, networks could be stronger and products be more visible. Generally, the statements for the national level like public awareness or the commitment of policy makers to BE are rated better than the regional level. Are the countries compared, the average shifts from overall more agreement with the statements in Finland to solely disagreement in Poland.

Stakeholders were also asked to indicate the most important driver for them. The most common answers were going in three thematic directions. The first group are regulatory and policy drivers like: financing opportunities for start-ups and SME, green public procurement like the use of renewable energies in public buildings in Spain, simple regional laws with fast procedures and shared standards / thresholds and the Agenda 2050 goals of the EU. Besides that, high public awareness, engagement of the government on the regional level and cooperation of public and private stakeholders were listed as drivers. At last, crises were

mentioned, which are considered to accelerate bioeconomy development like climate change, a price increase of fossil energy and supply problems.

0% 20% 40% 60% 80%100% 0% 20% 40% 60% 80%100% 0% 20% 40% 60% 80%100% 0% 20% 40% 60% 80%100% 0% 20% 40% 60% 80%100%

Figure 5-10: Statements about possible drivers in the stakeholder's regions of operation. From the bottom up, statements tend to be more drivers.

The participants from all countries are thinking cautiously optimistic about the future of bioeconomy policies, in Finland and Poland stakeholders are even a bit more optimistic (Annex III: Stakeholder online survey, Table A-2).

All of the given future policy measures were rated as important, but the most important ones are "Promoting R&D for bio-based innovation", "Circular economy regulations", "Pilot and demonstration facilities" and "Training & Capacity-Building" (Figure 5-11). After these, it is important for stakeholders to address the competitiveness of bio-based products on the market with tax incentives and the removal of fossil fuel subsidies. It seems like there is no connection between implementation of measures and stakeholders' perception of their importance. But the white bars show, that with three exceptions the measures to promote bioeconomic transformation are implemented by less than 50 % of the regions.

Compared to the worldwide expert survey from (Dietz et al., 2020), the measures reach with differences of maximum 0.3 on the Likert scale almost the same scores, while the first four measures in the survey here exceed the score from there. Like in this study it can be seen, that supply-sided measures like R&D activities are more often implemented than demand-side measures like consumption taxes, consumer information or encouraging the use of bio-based construction materials in Figure 5-8. The innovation of bio-based products is more favoured from current policies and already advanced, while the commercial success is mainly exposed to the market forces (Dietz et al., 2020). The lack of demand-side policies for bio-based products is a critic mostly from BE enterprises and can be even the highest barrier like in the project Biobase4SME (NNFCC Ltd, 2018). Even though this is more a matter to be solved on national or international level, on regional level it could be addressed e.g. with a green public procurement policy.

Figure 5-11: Importance of future policy measures to promote bioeconomic transformation. The white bars show the share of participants in whose regions these are already implemented.

Asked for the importance of future policy key principles, the stakeholders rated all of them as almost very important in average. Compared to another study in Germany (Edel et al., 2016), which introduced these categories, the "Potential to reduce GHG", "Technology development" and "Resource efficiency in domestic biomass supply" are also in the top four categories. The most significant difference is, that "Job creation" has been rated as more important by all countries except Germany. A reason for that could be that Germany has a lower unemployment rate than the other countries except Poland (Destatis, 2022). According to discussions going on, in the Central Germany region there will be rather the risk of skilled labour shortage for emerging jobs in the bioeconomy sector in the region.

Some participants left a final statement at the end of the survey. Some of them concluded, that the most important thing is to make BE financially competitive and rewarding. One suggestion was to have a clear, general and reasonably stable carbon tax as solution to promote BE. One was remarking, that the EU is an importer of raw materials but at the same time regulations are reducing the domestic production in the EU, which is aggravating global environmental issues. It was also noted, that the political attitude must change to approach BE in its real dimension and to substitute fossil products by bio-based products.

5.3 Summary

The last subchapters emphasised the findings from the stakeholder interviews and survey. The sample chosen is not representative of the population in each country or even the EU, as only a small selected group of stakeholders was interviewed and also the findings from the interviews are only qualitative results. But still, tendencies can be derived from the synopsis of methods. In this summary chapter, the most important regulatory and political obstacles in governance for bioeconomy development and drivers are summarized in an overview (Table 5-4). There appeared slight differences in the weighting of the importance of obstacles in financing due to a more business-oriented focus of the survey participants. But still, many of the findings were reported both in the interviews and the survey. Since the obstacles are the focus of this evaluation, they were complemented by examples from literature, which were not mentioned in either the interviews or the survey.

Table 5-4: Summary of regulatory and political obstacles in governance for BE development and drivers / trends, gathered through the data collection methods. Their findings were complemented by obstacles from literature.

	Summary of obstacles and drivers for bioeconomy development	Source
	Vague, not measurable policy goals	Interviews
	Uncertainty due to frequent regulatory changes	and survey
	Long-term strategies are not supported by policies	
	Commitment of policy makers to bioeconomy is too low	
	 Too much international harmonization of regulatory framework should not be targeted 	
	Long and complicated administrative processes	
	Stronger networks are needed in regions	
	Funding is difficult to access	
	Lack of collaboration between government and value chain actors	
	Negative trend: due to several geopolitical crises since 2019 uncertainty increases	
	Too slow adaptation of regulations	
	Lack of policy coherence	Survey
	Missing of robust standards and methods to reward sustainability	
	Social concerns are not well addressed in policies	
Obstacles	Lack of demand-side policy measures for bio-based products	
	Resource efficiency not ensured (cascading use, bio-based materials for construction)	
	 Policy support is needed for secondary / younger BE sectors like biotechnology, biochemicals and waste (see also section 4.3) 	
	Lack of information / knowledge provision	Interviews
	Lack of a clear regional management structure (ministries)	
	Lack of systemic future planning (vision)	
	Insecure investment environment for companies	
	Timeframe of policies uncertain (Pelkmans et al., 2016)	Others
	• Fragmented nature of BE sectors slows down policy adaption and alignment (Imperial College London et al., 2015)	from literature
	 Lack of supporting market mechanisms to face price competition from petro- chemistry (Elbersen et al., 2020) 	
	Sustainable biomass mobilisation (Elbersen et al., 2020)	
	• Perverse policy effects (e.g. waste reuse is hindered) (OECD, 2018)	
	Lack of investor confidence (Elbersen et al., 2020)	
	Lacking public support for scale up activities (NNFCC Ltd, 2018)	

	• • • • •	Regional BE policies can impact a region as much as EU policies Regional BE strategies, but sometimes not visible enough Public awareness and acceptance are drivers in regions with higher maturity stage (Regional) green public procurement policy to make bio-based products more visible Good funding programmes for research Authorities with good understanding of BE in general	Interviews and survey
Drivers / trends	• • • • •	BE strategies exist for many countries or are under development Monitoring exists for BE strategies, but not visible enough Promoting R&D for bio-based innovation implemented in many regions Measures for supply-side are effective at a low maturity stage Job creation as key principle of future policies Stakeholders think slightly optimistic about the future of bioeconomy policies	Survey
	•	Bottom-up cooperation between industry, research and regional government Cooperation and commitment to BE of academia in region	Interviews

6 Conclusions and recommendations

The presented report collects, with focus on regional and rural bioeconomy, current policy frameworks, good policy practices, regulatory and political obstacles and drivers / trends. The five selected regions are (in ascending order of bioeconomy maturity development stage): Warmia and Mazury in Poland, Central Italy, the Ebro Valley region in Spain, Central Germany and Northern Finland.

Most of the 19 collected good policy practices are tailored to specific value chains from each region and cover therefore many different bioeconomy sectors (chapter 4). The majority of the policies are financial instruments, while market-based signalling instruments and regulatory instruments were missing, due to a lack of regional regulations in some countries like Italy and to general missing market incentives for bio-based products (see obstacles in chapter 5.2.2). Since most of the policies are derived from EU policies, they are easy to transfer. EU policies are an important driver but, as shown in the survey results, regionally implemented policies can foster development in a region just as strongly (chapter 5.3).

Consistent with survey results, it can be seen that in regard to value chain stages the end of life, like waste treatment and reuse of residues, and logistics (infrastructure) need more support. In regions with a lower maturity stage, first a reliable and sustainable biomass provision and an enabling environment with financing opportunities have to be established. The higher the maturity stage of a region, the more a monitoring of bioeconomy development and long-term strategies as enabling environment are demanded.

Answering the question "What makes the examples a good policy practice?" revealed many different aspects. These were organized in qualities and objectives, which were the most important for the project consortium. The working definition developed from these is summarized in Table 6-1.

Table 6-1: What makes a good policy practice for regional bioeconomy development? Summarized properties of good policies to foster rural bioeconomy collected in this project.

What makes a good policy?		
Overarching qualities		
٠	Ensuring sustainability safeguarding	
•	Containing clear targets	
•	Tailored to region and / or value chain	
•	Transferable - serving as example for other regions	
•	Promoting bioeconomy development in regard to at least one of the following main objectives	
Objectives to foster bioeconomy		
•	Support investment	
•	Promote innovation (research)	
•	Provide information	
•	Create networks	
•	Mobilise biomass	
•	Create a future vision	
•	Implement lessons learned	

Regulatory and political obstacles and drivers / trends with focus on regional and rural bioeconomy were derived through interviews with stakeholders, a survey and a literature review. All three methods identified

reoccurring barriers and the most common and significant ones are collected in Table 6-2 (see for more details chapter 5). Recommended solutions to remove these obstacles are gathered in the associated field on the right-hand side. The obstacles fall broadly into three thematic groups, which serve for simplification and a better overview. Though their order is not a weighting of importance, they can indicate a chronological order to remove obstacles:

Actors:

- Inform, connect and engage people in a transition to bioeconomy
- Although this group does not contain typical regulatory or political obstacles, it is affecting the framework created by policy makers. One of the highest rated barriers is, that policy makers don't commit to bioeconomy and as a consequence the public has no knowledge and awareness about it and vice versa. Without solving these problems, there won't be a supportive environment for bioeconomy in a region. Especially in regions with low maturity of bioeconomy it is important to address these issues and create networks.

Bounds:

- Create a reliable and enabling regulatory and political framework in the region
- The regulatory and political framework needs an update in many regions, because it relies on old concepts of resources, company types and challenges like the need of a higher resource efficiency. In addition, there are many policies with conflicting goals, which need to be embedded in an aligned, systemic future planning. A regional bioeconomy strategy can be a powerful starting point for that. But changes need to be handled with caution, because a too unsteady framework causes uncertainty.

Competition:

- Provide long-term certainty for companies, invest in innovation and develop a strong bio-based market
- Companies are in a key role of regional bioeconomy and can only develop, if they have certainty to be needed also in the longer term. At present, bio-based products are largely in an unequal competition with (subsidised) fossil-based products due to a lack of demand-side policies such as a commercial framework with market supports, taxation, etc. Standards could help to reward sustainability advantages. The availability of funding for innovation and investment is especially key in a medium to low maturity stage of bioeconomy.

The collected indications do not claim for completeness. It is a condensed and generalized compilation that requires different emphasis depending on the region or may need to be supplemented. But it fits to many European regions. The recommendations aim to build together with good policy practices a supportive framework for bioeconomy and can be considered when revising governance in a regional context.

Table 6-2: "ABC" for policy making to boost regional bioeconomy. Clustered in three groups with different objectives, the table summarises common obstacles in European regions and recommendations to avoid them.

"ABC" for policy making to boost regional bioeconomy					
Not to do – common obstacles	Recommendations – overcome obstacles				
ACTO	ACTORS				
 Lack of commitment of policy makers to bioeconomy Lack of information provision Lack of public awareness & acceptance Deficit of strong networks as well as collaboration between government and value chain actors Lack of clear regional management structures (ministries) 	 ✓ Get a good understanding of bioeconomy ✓ Involve the society: Raise public awareness and acceptance of the meaning, benefits and challenges of bioeconomy ✓ Establish networks and make actors known to each other ✓ Participate in an (international) exchange of experience and learn from other regions ✓ Build better cooperation between local ministries /agencies 				
BOU	NDS				
 Vague, not measurable policy goals Lack of systemic future planning: adaptation of regulations too slow while political attitudes on certain topics change fast, leading to uncertainty Fragmentation of legislation Long and complicated admission and approval processes Obsolete concepts in regulations Resource efficiency and sustainable biomass mobilisation is not ensured Social concerns are not well addressed in policies 	 ✓ Set clear targets and time frames for regulations and policies ✓ Establish an enabling policy framework, which is adaptable to new challenges but still reliable ✓ Create a bioeconomy strategy well adapted to the region ✓ Monitor the strategy and make results accessible ✓ Simplify and accelerate processes ✓ Ensure sustainable and constant availability of a regional biomass feedstock and support the reuse of "waste" and residues ✓ Foster job creation and train skilled workers 				
COMPE	TITION				
 Unstable investment conditions for entrepreneurs leading to a lack of investor confidence Unequal / adverse treatment of bio-based products Lack of demand-side policy measures for bio-based products like supporting market mechanisms Missing of robust standards and methods to reward sustainability Funding is difficult to access 	 ✓ Create long-term certainty for companies ✓ Promote research and development for bio-based innovation ✓ Establish a regional green public procurement policy ✓ Create a fairer competition of bio-based and conventional solutions and develop a strong bio-based market ✓ Ensure the availability of financial support and make it easy to obtain e.g. by offering legal advice 				

7 Literature

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Annex I: Good policy practice examples

Policy instruments categories can be found in chapter 1.3.

FINLAND

Policy 1	
Short title	Regional forest programmes 2021-2025
Main aim of the policy	The regional forest programmes 2021-2025 are statutory provincial forest sector development plans and work programs.
Year of implementation	Current programmes cover period 2021-2025
Is the policy still implemented?	Yes
Type of instrument	4 - information and advisory instruments
Influence level of policy	Regional
Funding body	Ministry of Agriculture and Forestry of Finland
Links and sources	https://www.metsakeskus.fi/en/forest-use-and-ownership/regional-forest-programmes

Description of policy:

The regional forest programmes 2021-2025 are statutory provincial forest sector development plans and work programs. They promote the diverse and sustainable use of forests, considering local starting points, development needs and objectives. The objectives of the regional forest programmes arise from the regions' own development needs and the objectives of the National Forest Strategy. The forest programmes implement the EU's and Finland's goals of increasing biodiversity, mitigating climate change and developing rural areas. The forest programmes transpose the EU policies to regional level. Finland is divided into 14 forest councils to which the separate regional forest programmes apply. Each regional forest programme is created for 5 years at a time. The regional forest programmes combine economic, ecological, social and cultural objectives. At the heart of the objectives is the diverse and sustainable use of forests. The forest councils monitor and promote the implementation of the programmes. Also, a variety of different stakeholder groups are engaged in drafting the programmes.

The regional forest programme is a good example of a policy instrument, as it enables to implement high-level policies to a regional and practical level. The instrument can be replicated in other countries as well, however, as the regional forest programmes consider various different regional aspects and hence differ from each other, one regional forest programme cannot be replicated to another country or region as such. Country- and regional level characteristics should be carefully taken into account, if a regional forest programme would be replicated in another country. The BE development stage does not impact the implementation potential of this policy instrument, as a regional forest programme can be formulated to a region with any BE development stage. Similar policy instruments are implemented also several EU countries, for example in Germany, Spain, Sweden. As a benefit, the regional forest programmes enable different stakeholders to actively participate in planning the regional forest utilization plans. As a drawback, due to the various stakeholders, finding a common consensus in the regional forest use might be difficult, as the stakeholders may have their own agendas which they want to promote. Also, the preparation process of the regional forest plants is time consuming, and a lot of involvement is required form the stakeholders in the planning process of the regional development programmes.

Policy 2	
Short title (Name of the policy/instrument)	National Forest Strategy 2025
Main aim of the policy (short, 1-2 sentence explanation)	National Forest Strategy aims for growth of welfare and overall sustainability
Year of implementation	2015-2025
Is the policy still implemented?	Yes
Type of instrument	6 - other instruments (strategy)
Influence level of policy	National
Funding body	Ministry of Agriculture and Forestry of Finland
Links and sources	https://mmm.fi/en/nfs

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The National Forest Strategy specifies the main objectives for forest-based business and activities until 2025. The target group is the whole forest sector in Finland. In the Forest Strategy, the forest sector covers not only forestry and the wood processing industry, but also production, processing and services based on other forest products, both tangible and intangible, and public goods. The National Forest Strategy has three strategic objectives:

- Finland is a competitive operating environment for forest-based business,
- Forest-based business and activities and their structures are renewed and diversified and
- Forests are in active, economically, ecologically, socially and culturally sustainable, and diverse use.

The Forest Council follows the implementation of National Forest Strategy. A great variety of stakeholders, Government ministries, forest administration, research and education, forest owners, forest industry, energy sector, environmental organisations, employer organisations and entrepreneurs as well as youth and leisure-time organisations, are represented in the Forest Council. The National Forest Strategy both follows up the EU policies and it also aims to influence the EU policies. Preparation of the National Forest Strategy requires extensive stakeholder cooperation, and the strategy has impact on the whole Finnish forest sector (described above). The strategy is created for 10 years at a time and hence it gives the framework for the forest sector for the given period. Creating a National Forest Strategy in another country would be beneficial as it would give the future framework to the national forest sector. Finland has exported the know-how of creating National Forest Strategies to other countries. It is assumed that National Forest Strategies have been formulated to countries where the forest sector covers a good share in the national GDP, such as in Sweden. EU does not have an official forest strategy of its own. The National Forest Strategy is created to cover one decade at a time and therefore it gives a framework in which the forest sector can operate during that timescale. However, when new international regulations are created (or old ones are updated) which concern the forest sector, large-scale modifications to the strategy might have to be made even in a short notice.

Policy 3	
Short title (Name of the policy/instrument)	National support scheme for private forest owners
Main aim of the policy (short, 1-2 sentence explanation)	Support private forest owners e.g., in management of seedling stands and management of young stands
Year of implementation	Continuous support
Is the policy still implemented?	Yes
Type of instrument	2 - economic instruments, 3 – voluntary initiative
Influence level of policy	National
Funding body	Ministry of Agriculture and Forestry of Finland
Links and sources	Only available in Finnish: <u>https://www.metsakeskus.fi/fi/metsatalouden-tuet/kemera-tuet</u>

Description of policy:

The Forest Centre of Finland grants financial support for private forest owners to support forest management. The policy instrument is not following up EU policies, as it is a national support scheme. The goal of the support scheme is to provide private forest owners financial incentives mainly for management of seedling stands and management of young stands. Therefore, with a small financial incentive, the support scheme improves the management of the seedling stands and young forests.

The Finance Act has been prior notified under EU state aid regulation to the Commission, which has adopted it as a fixed-term 2023 to the end. The main weakness of the current aid system has been seen as its rigidity and administrative inefficiency, especially in the case of small forest management sites. Problems arise

a large number of EU regulations, in particular the provisions on competition, state aid and agricultural and rural policy.

A similar support scheme has at least been implemented in Sweden, Germany and Estonia.

GERMANY

Policy 1	
Short title	Forest directive 2019 Saxony-Anhalt ("Richtlinie Forst 2019")
Main aim of the policy	Financial support for reforestation, soil protection and road construction. It is intendent to support forest owners in converting their forests into climate resilient forests.
Year of implementation	2019

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Is the policy still implemented?	Yes, until 2023
Type of instrument	2 – financial (funding), 3 - voluntary initiative
Influence level of policy	Regional – support forest owners in Sachsen-Anhalt
Funding body	Sachsen-Anhalt
Links and sources	https://landeszentrumwald.sachsen-anhalt.de/fuer-waldbesitzende/forstliche-foerderung/ https://alff.sachsen-anhalt.de/alff-anhalt/forstfoerderung/ https://www.foerderdatenbank.de/FDB/Content/DE/Foerderprogramm/Land/Sachsen- Anhalt/richtlinie-forst-2019.html

The "Richtlinie Forst 2019" is a directive issued by the government of Saxony-Anhalt state in central Germany. This directive replaces the previous "Waldbau" directive. The objective of this policy is to change the forest structure by reforestation, increasing the share of hardwood and mixed forest, in order to make it more resilient to climate change and future challenges. In principle, this instrument comes in the form of subsidies/funding aimed to directly support forest owners with specific activities. The activities supported are forest analysis and planning for a near-natural forest management; conversion of monoculture forests to mixed and climate resilient forests; soil and forest protection; reforestation and natural regeneration; and funding for trail construction.

This policy is following a line of EU regulations that support the development of rural areas across Europe, namely, Regulation (EU) No. 1303/2013; Regulation (EU) No. 1305/2013; the development program for rural areas of the state of Saxony-Anhalt 2014; the law on the joint task "Improvement of the agricultural structure and Coastal Protection" (GAK-Gesetz - GAKG); paragraphs 23&24 of the State Budget Code of the State of Saxony-Anhalt (LHO), among other EU and national laws. The directive puts direct funds available for private forest owners in a total sum of \in 10.2 million to be used until 2023 (Deter, 2019). It can be considered as a good policy as it is specifically tailored to support some of the pressing issues in the region and to facilitate the development of the forestry sector in a more natural and sustainable way. Moreover, this instrument is providing support for private stakeholders and encouraging actors in the sector to increase forest resilience also on small scale. This measure is specifically tailored for Saxony-Anhalt because the forests in the state are characterized by monoculture spruce forests that are highly uniformed, moreover, large plots of forest in Saxony-Anhalt are subjected to forest-dying due to climate change and reduced resilience of monoculture forests.

Such subsidies can thus also fit for other regions in which reforestation, improvement of forest management and diversification of the forest is needed. In areas with a low maturity level in the forestry sector could this type of instrument can be challenging to monitor. Areas with medium to high maturity level can facilitate such funding more successfully. In terms of similar policy instruments in other EU regions, there are numerous initiatives to support reforestation and creation of mixed forests in many European regions.

The most apparent barrier to this policy is lack or not enough funding. As large plots of forest are already damaged in Saxony-Anhalt, there were many private forest owners that demanded for higher subsidies to support reforestation and restoration of forests in the state (Kubatta-Große, 2020).

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Policy 2	
Short title (Name of the policy/instrument)	Innovation Hub "Future Wood and Climate" project
Main aim of the policy (short, 1-2 sentence explanation)	Ensure further development of bioeconomic processes between the regional forestry and lumber industry. Generate new sales markets with cross-regional cooperation and thus develop job perspectives.
Year of implementation	2022
Is the policy still implemented?	Yes
Type of instrument	4 – information and advisory instruments, 2 – financial support to research, 3 – voluntary initiative
Influence level of policy	regional
Funding body	Federal Republic of Germany, Federal State of Saxony-Anhalt
Links and sources	<u>https://mwu.sachsen-anhalt.de/artikel-detail/news/innovationshub-zukunft-holz-klima/</u> <u>https://www.seq-msh.de/aktuelles/aufbau-eines-innovationshubs-zukunft-holz-klima/</u>

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The innovation hub "Future Wood and Climate" is a project of "Standortmarketing Mansfeld-Südharz (SMG)" in cooperation with the county Mansfeld-Südharz and support by the ministry of science, energy and climate (MWU) and the BioEconomy Cluster Saxony-Anhalt. The project is funded by the federal government (90 %) and the state of Saxony-Anhalt (10 %). A lump sum of € 500,000 is provided for the hub. The aim of the project is to build a Hub, where a) new value chains for the region can be developed, b) services for new value chains can be provided (analytics, tests, support in regulatory services etc.) to small and medium sized companies in the region, c) professionals can be trained and continuing education events will be organized, d) consulting services for forest owners and rangers can be provided, e) architectural support can be given. This should result in a stronger wood based economy with the rooting in the local economy.

Policy 3	
Short title (Name of the policy/instrument)	BioEconomy HUB
Main aim of the policy (short, 1-2 sentence explanation)	Setting up a pilot facility for wood based biotech processes, creating a platform where start- ups and small companies can scale up their technologies and produce first tonnage of desired products
Year of implementation	2021
Is the policy still implemented?	Yes
Type of instrument	4 – information and advisory instruments, 2 – financial support to research, 3 – voluntary initiative
Influence level of policy	regional
Funding body	Federal Republic of Germany, Federal State of Saxony-Anhalt
Links and sources	<u>https://www.iqb.fraunhofer.de/de/presse-medien/presseinformationen/2020/bioeconomy-hub-mit-biooekonomie-den-strukturwandel-qestalten.html</u> (BEV, 2022)

Description of policy:

The BioEconomyHub is a project of "Kreisentwicklungsgesellschaft Saalekreis (KEG)" and with the support by the ministry of economy, tourism, agriculture and forestry, (MWL) and the BioEconomy Cluster Saxony-Anhalt. The project is funded by the federal government (90 %) and the state of Saxony-Anhalt (10 %). A lump sum of € 395,000 is provided for the BioEconomyHub. The aim of the project is to provide lab- and pilot capacity to Start-Up and small and medium sized companies for scaling up new biotech Processes. At the BioEcoHub the companies can produce first industrial quantities for market seed and reaching industrial maturity. As the target is the lignocellulosic based biotechnology, the BioEcoHub will provide various pre-treatment technologies for pulping the lignocellulose as raw material.

ITALY

Policy 1	
Short title	EIP AGRI
Main aim of the policy	The European Partnerships for Innovation (EIP) were introduced by the European 2020 flagship initiative "The Innovation Union" (EU Commission, 2010) to implement a new approach in defining research paths and innovation in EU to support the needs of local producer and their production systems.
Year of implementation	2010
Is the policy still implemented?	Yes
Type of instrument	2 – financial (funding), 3 - voluntary initiative
Influence level of policy	regional, national, EU
Funding body	Regional administration of Tuscany
Links and sources	https://www.regione.toscana.it/psr-2014-2020

EIP focuses on the achievement of an "interactive model" for innovation, which implies the participation of different rural actors in the coproduction of knowledge, through development, research and adaptation of innovation in farms. The model also involves functions related to: 1) promote and facilitate cooperation between involved actors; 2) facilitate knowledge share; 3) promote dialogue and collective learning; 4) negotiate and manage conflicts between project partners. The added values of EIP consist of the potential ability to address existing policies towards innovation and the type of dynamic platform used which is able to connect with EIP-Agri, thus establishing a link between practitioners, farmers, other stakeholders and researchers. The envisaged actions are implemented through operational innovation groups (OIG) which should include farmers, researchers, experts, and/or companies. The operational groups will be developed on topics of interest and will carry out projects aimed at testing and applying innovative practices, processes, products, services and technologies.

The European Partnership for Innovation (EIP) has been one of the great innovations of the European rural development policies for the period 2014-2020. EIP was established by the European Commission to overcome one of the main obstacles to innovative processes, the distance between research results and the adoption of new practices/technologies by farmers and related companies (EU Reg. Nr. 1305/2013 - art. 55). In addition to the EIP-Agri network, also the National Rural Network (<u>http://www.reterurale.it/innnovazione</u>) promotes innovation in the agricultural sector and supports the research carried by partners belonging to Operational Groups. The objectives of the EIP-AGRI are the same as those of the EU agricultural policy but include also the bridging between research and technologies and operators of the agricultural and rural sector. In Italy 626 Operational Groups have been established, of which 52 are located only in Tuscany alone. The planned expenditure was \notin 581,876,255. In Tuscany: the estimated amount is \notin 39,157,479, indicated for the entire Measure 16.

Measure 16 aims to strengthen innovation and cooperation in rural areas, improve the competitiveness of farms, pursue environmental agroclimatic objectives and encourage diversification and the establishment and development of new small farms. Many rural technical assistance facilities had been dismissed in several Italian regions over the recent years and the result had been a progressive weakening of agricultural supply chains that compromised the transfer of knowledge and innovation to the rural sector. OGs have re-established a widespread and effective flow of information towards agricultural supply chains and, at the same time, have become an opportunity to grow by exchanging information and experience among stakeholders.

The measure can be replicated in regions with low, medium and high bioeconomy development stage; although they are already available.

There are similar policy instruments implemented in other EU countries, because EIP AGRI is derived from European regulation, available to all EU member countries, with all its Measures, including Measure 16 related to regional agricultural development plans and to the establishment of the Operational Groups.

The country and regional bureaucracy still faces difficulties in managing the new European instruments. State and regional officials should have been adequately prepared in advance to be ready to transpose and enforce European regulations

Policy 2	
Short title (Name of the policy/instrument)	Italian strategy for bioeconomy
Main aim of the policy (short, 1-2 sentence explanation)	The Italian Bioeconomy Strategy is promoted by the Italian Presidency of the Council of Ministers and involves different ministries in its implementation. The Strategy offers a shared vision of the environmental, economic, social and international cooperation opportunities and challenges connected to the development of an Italian bioeconomy strongly related to the needs of the country.
Year of implementation	2021
Is the policy still implemented?	(Yes)
Type of instrument	6 - other instruments such as vision documents, road maps, strategies (national strategy)
Influence level of policy	National
Funding body	
Links and sources	https://cnbbsv.palazzochigi.it/media/2426/actionplanbioeconomy_it.pdf

Description of policy:

The Strategy aims to offer a view of the economic, social, and environmental opportunities and the challenges combined with the implementation of a bioeconomy connected to the national territories. It also represents an important opportunity for Italy to strengthen its role in promoting sustainable growth in Europe and in the Mediterranean basin.

The Italian Bioeconomy pursues to overcome the sustainable production of renewable biological resources and the conversion of these resources and waste into products with high added value such as food, feed, bio-based products and bioenergy.

The Strategy is part of the implementation processes of the National Smart Specialization Strategy and of its related thematic areas that are "Health, Nutrition and Quality of Life" and "Smart and Sustainable Industry, Energy and Environment". It also relates to the Italian National Strategy for Sustainable Development and concerned principles, aimed at guaranteeing the "reconciliation" between environmental sustainability and economic growth.

Policy 3	
Short title (Name of the policy/instrument)	Rural Development Plan for the Tuscany Region - European Fund for Rural Development (EAFRD) 2014-2020. Measure 16. (Piano Sviluppo Rurale regione Toscana – Fondo europeo FEASR 2014-2020. Misura 16)
Main aim of the policy (short, 1-2 sentence explanation)	In the administrative region of Tuscany, the aim is to support, through co-financing, the activities related to the implementation of the Strategic Plans of Operational Groups (SP-OG) that were established after the selection of proposals submitted to the regional administration, with the purpose to identify concrete solutions in support of main issues faced by agricultural and forestry companies or to support them in taking opportunities that may materialize.
Year of implementation	2013
Is the policy still implemented?	(Yes)
Type of instrument	3 - voluntary initiative, 2 – financial (funding programm)
Influence level of policy	Regional
Funding body	Regional administration of Tuscany
Links and sources	https://www.regione.toscana.it/-/innovazione-in-agricoltura-contributi-per-piani-strategici- e-gruppi-operativi https://ec.europa.eu/info/sites/default/files/food-farming- fisheries/key_policies/documents/rdp-factsheet-italy-tuscany_en.pdf

Operating Groups should promote and transfer innovation to achieve precise and concrete results, in support of rural companies operating in the primary sector, through 1) the application of research results; 2) the implementation of new ideas and 3) the testing and adaptation of existing techniques/practices. For each SP-OG, the minimum number of participants is five, of which at least two agricultural and/or forestry companies, one actor operating in the field of production and one in the transfer of research, development, technological innovation and dissemination. The call is co-financed by the Tuscany Region's Psr Feasr 2014-2020 and is included, as far as the coaching activity is concerned, in the regional Giovanisì project.

The objective of the call is therefore to support, through co-financing, the activities related to the implementation of Strategic Plans of Operational Groups (Ps-Go) that will be set up following the selection of the proposals submitted, aimed at identifying a concrete solution for agricultural and forestry enterprises aimed at solving a specific problem or exploiting a particular opportunity. The call, therefore, aims to stimulate the implementation of the European Innovation Partnership for Agricultural Productivity and Sustainability.

POLAND

Policy 1	
Short title	Support for renewable energy provision in the region of Warmia/Mazury
Main aim of the policy	Improvement of energy efficiency and building a non-emission economy in the region of Warmia and Mazury
Year of implementation	2014-2020
Is the policy still implemented?	No
Type of instrument	2 – economic/financial instrument (grants), 3 – voluntary initiative
Influence level of policy	Regional
Funding body	EU: Regional Operational Programme for the Warmia and Mazury for the years 2014-2020 (Action 4.1)
Links and sources	https://ec.europa.eu/regional_policy/en/atlas/programmes/2014- 2020/europe/2014pl16m2op014

Description of policy:

The aim was to support

 production and distribution of energy from renewable sources was to improve the renewable energy production capacity in the region, and thus to increase the share of electricity produced from renewable sources in total electricity production.

- it was also assumed that the emission of greenhouse gases to the atmosphere would decrease.
- it was focused on financial support in the form of subsidies for investments in renewable energy production sources. The support concerned units with a lower generation capacity, incl. energy from biogas.
- projects aimed at improving the electricity storage capacity.

The implementation of the policy

- had a positive impact on the development of renewable energy sources in the region. In 2013, there were build, among others, 9 biogas plants, while at the end of 2019 there were already 20.
- there were 5 calls for proposals under the competition procedure.
- finally, 622 projects were implemented in total, 4.7 % of which involved the production of energy from biomass.

The main problem in the implementation was

- the fact that the group of entities authorized to apply for funding did not include farmers, i.e. the main biomass producers.
- the beneficiaries pointed out that the process of preparing the grant application was not easy. For this reason, many applicants used the support of consulting companies. An important issue was the relatively long waiting time for the payment of the grant.

Policy 2	
Short title (Name of the policy/instrument)	Priority Programme "Agroenergy"
Main aim of the policy (short, 1-2 sentence explanation)	Financial support for new ventures related to the production of energy from renewable sources on farms (e.g. biogas plants)
Year of implementation	2021-2027
Is the policy still implemented?	YES
Type of instrument	2 – economic/financial instrument (subsidies, loans), 3 – voluntary initiative
Influence level of policy	National
Funding body	National Fund for Environmental Protection and Water Management
Links and sources	https://ec.europa.eu/info/sites/default/files/2020-european-semester-national-reform- programme-poland en.pdf

Description of policy:

Agroenergy is a programme whose goal is to increase the production of energy from renewable sources installed in farms. The programme provides, inter alia, financial support for the construction of agricultural biogas plants with the accompanying installation of agricultural biogas production (up to 500 kW). This is to help build energy independence in rural areas, lead to an increase in local energy security and improve air quality.

The programme is addressed to:

- natural persons who are the owner or leaseholder of agricultural real estate, the total area of arable land of which is in the range from 1 ha to 300 ha and at least one year before submitting the application, the person running the farm personally,
- legal persons who own or lease agricultural real estate, the total area of agricultural land is in the range from 1 ha to 300 ha and at least one year prior to the submission of the application for granting subsidies, conducting agricultural activity or economic activity in the field of agricultural services.

The programme provides two forms of support: non-returnable subsidies and low-interest loans.

Co-financing in the form of a loan may amount to 100 % of eligible costs, while co-financing in the form of a non-returnable subsidy - up to 50 % of eligible costs.

Doliny 2	
Policy 5	
Short title (Name of the policy/instrument)	Energy Policy of Poland until 2040
Main aim of the policy (short, 1-2 sentence explanation)	Framework for the energy transition in Poland. Energy security, while ensuring the competitiveness of the economy, energy efficiency and reducing the impact of the energy sector on the environment
Year of implementation	2021
Is the policy still implemented?	Yes
Type of instrument	6 - Other instruments such as vision documents (national strategy)
Influence level of policy	National
Funding body	-
Links and sources	https://www.gov.pl/web/klimat/polityka-energetyczna-polski

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Energy Policy of Poland until 2040 sets the framework for the energy transition in Poland. It contains strategic decision regarding the selection of technologies used to establish a low-emission energy system. The policy takes into account the scale of the challenge of adapting the domestic economy to EU regulatory considerations related to the 2030 climate and energy targets, the European Green Deal, the COVID pandemic recovery plan and the pursuit of climate neutrality in line with national capabilities as a contribution to the Paris Agreement.

Measures aimed at the development of renewable energy sources serve to decarbonise the energy sector and diversify the structure of energy generation, reduce the intensity of fossil fuel use and reduce the country's dependence on fuel imports, which in the long-term will improve energy security. In 2018, the share of RES in gross final energy consumption in Poland was 11.3 %. The EU-wide target for 2020 is 20 % and 32 % for 2030. As part of its EU obligations, in 2020 Poland should achieve a share of energy from renewable sources in gross final energy consumption of 15 %. Poland declares reaching 23 % share of RES in gross final energy consumption in 2030 (measured as total consumption in electricity generation, district heating and cooling, and for transport purposes) as a part of participation in the achievement of the EU-wide target for 2030. Technological progress will have a significant impact on the scale of RES utilisation – both in terms of currently known methods of energy production and in terms of completely new generation technologies, but also in the area of energy storage.

The use of biomass will play a key role. Biomass has the greatest potential to meet the RES target in district heating due to fuel availability and technical and economic installation parameters. It can be used in cogeneration, but also in households, although non-combustible RES are more preferred. Biomass production units should be located close to the place of its production (rural areas, wood industry basins) to minimise the environmental cost of transport. The energetic use of biomass also contributes to better waste management. In turn the use of biogas will be particularly useful in the cogeneration of electricity, heat and gaseous fuels. Thanks to the possibility of its storage, biogas can be used for regulating purposes and for self-balancing of energy clusters and energy cooperatives. From an economic point of view, biogas offers additional value, as it makes it possible to manage particularly noxious waste (e.g. from agriculture, agro-food industry, animal waste or biodegradable municipal waste). Biogas builds a very important potential for the development of agricultural land.

Policy 4	
Short title (Name of the policy/instrument)	PhD Programme in Bioeconomy
Main aim of the policy (short, 1-2 sentence explanation)	Flexible education in various bioeconomy-related disciplines
Year of implementation	2018
Is the policy still implemented?	Yes
Type of instrument	2 – economic/financial instrument (grants), 3 – voluntary initiative
Influence level of policy	EU, regional
Funding body	Operational Programme of the EU Knowledge Education Development (POWER)
Links and sources	https://bioeconomy.uwm.edu.pl/

Description of policy:

The University of Warmia and Mazury in Olsztyn offers the interdisciplinary PhD studies in the field of bioeconomy. The subject of the doctoral thesis that is chosen or proposed by the doctoral candidate will determine the principle discipline that he or she will study. The doctoral candidate, with a "supervisory team" consisting of a supervisor and a co-supervisor, will determine the direction of the candidate's academic studies by selecting appropriate courses out of a broad catalogue of electives. Since the programme of studies is flexible, both academic and applied doctoral dissertations can be prepared. In view of the international nature of this programme, all courses will be conducted in English and the doctoral theses will be prepared in English.

The studies will prepare candidates to obtain PhD degrees in the following areas:

- biological sciences: biology, biotechnology;
- agricultural sciences: animal sciences, agronomy, environmental protection, fisheries, food technology and nutrition;
- technical sciences: ecological engineering;
- veterinary medicine.

The programme of studies is carried out on weekdays. The doctoral candidate will spend an average of 40 hours a week on research work, classes and internships. The organization of the courses will make it possible for PhD students to leave for domestic and foreign internships.

Policy 5	
Short title (Name of the policy/instrument)	Environment, Agriculture and Forestry – research programme BIOSTRATEG
Main aim of the policy (short, 1-2 sentence explanation)	The main objective of the strategic research and development programme is the development of knowledge in the programme areas, leading to an increase in the international position of Poland in scientific research and development works in this field, and the transfer to the socio- economic environment of innovative solutions developed under the programme.
Year of implementation	2014-2019

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Is the policy still implemented?	No
Type of instrument	2 – economic/financial instrument, 3 – voluntary initiative
Influence level of policy	National
Funding body	National Centre for Research and Development (NCBR)
Links and sources	https://archiwum.ncbr.gov.pl/programy/programy-strategiczne/srodowisko-naturalne- rolnictwo-i-lesnictwo-biostrateg/

Programme "Environment, agriculture and forestry" - BIOSTRATEG was a strategic research and development programme prepared by the NCBR Council and approved by the Minister of Science and Higher Education. The programme covered five strategic problem areas resulting directly from the National Research Programme, consistent with the priority directions of research currently carried out in the European Union and in the world. These areas were:

- Food security and food safety;
- Rational management of natural resources with particular emphasis on water management;
- Counteracting and adapting to climate change, with particular emphasis on agriculture;
- Protection of biodiversity and sustainable development of agricultural production space;
- Forestry and wood industry.

Budget 500 million PLN.

SPAIN

Policy 1	
Short title (Name of the policy/instrument)	Wine CMO 2019-2023 programme
Main aim of the policy (short, 1-2 sentence explanation)	National support programmes have played a key role in improving the competitiveness of EU wine producers and products. The measures in the national support programmes are generally relevant to the needs of the sector, especially because they offer a range of tools that can be adapted to the various levels of development of EU local supply chains (i.e. restructuring and conversion, investment, and promotion).
Year of implementation	Programme 2019-2023
Is the policy still implemented?	Yes
Type of instrument	Wine CMO: Financial execution of the national support programme 2019-2023 2 – economic/financial instrument, 3 – voluntary initiative
Influence level of policy	EU-National
Funding body	Members states Funding allocated per country 2019-2023 programme: https://ec.europa.eu/info/sites/default/files/food-farming- fisheries/farming/documents/wine-2009-2023-overview en.pdf programme: At National level the 3 entities involved are: Agriculture, Fishery and Food Ministry FEGA and autonomous communities. programme:
Links and sources	https://ec.europa.eu/info/food-farming-fisheries/plants-and-plant-products/plant- products/wine Wine CMO : Financial execution of the national support programme: https://ec.europa.eu/info/sites/default/files/food-farming-

Description of policy:

Introduced as a new measure innovation in the wine sector aiming at the development of new products, processes and technologies concerning the wine products. Furthermore, it expands promotion measures in EU countries, with a view to informing consumers about the responsible consumption of wine and about the EU systems covering designations of origin and geographical indications. It also extended the restructuring and conversion of vineyards to replanting of vineyards where it is necessary following mandatory grubbing up for health or phytosanitary reasons.

Wine-producing EU countries may currently offer support for the following measures:

- promotion in non-EU countries,
 - informing consumers about the responsible consumption and EU quality schemes,
 - restructuring and conversion of vineyards including replanting for health or phytosanitary reasons,
 - green harvesting,
 - mutual funds,

- harvest insurance,
- investments in enterprises,
- innovation aiming at the development of new products, processes and technologies,
- by-product distillation.

The yearly allocations from the EU budget are fixed by EU country, taking into account the transfer for some EU countries to the single payment scheme.

Policy 2	
Short title (Name of the policy/instrument)	Aragón Circular
Main aim of the policy (short, 1-2 sentence explanation)	Aragón Circular is the circular economy strategy that has been developed by Aragón region government in order to reach the sustainable objectives settled in 2030 agenda aiming to create and appropriate politic, economic and social framework for the transition towards circularity. The associated funding scheme aims to promote the industrial development and research, boost the sustainable and circular economic model and improve competitiveness while increasing employment in the region.
Year of implementation	2020
Is the policy still implemented?	Yes
Type of instrument	6 - Other instruments such as vision documents (strategy), 2 – financial (associated to funding)
Influence level of policy	Region (Autonomous community)
Funding body	Aragón region Government - Economy, planning and employment department
Links and sources	https://www.aragon.es/-/aragon-circular#anchor1 https://aragoncircular.es/aragon-circular-version-accesible-sin/ http://www.boa.aragon.es/cgi- bin/EBOA/BRSCGI?CMD=VEROBJ&MLKOB=1181304803232&type=pdf

Description of policy:

The strategic objectives of the strategy include:

- Promote the economic activity in the region and the employment creation on circular economy.
- Boost circular economy sector
- Promote entrepreneurship related to circular economy initiatives and synergies among the existing innovative companies
- Recognition of enterprises leadership in the transition towards a new economic model
- Positioning as strategic sector in the region economic context
- Increase sectorial specialisation

Actions designed to address these goals imply the optimization of the resources needed and the actors involved, promote strategic alliances, sector stimulation as well as actors involved to reach a successful development or identification and monitoring of performance indicators. In order to achieve these goals, an action plan has been developed setting a set of actions aligned with the 12 ODS of 2030 Agenda. Funding scheme aims to finance enterprises' projects (SME or autonomous) including not only the investment but also the budget corresponding to all activities required to implement it.

The funding scheme allows to finance therefore project related to the eco-design of processes and products leading to a higher efficiency regarding the use of raw materials along the life cycle of the product, recycling or other paths to valorise by-products or residues, industrial symbiosis which promotes the residues and by-products efficiency or new processes, technologies or materials contributing to the residues valorisation that are not currently valorised.

POL	ICV	3

i oney o	
Short title (Name of the policy/instrument)	Cataluña Bioeconomy Strategy 2021-2030
Main aim of the policy (short, 1-2 sentence explanation)	The main objective of the strategy is to promote the development and growth of a sustainable economy in the region through the increase of the biological resources and local and renewable developments.
Year of implementation	2021
Is the policy still implemented?	Yes

Type of instrument	6 – Other instruments such as vision documents (strategy)
Influence level of policy	Region (Autonomous community)
Funding body	Cataluña region Government – Climate action, food and ural agenda department
Links and sources	https://portaldogc.gencat.cat/utilsEADOP/PDF/8503/1870534.pdf

The strategy includes different action seeking to transform and improve the circular bioeconomy in Catalonia. The strategy is therefore structured in 7 operative objectives:

- Improve the biomass exploitation in Catalonia by means of characterization, quantification of the and optimization of the management and distribution of the resource.
- Develop a business network based on the circular bioeconomy for the whole region paying special attention to the primary sector.
- Promote the use and consumption of bioproducts, bioenergy and biomaterials.
- Promote resilient agroforestry landscapes and the provision of ecosystems services in the context of the Catalonian circular bioeconomy.
- Place the knowledge as driving force of the circular bioeconomy
- Enforce the role of the administration and adapt the legal and policy framework seeking to favour the circular bioeconomy in Catalonia.
- Prepare the Catalonian society for the change towards circular bioeconomy.

Furthermore, these objectives are organized in 17 strategic lines and 37 measures.

The strategy also intends to identify the value chains generated in the primary sector, agri-food processing, forestry and fishery in order to determine those that are less developed, whose by-products and residues can be valorised for different purposes but are currently not used as well as others that are not addressed in any other strategy or policy to improve their development.

Policy 4	
Short title	Digital Europe Programme (Digital kit program)
Main aim of the policy	Digital Europe Programme is the first EU programme that aims to accelerate the recovery and drive the digital transformation of Europe.
Year of implementation	Calls for Grants and Procurement opened for proposals in 2021 and 2022
Is the policy still implemented?	Yes
Type of instrument	2 – Financial (funding program), 3 – voluntary initiative
Influence level of policy	EU
Funding body	European commission Next Generation
Links and sources	https://digital-strategy.ec.europa.eu/en/activities/digital-programme
	https://digital-strategy.ec.europa.eu/en/activities/get-funding-digital
	https://digital-strategy.ec.europa.eu/en/news/first-calls-proposals-under-digital-europe-
	programme-are-launched-digital-tech-and-european-digital
	Royal Decree which transposes the requirements to participate
	https://www.boe.es/diario_boe/txt.php?id=BOE-A-2021-21873

Description of policy:

The Digital Europe Programme will provide strategic funding to answer these challenges, supporting projects in five key capacity areas: in supercomputing, artificial intelligence, cybersecurity, advanced digital skills, and ensuring a wide use of digital technologies across the economy and society, including through Digital Innovation Hubs. With a planned overall budget of € 7.5 billion (in current prices), it aims to accelerate the economic recovery and shape the digital transformation of Europe's society and economy, bringing benefits to everyone, but in particular to small and medium-sized enterprises.

The Digital Europe Programme will not address these challenges in isolation, but rather complement the funding available through other EU programmes, such as the Horizon Europe programme for research and innovation and the Connecting Europe Facility for digital infrastructure, the Recovery and Resilience Facility and the Structural funds, to name a few. It is a part of the next long-term EU budget, the Multiannual Financial Framework 2021-2027.

The Digital Europe programme will be implemented through four work programmes:

• For all actions excluding those implemented by the other three work programmes as indicated below - DIGITAL Europe Work Programme 2021-2022 (.pdf)

- For the European Digital Innovation Hubs DIGITAL Europe EDIH Work Programme 2021-2023 (.pdf)
- For Cybersecurity actions DIGITAL Europe Cybersecurity Work Programme 2021-2022 (.pdf)
- For High Performance Computing actions the work programme will be prepared by the EuroHPC Joint Undertaking

Policy 5

Short title (Name of the policy/instrument)	2021 OIV Research grant program (OIV: The International Organisation of Vine and Wine)
Main aim of the policy (short, 1-2 sentence explanation)	OIV grants research scholarships in priority programme fields on a yearly basis.
Year of implementation	2021 (yearly)
Is the policy still implemented?	Yes
Type of instrument	2 – financial (scholarship in priority programme field), 3 – voluntary initiative
Influence level of policy	National
Funding body	OIV
Links and sources	https://www.oiv.int/en/the-international-organisation-of-vine-and-wine/2021-oiv-research- grant-program

Description of policy:

The OIV is an intergovernmental organisation of a scientific and technical nature of recognised competence for its works concerning vines, wine, wine-based beverages, table grapes, raisins and other vine-based products.

Grants offered within the framework of this programme are short term (six months to fifteen months maximum) and are provided for specific post graduate training programmes. Targeted candidates must be very qualified, with the desire to pursue their research, further knowledge and keep up on the latest progress made in their field of study and/or work.

In 2021 the main topics addressed included:

Viticulture:

1. Tables Grapes, Grape Juice and consumer perception regarding health, nutritional and phytosanitary aspects. Comparison with other drinks and Impact of different grape dehydration conditions on secondary metabolites changes.

2. Climate Change: Innovative Strategies to modulate grapevine resilience in new cultural contexts and a changing environment.

3. Methodologies and key indicators of CO2 storage capacity in vineyard soils for mitigation of the emissions in balances.

4. Reduction of Pesticides. Searching for new approaches or alternatives to reduce the traditional phytosanitary products (Cu, Biostimulants, other) applications.

5. Sustainable use of water in viticulture: Varietal adaptation related to water consumption (Water Use Efficiency and climate change).

6. Development, test and evaluation of relevant biodiversity indicators for application at vineyard-scale and wine region landscape management.

7. Application of physical or non-chemical treatments (heat, UV, etc.) to reduce pest and disease pressure in vineyards.

8. Genetic bases of the viticultural traits.

9. High-resolution mapping of soil and water indicators to manage erosion and landslides risks of slope vineyards.

10. Berry Sampling in vineyards. Sampling approaches and methodologies adapted and optimized to the different production situations of the vitivinicultural sector.

Oenology

- 1. New techniques for the recovery and the exploitation of the by-products from the wine industry.
- 2. Managing calcium instabilities in wine

3. Chemical and organoleptic characterization of "minimal intervention wines" (Wines made by spontaneous fermentation and/or without added SO2).

4. Metagenomic analysis of the effects of copper on microbial diversity in vineyard soils, grapes and vines

5. Development and validation of analytical methods for quantifying the addition of exogenous water to grape juice, must, or wine and how new technologies can influence in those analysis

6. Improving the knowledge on oenological tannins: chemical characterization, functionalities, and analytical methods for their characterisation

Economy and Law

1. Structural changes and adaptation strategies to the Covid-19 pandemic in the wine industry

2. Analysis and perspectives of wine tourism in different territorial and socio-economic contexts

3. The challenges of logistics and supply chain management in the global wine trade


- 4. Study of distribution channels of the wine sector
- 5. Sustainability in the vitivinicultural sector
- 6. Climate change:

Safety and Health

- 1. The effects of wine consumption on diseases (in particular all-causes mortality and wine consumption, assessment of the health
- impact on autoimmune disease)
- 2. Contaminants, toxins and additives (in particular zinc, cadmium, aluminium, etc.)
- 3. Assess the health risks of phytosanitary product residues
- 4. Biological effects of wine consumption (in particular wine and aging, resveratrol and physiological effects)
- 5. Longitudinal changes in consumption habits
- 6. A review of the literature around wine impacts on health (as distinct from alcohol)
- 7. Consumers' perception on organic wine
- 8. Social and cultural context of wine consumption



Annex II: Literature review guideline template

The information collected through this guideline is set to be a part of D4.2 "Good Practices in policy for bioeconomy value chains in European regions". In deliverable 4.2 we aim to identify the regulatory landscape in which successful bioeconomy value chains can be established and supported. In order to have a comprehensive overview of the various regions of the BRANCHES project we have prepared this guideline to collect specific information from each country. The material collected in this review can be sourced from former EU projects results (see table 1.3a in the BRANCHES proposal) and various governmental or scientific publications. Since this is a relatively short review we understand that it cannot be all-encompassing, therefore, we encourage you to use this guideline tentatively and adapt this template according to your resources and needs.

Please note: The following sections will serve as sub-chapters for deliverable 4.2. Therefore diagrams, informative figures and tables, which can be used in the final deliverable, are welcome.

Date	Date the sheet is filled				
Country	Partner's country				
Partner	Name of person(s) responsible for filling this sheet and corresponding institution				

[COUNTRY]'s Bioeconomy Policy Landscape

Overview of the national bioeconomy market

Before directly discussing policies in each country, it is important to provide context information including the framework in which bioeconomy policy mechanisms are implemented in.

Please use the following points to guide this section:

- Bioeconomy market size (in monetary terms or significance to the country's economy)
- Development stage of the bioeconomy in the country (a developed bioeconomy is characterized by a significant market share, high innovation levels and distribution of novel technologies as well as judicial instruments and inter-connectivity of stakeholders)
- Evolution in the past, current discussion and trends
- Prominent sectors and value chains

Overview of national bioeconomy policies

This section aims to provide a snapshot of the current situation in each of the countries regarding national bioeconomy policies and strategies to facilitate further market development and technology implementation.

Note: since this is a literature review, please do not consider only the information related to your case study value chain. The goal here is to provide a short but comprehensive overview for all sectors of the national bioeconomy.

Please use the following points to guide this section:

- Implementation of European law (how EU directives and regulations are manifested in national law?)
- National bioeconomy strategy goals and key policies (if there is no bioeconomy- specific strategy please include mentions of the bioeconomy in other national strategies)
- Other bioeconomy related policies (usually, there are many regulations that are shaping the bioeconomy even though they do not explicitly deal with the bioeconomy; for example – related to waste, energy, construction, or climate change)

Regional policies

In this section the goal is to zoom into the regional level and highlight regional policy mechanisms which relate to the bioeconomy in general and the most prominent sector / value chain in the selected region. Countries may vary in the level of judicial activity on the regional level (some countries practice more centralized governance while others allow more agency in states, districts or municipalities). As such, first describe how policies are realized locally and then describe the specifics of the policy mechanisms.

Note: if examples from different regions/sectors/value chains stand out, it is encouraged to focus on more than one.

Please indicate the following points and specify:

- local strategies for bioeconomy
- any networking initiatives (clusters)
- regional regulations affecting bioeconomy
- funding / investment projects
- Research activities, knowledge transfer, demonstration projects



Annex III: Stakeholder online survey

Questionnaire



! Please select your preferred language (English, Deutsch, Suomi, Español, Italiano, Polski) using the flags at the bottom of the page

Survey about the legislative and policy framework of bioeconomy in European regions

Dear participant,

the EU-funded project <u>BRANCHES</u> (Boosting RurAl bioeconomy Networks following multi-actor approaCHES) works to increase the flow of information, new ideas and technologies among European agriculture and forestry professionals, especially in rural areas. The aim is to promote the bioeconomy and rural development in European regions.

The policy and regulatory framework of the bioeconomy is complex and may vary depending on the studied region. In our policy analysis of regions in Finland, Germany, Italy, Poland, and Spain we aim to find out what the most important obstacles are and how good policy practices need to be designed to promote the development of a bio-based economy. The experiences of stakeholders like you play an important role. Therefore, we ask you to take 15 minutes of your time and answer the following questionnaire, which consists of 4 thematic blocks.

All data collected is fully anonymized and processed in accordance with the GDPR. With your participation, you agree to the anonymized evaluation and publication of the results. For data protection reasons, please refrain from providing personal data in any form.

With your participation you make an important contribution to our research project! You are welcome to forward this online survey also to other people, who are interested in the policy framework of the bioeconomy.

Thank you for your participation in advance!

The project received funding from the European Union's research and innovation program HORIZON 2020 under grant agreement No. 101000375









Block 1: Background information

We are starting with some short questions about your role and your region as well as your experiences in the field of bioeconomy policies.

1. Which stakeholder group do you belong to?

If there are several, please choose a maximum of 3 answers.

Public administration National Regional Municipalities Politician National Regional Municipalities Business Business (enterprise in bioeconomy) Research & development Research institutes Universities Other research & development institutions NGO Civil Society Business organization Another NGO (please specify): Others Educators Experts Media Other (please specify):



2. Which sector(s) of the bioeconomy does your organization operate within, or which topics do you deal with?

If there are several, please choose a maximum of 3 answers.

General

All of the bioeconomy sectors 0

Agriculture

Agriculture 0

Bio-Based products processing

Chemicals
Food
E Feed
Textiles
Other (please specify):
Bioenergy
Biofuels
Electricity
Heat
Heat and power
Other (please specify):
Biotechnology
Biotechnology 0
Construction
Construction with bio-based building materials
Fishery
Fishery (e.g. aquaculture)
Forestry and wood processing
Forestry
Pulp and paper production
Wood products and furniture
Other (please specify):
Technology
Technology production 0
Waste
Organic waste and residues
Others
Other (please specify):



3. Which country and region are you operating in?

If there are several, please choose the one in which you work most of the time:

Finland

North Ostrobothnia, Kainuu and/or Lapland

Another region in Finland

Germany

O Saxony, Saxony-Anhalt and/or Thuringia

Another region in Germany

Italy

Tuscany and/or Abruzzo

Another region in Italy

Poland

Warmia and/or Mazury

Another region in Poland

Spain

Aragón and/or Cataluña

Another region in Spain

Other

Other (please specify):



4. Which bioeconomy sectors are particularly prominent in the region you operate in?

Please select the 3 most important ones:

Ag	ric	ult	ure
----	-----	-----	-----

Agriculture 0
Bio-Based products processing
Chemicals
Food
Feed
Textiles
Other (please specify):
Bioenergy
Biofuels
Electricity
Heat
Heat and power
Other (please specify):
Biotechnology
Biotechnology 0
Construction
Construction with bio-based building materials
Fishery
Forestry and wood processing
Forestry
Pulp and paper production
Wood products and furniture
Other (please specify):
Technology
Technology production
Waste
Organic waste and residues
Others
Other (please specify):



5. How long do you already follow updates about bioeconomy policies?

O Less than 1 year
O 1-3 years
O 4-5 years
O 8-10 years
O 11-15 years
O longer than 15 years
 I don't follow bioeconomy policies and regulations actively

6. Do you feel well informed about the policy developments affecting the bioeconomy?

	No	Yes
On EU-level	0	0
On national level	0	0
On regional level	0	0

7. How do you track regulatory changes of the bioeconomy?

Please select the 3 most important sources for you:

News (TV, radio, newspaper)
Online news (press releases, etc.)
C Scientific reports
Social media
Networks (Clusters, personal or business network)
Newsletters
Specific platform, namely:
Others (please specify):

8. What is the overall maturity stage 0 of bioeconomy development in the country you operate in?

0	0	0	0	0
Low maturity				High maturity

9. What is the overall maturity stage 0 of bioeconomy development in the region you operate in?





10. Is there a national bioeconomy strategy in your country?

 Yes, an explicit stand-alone bioeconomy strategy
 Yes, implicit bioeconomy strategy within another strategy
○ No
🔿 I don't know

11. Are there regional bioeconomy strategies in your country?

 Yes, an explicit stand-alone bioeconomy strategy
○ Yes, implicit bioeconomy strategy within another strategy
O No

O I don't know

Block 2: Obstacles in the legislative and policy framework of bioeconomy

This question block aims to identify the major obstacles and weaknesses of the legislative and policy framework of the bioeconomy.

12. In your opinion, which impact does each policy level have on bioeconomy actors within the region you operate in?

	No impact			I	High impact	Not available
Regional policies	0	0	0	0	0	0
National policies	0	0	0	0	0	0
EU policies	0	0	0	0	0	0

13. To what extent do you agree with the following statements regarding your region of operation? The following sector needs more attention in the legislative framework of the region I operate in:

	Totally disagree	Fully agree
Agriculture 0	000	000
Bio-Based chemicals and materials	000	000
Food	000	000
Bioenergy	000	000
Biotechnology 🖯	000	000
Construction with bio-based building materials	000	000
Fishery (e.g. aquaculture)	000	000
Forestry	000	000
Wood and wood products	000	000
Organic waste and residues	000	000



14. To what extent are the following stages of bioeconomy value chains supported by policies in the region you operate in?

	Hindered by policies			1	Well supported by policies	I don't know
Provision of biomass Θ	0	0	0	0	0	0
Logistics	0	0	0	0	0	0
Conversion and processing of biomass $\boldsymbol{\vartheta}$	0	0	0	0	0	0
Consumption / market 0	0	0	0	0	0	0
End of life $\boldsymbol{\theta}$	0	0	0	0	0	0
Enabling environment:						
Financing research and education	0	0	0	0	0	0
Collaborations	0	0	0	0	0	0
Long term strategies	0	0	0	0	0	0
Monitoring	0	0	0	0	0	0

15. Please rate the significance of each regulatory or policy barrier for bioeconomy development in the region you operate in:

	Low barrier				High barrier	I don't know
Lack of an international harmonized regulatory framework	0	0	0	0	0	0
Lack of a <u>national</u> harmonized regulatory framework	0	0	0	0	0	0
Lack of international agreed sustainability criteria	0	0	0	0	0	0
Lack of efficient and transparent standards	0	0	0	0	0	0
Lack of an internationally agreed certification system	0	0	0	0	0	0
Lack of collaboration between government and value chain actors	0	0	0	0	0	0
Lack of an efficient "green public procurement" legislation at the <u>regional</u> level	0	0	0	0	0	0
Lack of an efficient "green public procurement" legislation at the national level	0	0	0	0	0	0
Unequal or unfair sustainability comparisons	0	0	0	0	0	0
Specific environmental regulation blocking the development of bio-based products or processes	0	0	0	0	0	0
Frequent changes in regulations leading to uncertainty	0	0	0	0	0	0
Vague, not measurable policy goals	0	0	0	0	0	0
Too many policies with conflicting goals	0	0	0	0	0	0

16. I think the highest barrier for the bioeconomy development in the regulatory framework is:

Please specify:



17. To what extent do you agree with the following statements regarding your region of operation?

	Totally disagree	Fully agree
Administrative processes (e.g. approval procedures) for actors in the bioeconomy are short and simple	000	00
The policy landscape supports bioeconomy innovation	000	00
Economic concerns are adequately addressed by policies for the bioeconomy	000	00
Social concerns are adequately addressed by policies for the bioeconomy	000	00
Environmental concerns are adequately addressed by policies for the bioeconomy	000	00
Legislation encourages the material use of wood more than the energy use	000	00
Legislation encourages the use of bio-based products in the construction sector	000	00
Legislation is designed to ensure a cascading use of biomass	000	00
Legislation encourages the use of rest streams	000	00

18. Please rate the significance of each <u>bureaucratic barrier</u> for small and medium-sized bioeconomy enterprises in the region you operate in:

	Low barrier				High barrier	I don't know
Building permissions	0	0	0	0	0	0
Quality assurance	0	0	0	0	0	0
Certification schemes	0	0	0	0	0	0
Industrial safety	0	0	0	0	0	0
Categorisation of the type of enterprise	0	0	0	0	0	0
Energy requirements	0	0	0	0	0	0
Environmental requirements	0	0	0	0	0	0
Admission procedures	0	0	0	0	0	0
Other barriers (please specify):						



Block 3: Drivers and trends in the legislative and policy framework of the bioeconomy

Thank you! You have already completed the longest block and more than 50% of the survey! Now we would like to find out which new developments are forming the policy and legal framework of your region.

19. To what extent do you agree with the following statements?

	Totally disagree	Fully agree
In my country: Public awareness is high for sustainability	000	00
In my region: Public awareness is high for sustainability	000	000
In my country: Public acceptance is high for bio-based products	000	00
In my region: Public acceptance is high for bio-based products	000	000
National policy makers show a strong commitment with bioeconomy	000	00
Regional policy makers show a strong commitment with bioeconomy	000	000
Networks of bioeconomy actors are strong in my region	000	000
Visibility of bio-based products is high in my region	000	000
Stakeholders in my region have much knowledge in respect of bio-refining activities	000	00
Many easily accessible funding possibilities exist for bioeconomy enterprises in my region	000	000
Messages in the media in my region are mostly supporting bioeconomy	000	000

20. I think the strongest regulatory driver for bioeconomy is:

Please specify:

21. Is the national bioeconomy strategy in your country monitored?

○ Yes
○ No
○ I don't know
22. What is the name of the bioeconomy monitoring system/institution/project?
O Please specify:

I don't know



Block 4: Future bioeconomy legislation and policies

This is the last and shortest block of the survey. It aims to find suggestions for improvement of the legislative and policy framework of bioeconomy.

23. What are your views on bioeconomy policies based on the developments of the last 5 years?

	Pessimistically Optimistic	ally
I think about the future of bioeconomy policies.	$\circ \circ \circ \circ \circ$	

24. Please rate the importance of the following policy measures for the bioeconomy development <u>AND INDICATE</u>, if they are already implemented in the region you are operating in?

	Not important		Very important	Not implemented	Implemented	I don't know
Promoting research & development for bio-based innovation	000	0 0	0 0	0	0	0
Training & Capacity-Building	000	00	0 0	0	0	0
Pilot and demonstration facilities	000	0 0	0 0	0	0	0
Cluster development	000	00	0 0	0	0	0
Bio-based public procurement policy	000	0 0	0 0	0	0	0
Certification and labels explaining a product's life cycle impact, e.g. footprint	000	00	00	0	0	0
Consumer information and communication campaigns	• • •	0 0	0 0	•	0	0
Tax incentives	000	00	0 0	0	0	0
Removal of fossil fuel subsidies	000	00	0 0	0	0	0
Carbon tax	000	00	0 0	0	0	0
Regulations on biodiversity protection and ecosystem regeneration	000	0 0	• •	0	0	0
Circular economy regulations (recycling quotas, use of by-products, eco-design, life-cycle assessment of patents)	000	00	00	0	0	0

Other, please specify:



25. In general, which key principles should be prioritised for future bioeconomy policy formation?

	Not important	Very important
Displacement effects (land&water use, biodiversity, ecosystems services, food prices,)	000	00
Social sustainability and well-being	000	000
Potential to reduce GHG	000	00
Biodiversity	000	000
Planetary Boundaries	000	00
Energy security	000	000
Resource efficiency in domestic biomass supply (cascading of biomass resources)	000	00
Job creation	000	000
Technology development towards long-term solutions	000	00
Prices to industry	000	000
Prices to consumers	000	00
Other, please specify:		

26. Notes and Remarks: Is there anything else you would like to add? Did we forget something important?

Thank you!



Thank you for your participation!

Feel free to contact us

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Results



Figure A-1: Respondent's sectors of operation: The online survey participants could indicate which at maximum three bioeconomy sectors they deal with. The labels show the number of responses for each sector.

Table A-1: Obstacles results. (I don't know-answers are only considered, where indicated and are not included in the averages). Results to be highlighted are marked in yellow.

Question	Answer supplement to question	Response option scale	Results Ø	FI	DE	IT	PL	ES
Which impact does each	Regional policies		3.4	3.6	4.1	2.9	3.8	3.7
policy level have on	National policies	1 – No impact	3.5	4.0	3.6	3.4	3.8	3.3
bioeconomy actors within the region you operate in?	EU policies	5 – High impact	3.7	3.8	3.4	3.8	4.0	3.5
To what extent do you agree	Agriculture		3.7	3.8	3.4	3.8	3.8	3.7
with the following	Bio-Based chemicals and materials	1 - Totally	3.9	3.4	3.9	4.2	2.7	3.8
statements regarding your	egarding your	disagree	3.6	3.8	3.6	3.6	4.0	3.2
operation? Bioenergy	Bioenergy	5 - Fully agree	3.9	3.8	3.6	4.0	4.0	3.8
sector needs more attention	Biotechnology		3.8	3.4	3.7	3.9	4.0	3.6



Question	Answer supplement to question	Response option scale	Results Ø	FI	DE	IT	PL	ES
in the	Construction with bio-		4.2	3.6	4.3	4.1	4.7	4.3
legislative framework of	based materials			2.4	2.2	2.7	2.0	2.2
the region I	Fishery		3.4	3.1	3.3	3.7	2.8	3.2
operate m:	Forestry		3.6	3.3	3.8	4.0	2.3	3.4
	Wood and wood products		3.7	3.8	3.8	3.8	2.3	3.6
	Organic waste and residues		4.0	3.9	4.6	4.0	3.8	4.0
	Provision of biomass		2.7	3.6	3.2	2.3	2.3	2.6
	Logistics		2.7	3.4	3.0	2.3	2.7	2.8
To wh <u>at extent</u>	Conversion and processing of biomass		2.8	3.6	2.9	2.5	2.8	3.0
are the following stages	are the 1 - Hindered by following stages Consumption / market nolisies	2.7	3.0	2.9	2.6	3.0	2.6	
of bioeconomy value chains supported by policies in the region you	End of life (waste, recycling,)	5 - Well supported by policies	2.7	4.0	2.5	2.6	2.0	3.0
	Enabling Environment: Financing research and education		2.8	3.4	3.0	2.8	2.0	2.3
operate in?	Enabling Environment: Collaborations		3.0	3.1	3.3	3.0	2.3	2.6
	Enabling Environment: Long-term strategies		2.6	2.9	2.9	2.4	2.3	2.6
	Enabling Environment: Monitoring		2.4	2.9	2.4	2.3	2.3	2.5
	Lack of an international harmonized regulatory framework		3.3	3.5	3.5	3.3	3.8	3.0
	Lack of a national harmonized regulatory framework		3.6	3.3	3.8	3.5	4.0	3.5
Please rate the significance of each regulatory	Lack of international agreed sustainability criteria	1 - Low barrier	3.6	3.8	3.3	3.4	4.3	3.7
or policy barrier for bioeconomy	Lack of efficient and transparent standards	5 - High barrier	3.7	3.7	4.0	3.6	4.5	3.4
development in the region you operate in:	Lack of an internationally agreed certification system		3.5	2.8	3.8	3.6	4.5	3.1
	Lack of collaboration between government and value chain actors		3.6	3.5	4.3	3.4	4.0	3.3
	Lack of an efficient "green public		3.5	2.3	4.2	3.5	3.8	3.2

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Question	Answer supplement to	Response	Results	FI	DE	IT	PL	ES
	question	option scale	Ø					
	procurement" legislation at regional level							
	Lack of an efficient		3.8	3.3	4.0	3.8	4.5	3.3
	"green public							
	procurement" legislation							
	Unequal or unfair		3.3	3.8	3.1	3.3	3.5	3.3
	sustainability		0.0	0.0	0.1	0.0	0.0	0.0
	comparisons							
	Specific environmental		3.5	4.0	3.0	3.5	3.5	3.4
	development of bio-							
	based products or							
	processes							
	Uncertainty due to		3.9	3.8	3.4	4.0	4.5	3.8
	frequent regulatory							
	Vague, not measurable		4.0	4.3	3.6	4.0	4.8	3.9
	policy goals				0.0			0.0
	Too many policies with conflicting goals		3.8	4.2	3.3	3.8	4.8	3.6
	Administrative		1.9	2.3	2.6	1.5	2.3	2.2
	processes are short and							
	The policy landscape		2.5	3.4	3.0	2.3	1.5	2.6
	supports bioeconomy		_	-		-	_	-
	innovation							
	Economic concerns are		2.5	2.6	3.3	2.4	1.8	2.3
	policies for the							
	bioeconomy							
	Social concerns are		2.5	3.1	2.8	2.6	1.5	2.1
To what extent	adequately addressed by							
do you agree	bioeconomy							
with the	Environmental concerns	1 - Totally	2.8	3.7	2.7	3.0	1.5	2.3
following	are adequately	disagree						
regarding vour	addressed by policies for	5 - Fully agree						
region of	the bioeconomy		2.6	3.6	10	25	1 0	3.1
operation?	the material use of		2.0	5.0	1.5	2.5	1.0	5.4
	wood more than the							
	energy use							
	Legislation encourages		2.3	2.7	1.7	2.2	2.0	2.7
	products in the							
	construction sector							
	Legislation is designed to		2.2	3.0	2.1	2.1	2.3	2.1
	ensure a cascading use							
	legislation encourages		2.6	2 2	2.6	24	2.0	3 1
	the use of rest streams		2.0	5.5	2.0	2.7	2.0	5.1

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Question	Answer supplement to question	Response option scale	Results Ø	FI	DE	IT	PL	ES
	Building permissions	1 - Low barrier 5 - High barrier	4.0	3.5	3.3	4.1	4.5	3.7
Please rate the	Quality assurance		3.4	2.8	2.3	3.8	3.8	2.9
significance of each	Certification schemes		3.5	2.7	3.3	3.6	4.8	2.9
bureaucratic barrier for small	Industrial safety		3.1	2.0	2.5	3.4	3.5	3.3
sized bioeconomy	Categorisation of enterprise type		2.9	2.3	2.3	3.1	2.5	3.0
enterprises in the region you	Energy requirements		3.4	2.4	4.0	3.5	4.0	3.0
operate in:	Environmental requirements		3.8	3.3	3.8	4.0	4.0	3.3
	Admission procedures		3.9	3.9	3.0	4.0	4.3	3.7

Table A-2: Drivers and trends of regional bioeconomy. (I don't know-answers are only considered, where indicated and are not included in the averages). Results to be highlighted are marked in yellow.

Question	Answer supplement to question	Response option scale	Results Ø	FI	DE	IT	PL	ES
	Yes, explicit stand-alone BE strategies	/	31 %	50 %	33 %	18 %	40 %	50 %
Are there regional BE	Yes, implicit bioeconomy strategies in another strategy	/	33 %	50 %	22 %	35 %	20 %	25 %
your country?	No	/	24 %	0 %	44 %	35 %	0 %	8 %
	l don't know	/	11 %	0 %	0 %	12 %	40 %	17 %
Is the national	Yes	/	38 %	57 %	83 %	39 %	0 %	22 %
Strategy in your	No	/	13 %	0 %	17 %	13 %	25 %	22 %
monitored?	l don't know	/	49 %	43 %	33 %	48 %	75 %	67 %
To what extent	In my country: Public awareness is high for sustainability	1 - Totally	3.4	4.3	3.7	3.4	2.5	2.9
do you agree with the following statements?	In my region: Public awareness is high for sustainability	disagree 5 - Fully agree	3.2	4.1	3.4	3.2	2.3	2.7
	In my country: Public acceptance is high for bio-based products		3.4	4.4	2.8	3.4	3.0	3.2



Question	Answer supplement to question	Response option scale	Results Ø	FI	DE	IT	PL	ES
	In my region: Public acceptance is high for bio-based products		3.2	4.1	2.7	3.3	1.8	3.0
	National policy makers show a strong commitment with bioeconomy		2.7	3.6	3.0	2.6	1.8	2.6
	Regional policy makers show a strong commitment with bioeconomy		2.6	3.9	2.7	2.5	1.5	2.5
	Networks of bioeconomy actors are strong in my region		2.8	4.4	3.0	2.5	1.8	2.8
	Visibility of bio-based products is high in my region		2.6	3.9	2.3	2.5	1.8	2.4
	Stakeholders in my region have much knowledge in respect of bio-refining activities		2.7	3.6	3.3	2.3	2.3	3.0
	Many easily accessible funding possibilities exist for bioeconomy enterprises in my region		2.4	3.0	2.4	2.3	1.5	2.6
	Messages in the media in my region are mostly supporting bioeconomy		2.6	3.0	3.1	2.4	1.8	2.8
What are your views on bioeconomy policies based on the developments of the last 5	I think about the future of bioeconomy policies.	1 - pessimistic 5 - optimistic						
years?			3.4	3.5	3.3	3.4	4.3	3.2
	Promoting R&D for bio- based innovation		6.2	6.7	6.4	6.0	7.0	5.4
Please rate the importance of the following policy measures for the bioeconomy development:	Building	1 - Not	5.9	6.3	6.4	5.8	6.3	5.2
	Pilot and demonstration facilities	important	5.9	6.4	6.2	5.9	6.5	5.0
	Cluster development	7 - Very important	5.5	5.7	6.2	5.7	5.3	4.4
	BIO-based public procurement policy Certification and labels		5.6	6.0	6.1	5.8	6.0	4.3
	(product's life cycle impact)		5.5	5.1	5.9	5.6	6.3	4.6



Question	Answer supplement to question	Response option scale	Results Ø	FI	DE	IT	PL	ES
	Consumer information and communication campaigns		5.7	5.6	5.7	6.0	5.8	5.0
	Tax incentives		5.8	5.3	5.9	5.9	6.8	5.4
	Removal of fossil fuel subsidies		5.8	5.4	6.3	5.7	6.0	5.8
	Carbon tax		5.6	4.8	6.8	5.6	3.8	5.9
	Regulations on biodiversity protection and ecosystem regeneration		5.4	5.1	6.2	5.6	5.5	4.3
	Circular economy regulations (recycling quotas,)	-	6.0	5.9	6.6	6.1	5.5	5.2
	Displacement effects (land & water use, biodiversity, ecosystems services, food prices,)	ts and	4.3	4.7	4.2	4.4	4.0	3.9
	Social sustainability and well-being		4.3	4.6	4.0	4.3	4.5	4.0
In general.	Potential to reduce GHG		4.6	4.6	4.8	4.4	4.8	4.6
	Biodiversity		4.3	4.4	4.3	4.2	4.5	4.1
which key principles	Planetary Boundaries		3.7	4.3	4.0	3.4	4.0	3.7
should be prioritised for	Energy security		4.3	4.3	3.4	4.4	4.8	4.3
future bioeconomy policy formation?	Resource efficiency in domestic biomass supply (cascading of biomass resources)		4.5	4.4	4.6	4.5	4.5	4.3
	Job creation		4.4	4.4	3.4	4.6	4.3	4.5
	Technology development towards long-term solutions		4.5	5.0	4.2	4.5	5.0	4.4
	Prices to industry		3.7	3.6	2.8	3.8	4.5	4.0
	Prices to consumers		4.1	4.1	3.2	4.2	5.0	4.2



Annex IV: Interview outline

Backgro	ound information of interview						
Interview conducted:		DD/MM/YY					
Country		Partner country					
Interviewer		Name of person(s), who conducted the interview					
Interviewee		 Short information about the interviewee: Enterprise/institution, in which she/he is operating in 					
Region	of interviewee	Is the interviewee operating in one of the target regions from WP4? North Ostrobothnia, Kainuu and/or Lapland Saxony, Saxony-Anhalt and/or Thuringia Toskana and/or Abruzzo Warmia and/or Mazury Aragón and/or Catalonia					
Intervie	w questions:	Answers:					
1.	Which bioeconomy sectors (e.g. forestry, biochemicals, bioenergy) does your organization/institution operate within or which topics do you mostly deal with?	• Key point 1 of answer					
2.	Do you know of any good policy practices in the bioeconomy (on a regional level) in your region? If yes, why do you consider it/them as "good"?	•					
3.	What specific amendments or changes in the legal and political framework of bioeconomy would you welcome? Why? On the other hand, why have these changes not been implemented yet?	•					
4.	What (other) kind of legislative or political obstacles do bioeconomy enterprises face in your region?	•					
5.	Did the legislative and political obstacles change in the last 5 years? If yes, can you give examples?	•					
6.	Do bioeconomy-related enterprises in your region face bureaucratic hurdles and, if so, what kind of?	•					
7.	Is there anything you would like to add, which is important for you, e.g. something policy makers should know?						





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