POWER4BIO
REGIONS FOR BIOECONOMY

Summary report on specific interventions

Deliverable 5.5

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DATE: 31ST MARCH 2021

PUBLIC

Project POWER4BIO "emPOWERing regional stakeholders for realising the full potential of European BIOeconomy"
Grant Agreement no. 818351
H202-RUR-2018-2020

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 818351

Document Factsheet	
Project duration	From October 2018 to March 2021
Project website	https://power4bio.eu/
Document	Deliverable 5.5: Summary report on specific interventions
Work Package	WP5. Developing and reinforcing the bioeconomy in EU regions
Task	Task 5.4 Specific interventions in advanced regions (M16-M30)
Version	1
Version date	31.03.2021
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Reviewers	Christine Beusch (EPC), Ignacio Martin (CIRCE)
Type of deliverable	Report
Dissemination level	PU Public

Table 1 Document Factsheet

Document History			
Version	**Date**	**Main modification**	**Entity**
Draft 1	16/03/2021	Integrated reports for all WE regions	DBFZ
Draft 2	23/03/2021	Revisions from all WE regions and first reviewer	WE regions EPC
Consolidated	24/03/2021	Integrated revisions	DBFZ
Final Draft	30/03/2021	Comments final revisions	CIRCE
Final	31/03/2021	Integrated comments for final version	DBFZ

Table 2: Document History

ABBREVIATIONS

ACBS: Andalusian Circular Bioeconomy Strategy

BAE: Business Angels Europe

B2B: Business to Business

B2C: Business to Consumer

BBEPP: Bio Based Europe Pilot Plant

BSAT: Bioeconomy Strategy Accelerator Toolkit

CAP: Common Agriculture Policy

CEE: Central and East Europe

CBP: Center for Chemical-Biotechnological Processes

EAFRD: European Agricultural Fund for Rural Development

EBAN: European Business Angel Network

EIB: European Investment Bank

EIP: European Innovation Partnership

ECRN: European Chemical Regions Network

EMFF: European Maritime and Fisheries Fund

ERDF: European Regional Development Fund

EVOO: Extra Virgin Olive Oil

ESF: European Social Fund

FIT: Flanders Investment and Trade

FWO: Fund for Scientific Research

ILVO: Flemish Institute for Agricultural and Fisheries Research

KF: Key factors

LECA: Law for Circular Economy in Andalusia

LV: Flemish Department of Agriculture and Fisheries

NUVEC: Nucleus of Verification and Control (IT)

OVAM: Flemish Public Waste Agency

RAFVG: Autonomous Region Friuli Venezia Giulia

R&D: Research and Development

SAT: Self-Assessment Test

SDGs: Sustainable Development Goals

SME: Small and Medium Enterprise

S3: Smart Specialisation Strategy

SO: Strategic Objective

TRL: Technology Readiness Level

UNIZO: Flemish Organisation for the Self-Employed and SMEs

VLAO: Flemish Agency for Innovation & Entrepreneurship

VLAIO: Flemish Agency for Innovation and Entrepreneurship

VOKA: Flemish Chambers of Commerce and Industry

WE: Western Europe

WP: Work Package

PROJECT PARTNERS

CIRCE: Fundación CIRCE Centro de Investigación de Recursos y Consumos Energéticos

DBFZ: DBFZ DEUTSCHES BIOMASSEFORSCHUNGSZENTRUM GEMEINNUETZIGE GMBH

WR: STICHTING WAGENINGEN RESEARCH

META: META GROUP SRL

AKI: AGRARGAZDASAGI KUTATO INTEZET

NAK: MAGYAR AGRAR-, ELELMISZERGAZDASAGI ES VIDEKFEJLESZTESI KAMARA

EPC: EPC Project Corporation Climate. Sustainability. Communications. mbH

DRAXIS: DRAXIS ENVIRONMENTAL S.A.

BZN: Bay Zoltán Nonprofit Ltd. for Applied Research

UNFU: Ukrainian National Forestry University

CAGPDS (former CAPDER): Junta de Andalucía – Consejería de Agricultura, Ganadería, Pesca y Desarrollo Sostenible

MAE: Mazovia Energy Agency

USB: University of South Bohemia

CCB: Chemie Cluster Bayern GMBH

SPRING: Sustainable Processes and Resources for Innovation and National Growth

EWI: VLAAMS GEWEST (Government of Flanders)

SUA: Slovak University of Agriculture in Nitra

ECRN: European Chemical Regions Network (ECRN) e.V.

PUBLISHABLE SUMMARY

The bioeconomy involves the integration of various knowledge areas, policy fields and economic sectors (agriculture, forestry, waste management, wood industry, food industry, chemical and biotechnology). Apart from this, other structural components come into play to make its effective implementation possible, such as infrastructure (transport and logistics, biomass management, research and technological development, etc.), effective information dissemination, education and capacity building, creation of new markets, among others. This poses great challenges in its implementation at the national and regional levels, which not only require great political coordination efforts, but also actions that generate synergies between stakeholders who have traditionally remained in their own silos, and promote learning processes on how to work together in the development of new value chains, with interdisciplinary methods.

Regions with a high level of development in bioeconomy, such as those presented in this report, are leading the way in finding paths for an integrated bioeconomy implementation. Regions are driven to establish or update their bioeconomy strategies by challenges of their contextual case, as well as by regulation, sustainability requirements, the development of new value chains that make the most effective use of renewable resources, the contributions to climate change mitigation and to support the further development of collaborative platforms and development of skills.

In this report, the five Western and South European regions participating in POWER4BIO are featured, namely Andalusia (Spain), Bavaria (Germany), Saxony-Anhalt from Central Germany (Germany), Flanders (Belgium) and Piemonte (Italy). In addition, another region has joined the analysis process under the leadership of SPRING Cluster (IT) and is also included in this report, Friuli Venezia Giulia. For each region is presented, their regional status regarding bioeconomy, encountered challenges and specific interventions taken by the regions themselves and/or recommended during the development of the project. The interventions have been developed in following categories for four of the regions:

- Mobilization and cooperation among stakeholders
- Training Skills and Expertise
- Policy framework and legislation
- Funding and Financial instruments
- Business development and markets
- Biomass supply, availability, information and monitoring

To identify the interventions to be recommended for each region, the online Self-Assessment Tool from ESCSS, also used in Task 6.2 and previously with the Central and East European (CEE) project regions, was employed as a basis for a comparative analysis that would allow the regions to learn from each other. In particular, the region of Flanders has developed an overarching policy plan, which integrates the actual bioeconomy strategy in a larger framework, with a defined and ambitious vision of their bioeconomy to 2030 and promoting the sustainable and inclusive regional development. The region of Bavaria developed its new regional bioeconomy strategy, Future.Bioeconomy.Bavaria., with fifty planned measures that tackle much of identified challenges. Piemonte and Andalusia, are updating their bioeconomy strategies. Finally, the region of Friuli Venezia Giulia developed their own bioeconomy position paper, identifying the main focus and objectives of their regional bioeconomy and a perspective for future development.

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1 INTRODUCTION

In recent years, European policies and key strategic plans have been updated or newly developed to accelerate the realization of the Sustainable Development Goals (SDGs), such as the update of EU Bioeconomy Strategy (2018), the overarching plan of the European Green Deal (2019) and the new Circular Economy Action Plan (2020). These policy and action plans reinforce steps towards a CO2-neutral economy and provide additional instruments for the transition to economic models that maintain resource consumption within planetary boundaries. Countries and regions respond to these policy advances, drive to develop new regional bioeconomy strategies or revise and update existing ones. The beginning of the program period 2021 -2027 offers also a window of opportunity for the revision of Smart Specialization Strategies and with them actions directed towards circularity and bioeconomy activities in the regions.

Western (WE) and South European regions involved in POWER4BIO (Andalusia, Flanders, Bavaria, Central Germany, Piemonte and Friuli Venezia Giulia) are frontrunners in translating EU and country bioeconomy strategies at regional level. These regions have advanced initiatives for the use of regional renewable resources (non-food or not consumable), in the identification of key actors for their bioeconomy activities, the promotion of R&D+i plans, and the development of pilot and flagship biorefinery projects. These past years of implementation allow these regions to identify possible areas of improvement, challenges arising in the shift towards bioeconomy and possible areas of intervention.

This final report summarizes the status of partner WE and South European regions in POWER4BIO. It elaborates on their regional bioeconomy status, experienced challenges and specific interventions being applied or recommended for each one of the regions. In order to have a comparable approach when analysing the five regions, their responses to online ESCSS Self-Assessment Tool (SAT)[1] were used. This instrument selected and used along the project as an analysis tool helps regions to conduct a first assessment of the investment readiness level concerning sustainable chemical production. The SAT was supplemented with a semi-structured interview with representatives of each region in the project to identify main challenges to the implementation of bioeconomy in their regions and with a workshop including all project partners to discuss possible solutions to those challenges. The analysis revealed very similar challenges are shared among POWER4BIO regions, even considering the particular differences among them.

The specific interventions summarized in this report and aimed to overcome encountered challenges for bioeconomy implementation, stem also from a multi-governance policy alignment process, which consider also policies in related sectors such as the Common Agriculture Policy (CAP)[2] update and Farm-to-Fork strategy. This final deliverable culminates the activities in WP5 with WE and South European regions, and provides final input to the Bioeconomy Strategy Accelerator Toolkit (BSAT)[3], which encloses all key results of POWER4BIO and regional experiences in bioeconomy strategy development and update.

[1] Self-Assessment Tool (SAT) https://ec.europa.eu/growth/tools-databases/escss
[2] CAP-Related Material - POWER4BIO
[3] http://www.bioeconomy-strategy-toolkit.eu

2 METHODOLOGY

During the development of WP5 to support WE and South European regions in their identification of regional bioeconomy challenges and development of possible interventions, the following methodology was applied.

2.1 Interviews and follow-up calls

Beginning the activities of this task, a semi-structured interview was carried out with each one of WE and Southern regional partners. The template used (see Annex A) was simple and mainly concentrated on identifying priorities to deal with in Task 5.4, main barriers being experienced in regional bioeconomy, as well as possible solutions from their regional perspective and expertise.

At the point, available information from the regions had been collected one year ago with the Template 2.1. Thus, the discussion of regional status at the moment provided an update on the specific challenges, while noticing recurrent topics mentioned among the regions. As result, the initial categorization of challenges was drafted and later on used as the basis for workshop preparation.

Complementary, several bilateral and group calls were organised during the task duration. The main goal of these interactions was primarily to follow-up on regional activities, propose ideas towards the regional strategy update. Secondly, group calls were organized to provide a space for exchange among the regions.

2.2 Workshop: challenges of regional bioeconomy and possible solutions

The workshop regarding regional challenges and possible solutions to those challenges was organized to contribute to both Task 5.3 and Task 5.4. It took place during the Bavarian Cross-visit, on the 20th of January 2020 in Munich, with the attendance of all regional representatives and project partners. As previously mentioned, an initial characterisation of challenges was the base for this workshop, organising group discussions based on pre-categorisation of challenges. The main goal of the workshop was to identify jointly possible missing challenges, and overall to discuss possible solutions to systemic and complex challenges faced by regions in their bioeconomy activities. Further information and the summary of workshop results can be found in Deliverable 5.3.

Furthermore, the cross-visit in Central Germany was organized around the topic of challenges to regional bioeconomy. Although this event concentrated some sessions on regional aspects of Central Germany, it also focused on the shared challenges among regions. Thus, during the second day a workshop was organised to discuss three specific challenges, namely:

- How to incentivize the systemic contribution of bioeconomy?
- What impact regional bioeconomy strategies might/should have?
- In which ways could the gap between R&D and industry be closed?

The online workshop counted with about 60 attendants from all Europe and with the use of a polling tool, solutions to challenges were initially brainstormed and then prioritized. The main results of this workshop have been recounted and made available in the webpage of POWER4BIO[4].

2.3 SAT analysis for regional bioeconomy analysis and specific interventions

In the framework of Task 5.4, the SAT has been used as the main tool to get a comparable analysis regarding bioeconomy status for each one of WE and South European regions. As in other stages of the project, the comprehensive information collected for each region and automatic results of the tool have been leveraged for additional analysis. All WE and South regions were indicated to respond to both questionnaires proposed by the SAT, for biomass and for waste to be used in two Work Packages (WP) of the project, namely in Task 5.4 (specific interventions) and Task 6.2 (cross-border cooperation). All regions had filled out and provided their results by April 2020. The tool proposes an analysis of the same eight key factors (KF) per each questionnaire.

The automatic results of the SAT provide an automatic document with comments and recommendations and a spider diagram for each questionnaire. The diagram indicates between zero to ten a positioning of the region per each KF, while providing an average diagram as well for reference. It is indicated in the graphic that the average diagram is calculated based on random results of other regions that have responded to the SAT in Europe. This however was not conclusive for the analysis of the results, given that there was no indication of the regions used to frame the average, or even if perhaps repeated results of the same regions might be counted on the random calculation of this average.

[4] https://power4bio.eu/power4bio-cross-visit-to-central-germany-day-2-workshop#iLightbox[gallery_image_5]/1

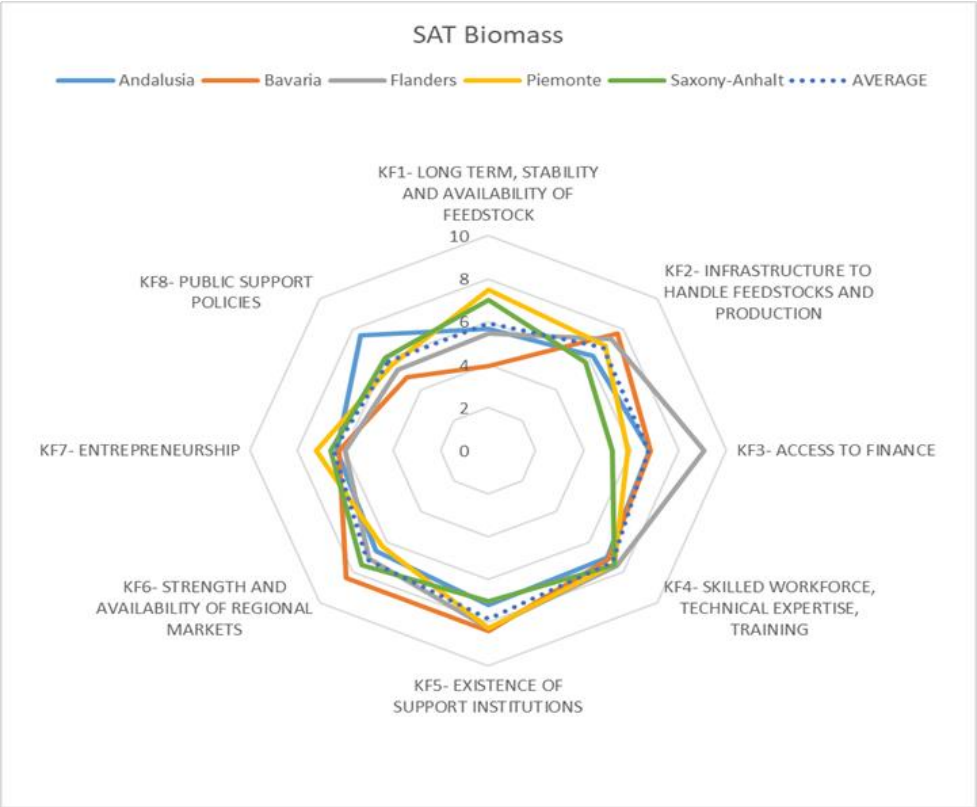

Figure 1: Results of the West- and South European regions in POWER4BIO from SAT-BIOMASS investment readiness level for a sustainable chemical production

Without being able to get additional information about the random selection of regions in the average for the comparison, it was decided to compare the spider diagrams of the five WE and Southern regions in POWER4BIO among themselves. This approach allowed for an additional perspective, given there is a good understanding of each one of the regions in the projects and a new average was calculated only among them. To facilitate the comparison and also based on regional status, from Central Germany only Saxony-Anhalt was selected for the analysis.

The overlap of spider diagrams from the biomass SAT questionnaire (see Figure 1) and from waste SAT questionnaire (see Figure 2), with the new average among only WE and South regions was used to identify key factors of the regional bioeconomy in need for improvement. Thus, for each region the key factors found under average for biomass and waste were selected to develop recommendations about possible interventions. In the process of developing recommendations, the collected challenges for bioeconomy implementation (from the experiences of POWER4BIO regions collected in workshops and follow-up calls) were related to the aspects evaluated with the SAT – both biomass and waste-. Complementarities have been analysed and decided that potential solutions and specific interventions will be developed within these seven categories (see Table 3).

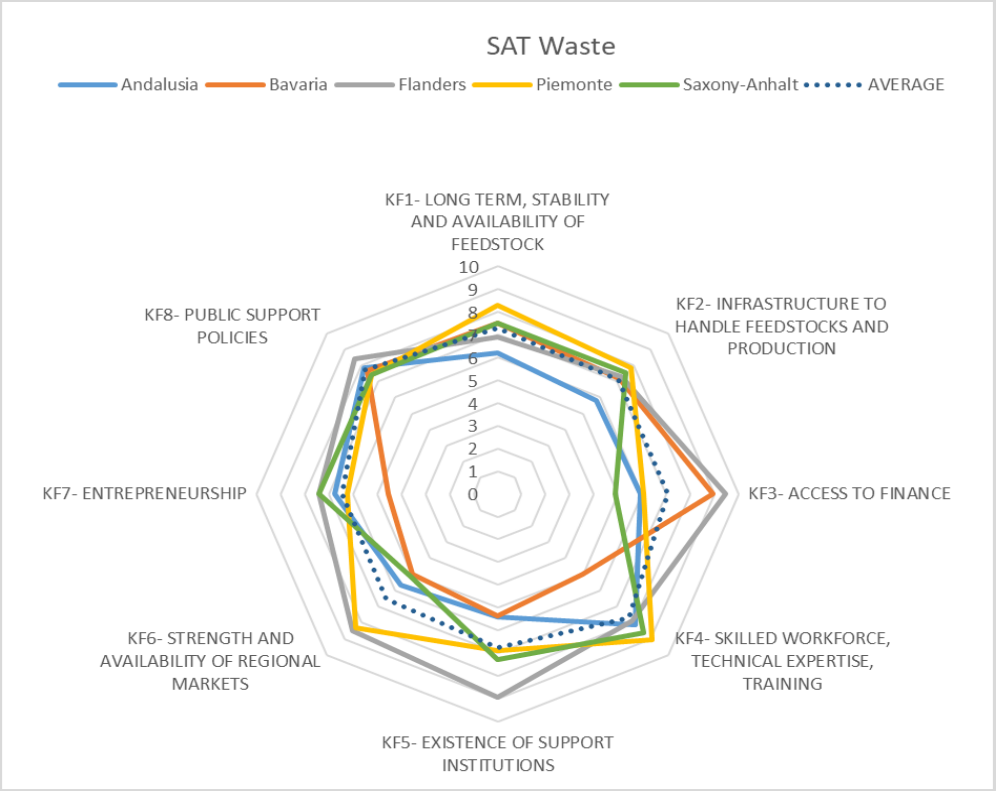

Figure 2: Results of the West- and South European regions in POWER4BIO from of the SAT WASTE - investment readiness level for a sustainable chemical production

Based on collected inputs from WE regions, as well as CEE regions in POWER4BIO, key challenges to regions developing their bioeconomy have been summarized (see *Annex B: Challenges to bioeconomy in EU regions*). These challenges and their categorization have been maintained as a structure for the identification of potential interventions to overcome them or initialize a process towards its resolution.

Relation between the Self-Assessment Tool and challenges categories.	
Challenge category	Complemented by/linked to SAT key factors
Mobilization and cooperation among stakeholders.	Certain aspects evaluated in KF1, KF2 and KF7 are linked to this category as influencing factors.
Lack of training, skills and expertise.	Complemented with KF4
Policy framework and legislation	Complemented with KF8
Business development and markets	Complemented with KF6, KF7 and specific aspects for support of business and new projects from KF5
Funding and Financial instruments	Complemented with KF3

Biomass supply, availability, information and monitoring	Complemented with KF1 and linked to KF2 for aspects of biomass management.
Sustainability	

Table 3: Relation between the Self-Assessment Tool and challenges categories.

The recommendations were generated in separate documents for four regions (Andalusia, Bavaria, Saxony-Anhalt and Piemonte), in some regional cases with several iterations of feedbacks and discussion about applicability of recommendations and enrichment of explanations or examples. As a special case the recommendations for Bavaria were developed together with the Chemie-Cluster Bayern initially as a contribution to the strategy process. However, after the new Bioeconomy Strategy was disclosed, the recommendations were reshaped as an analysis of the response of the strategy to identified areas of improvement in the SAT and possible paths to detail and prioritize the implementation of proposed measures.

3 KEY FACTORS FOR UPDATE AND DEVELOPMENT OF BIOECONOMY STRATEGIES AT REGIONAL LEVEL

Key factors and drivers for the update and revision of bioeconomy principals have been identified for the WE regions. These have allowed to recognise how more advanced regions respond to present challenges on their regional bioeconomy implementation. As well as, to realize how advanced regions prioritize and assess their new policies and translate them to their specific needs. A questionnaire has been used to collect the inputs from participant WE regions, with detailed responses for each region available in Annex C: *Identification of key factors which lead to updating bioeconomy strategies at regional level*. Hereafter the main conclusions have been summarized.

- General priorities and broad areas to foster:

The 5 WES regions account for the same general principles used in the launch of their respective bioeconomy strategies. Then, the same general priorities are still today valid, and are applied to the updated bioeconomy strategy (for those regions carrying out an update process). Among others, to boost structuring effect and mobilization of actors across the whole value chain and to keep promoting a cascading use of biomass are seen as key drivers.

Also, in most of the cases, the WES aim to align different policies and initiatives to avoid neither overlaps nor gaps, covering; policy framework and favourable political conditions, access to feedstock, infrastructure/industrial factors, transfer of know-how and market conditions.

- Regulation:

It is mostly recognized that the End of Waste regulation requires an update. For the time being, it is extremely time-consuming and create uncertainty for the commercialization of bio-based technologies. In some cases, the regions did not decide a regulatory framework to foster the bioeconomy. Nonetheless, it is acknowledged the importance of this aspect when boosting bioeconomy. In other cases, it is out of their control as it is determined at national level. Even though, it remains to be a very

sensitive issue at regional level. European regulations leave many aspects of relevance to national criteria, such as lack of coordination and lack of harmonization. This occurs in a similar way at the national level with the autonomies, being difficult to find univocal definitions. Thus, a fluid cooperation from the regional to the national level is highly encouraged. For example, in Bavaria, biowaste recyclers should be included in the bioeconomy to test possible ways to integrate bioplastics into composting facilities. The new strategy addresses this challenge by funding a pilot project in which bio-based, compostable plastic bags are being processed in an industrial composting plant. In the end, the EoW cannot be detrimental to the circular economy, as it this compromises the goal of the circular economy at regional level.

- Sustainability requirements:

Value chains and cycles must be redeveloped and restructured while also taking the aspects of climate protection into account. To this end, the sustainability requirements are in some regions under development. It is an important element which plays a key role in analysing the benefits of the bioeconomy field. However, this process has a large impact on the market development for waste stream valorisation. So, the alignment between innovative solutions for biobased activities and new sustainability requirements demands strong cooperation between actors and administrations.

- New value chains:

As part of the update exercise of the respective bioeconomy strategies or development of their strategies, each region has undertaken a review of the value chains to prioritise. In most of the cases, valorisation of industrial waste streams has been flagged of high interest; CO2/CO as feedstock – And other industrial streams for production of advanced fuels and/or chemicals, materials, reuse / Recovery of Waste for industrial production and / or energy use (consumer and / or industrial waste). Hence, the bioeconomy is broadened to a larger number of valuable streams, not only coming from agroforestry, which is seen as the traditional and more common source of useful biomass (feedstock for bioeconomy purposes). At the same time the logistics of renewable resources must be considered for the establishment of new value cycles. Also, new logistics chains must be established for thus far underused or unused resources as e.g. from food production or organic waste products. To sum up, this broader approach will imply a coherence with other policies and industrial needs.

- Climate Change:

It is a frequent question how much the bioeconomy contributes to mitigate climate change. The quantification however is much more complicated than in the case of renewable energy for example. This makes that much more detailed monitoring is necessary to account for climate change impact.

- Supporting tools to boost bioeconomy ecosystems

The WES regions apply and display a wide portfolio of incentives and actions to support and flourish their bioeconomy ecosystem. They are primarily; incentivize industrial clustering, promote industry 4.0 benefits in the bioeconomy arena, definition of by-product in the bioeconomy strategy and ensuring that environmental burdens are allocated consequently along the whole value chain, sector or life cycle stage.

The same applies to financial schemes. The regions use a wide range of financial actions. In any case, all of them promote large scale demonstration programs.

- Skills and collaborative platforms

These aspects are of instrumental importance for all the WES regions. Dialogue platforms are created in order to allow for an open discourse with the public and discuss questions related to the bioeconomy, its advantages, framework conditions and economic perspectives. Current environmental changes, economic stipulations, planetary limits, biodiversity and ecosystem services as well as man's reliance on nature are especially considered. However, skills are very important, but it is very difficult to develop a program for the bioeconomy. There are sufficient academic and technical education programs going on, but the big challenge is life-long learning and on-the-job training for persons who already left school and are working in related companies.

Lastly, despite the 5 studied WES regions are more advanced in the area of bioeconomy in comparison to the 5 CEE of the Power4Bio project, there is uncertainty about the development of possible markets arising from the productive areas that should form part of the bioeconomy. As this is an economic model that is already being developed in Europe, the difficulties for the business sector in general, and for the business sector in general, and of innovative companies in particular, to access new markets or to maintain their leadership new markets or to maintain the leadership quotas achieved in certain areas, in the face of international competition.

4 SPECIFIC INTERVENTIONS TO WESTERN AND SOUTHERN REGIONS

4.1 Andalusia (ES)[5]

4.1.1 Regional Status

The region of Andalusia is a model bioeconomy region, with an approved stand-alone circular bioeconomy strategy since September 2018. The Andalusian Circular Bioeconomy Strategy (ACBS) to 2030 was developed with the collaboration of more than 50 external experts from above mentioned sectors. Considering four strategic lines focused on r*esources, logistics, transformation and markets* and four instrumental programmes on *communications, R&D, funding and coordination*. The ACBS has been directed towards areas and activities of the bioeconomy that were less developed at the moment of strategy establishment and that, therefore, need major institutional support through the implementation of measures and specific actions to facilitate its development and consolidation in the medium-and-long term. Thus, the strategy does not include the primary and agro-industrial production of food for human consumption, as it is believed that these sectors are part of plans and strategies already developed. Nevertheless, food is considered as a resource for the circular bioeconomy if during the

[5] Representatives for Andalusia region in the POWER4BIO project have been the Andalusian Regional Ministry, which name has changed to Regional Ministry of Agriculture, Livestock, Fisheries and Sustainable Development of Andalusia. The acronym changed from CAPDER (Consejería de Agricultura, Pesca y Desarrollo Rural) to CAGPDS (Consejería de Agricultura, Ganadería, Pesca y Desarrollo Sostenible).

food-processing production, it is no longer intended for human consumption due to loss of quality or for not meeting the requirements needed.

The regional strategy includes as most relevant sectors for the regional bioeconomy the agriculture, forestry, fishing, food and paper production, as well as part of the chemical, biotechnology and energy industries in the region. Only on agriculture, the region generates around 8 million tons per year of biomass, highlighting sectors such as the olive grove (27%), horticulture (15%), wheat straw (14%) and corn straw (10%).

The priority value chains on bioeconomy for the region are horticulture and agri-food, olive, forestry, livestock farming and algae cultivation. While several new plants are expected to be developed before 2030, COVID-19 may impact the development of the previously set up objectives.

Among key actors for the regional value chains are foremost farmers and foresters – including forest wardens in charge of pruning and cleaning or trees, among other activities -, as well as algae producers. The region also highlights the importance of regional industry actors, including those connecting the feedstock producers with industrial facilities, thus making available biomass at place of utilisation. Furthermore, industry actors using waste as resources and developing innovative methods and technology for the exploitation of regional waste from the agri-food sector and other residual biomass are key to boost the current status of regional bioeconomy. Research and technology centres, and universities are key to establish collaborations with industry to promote the desired technological leap in the region towards utilization of biomass for high added-value products.

Presently the ACBS is under revision for an update, to align it with current innovation trends, newest regulation at European, National, and Regional levels, and public demands. Regulation improvement and update which related to the bioeconomy and could have a role in the new bioeconomy strategy is related to the need of promoting bioproducts in a similar way as in Green Public Procurement. Having a strategy on bioeconomy at regional level has conformed a success story by itself allowing Andalusia and in this case, its promoter, the Regional Ministry of Agriculture, Livestock, Fisheries and Sustainable Development of Andalusia the participation in European initiatives as BBI JU; H2020 or Interreg projects such as ICT-BIOCHAIN, BLUE BIO MED or POWER4BIO. This has paved the way to public administration visibility in Europe showing a commitment towards innovation, support, coordination and implementation of the insights related to the bioeconomy. It is worth noting that Andalusia was the first region in Spain in approving a Circular Bioeconomy Strategy and currently is the first (to our knowledge) in having a Law on Circular Economy (draft under revision after public consultation finalized in December 2020) which includes measures on bioeconomy as well.
In Andalusia there are two main instruments to look at when updating the current ACBS. These two policy instruments are:

- Law for Circular Economy in Andalusia (LECA)[6] – still a draft, final document to be announced.

[6] Current document accessible in this link *https://www.juntadeandalucia.es/servicios/participacion/todos-documentos/detalle/207737.html*

- Strategic Plan for the Competitiveness of the agricultural, livestock, fishing, agro-industrial and rural development sectors of Andalusia[7] ("Plan Estratégico para mejorar la competitividad del sector agrícola, ganadero, pesquero, agroindustrial y del desarrollo rural de Andalucía 2020 – 2022") (December 2020):

- In addition, at a National scale it is also relevant the new Circular Economy Strategy (Estrategia y Plan de Economía Circular de España 2030), while at an EU scale, other relevant policy instruments include: CAP, Green Deal, Farm-to-fork Strategy, as well as financial instruments such as European Agricultural Guarantee Fund (EAGF), European Agricultural Fund for Rural Development (EAFRD), European Regional Development Fund (ERDF), European Social Fund (ESF), European Maritime and Fisheries Fund (EMFF), COVID-19 - EU Solidarity Fund, or the Next Generation EU.

4.1.2 Barriers and challenges during strategy implementation

When revising the implementation of the strategy in the last two years, the regional administration (CAGPDS) analyses the advancement and perceived challenges according to the overarching goal and three specific goals of the ACBS. The strategy establishes as main objective to contribute to sustainable growth and development in Andalusia by foresting actions towards the production of renewable and biological products and processes, with following specific strategic objectives:

1. **Increase the availability of sustainable biomass for its use through innovative treatments.** In order to fulfil this objective, the first work has been the analysis and quantification of the available biomass in the region. The main challenge for this quantification is the diversity of the biomass produced in the region. The biomass produced in Andalusia includes among others: horticultural and agro-industry biomass (tomato, cucumber, pepper, aubergine, courgette, strawberry and other berries, etc), cereals (wheat, corn, barley, oats, rice, rye, etc), oilseed (sunflower), industrial (sugar beet, cotton, etc), forestry, olive sector (Andalusia is the main producer of olive oil worldwide), other pruning biomass, livestock biomass (slurry, manure and parts of animals not intended for human consumption), fishery discards and other by-products, algae, bio-residues, sewage and sludge from wastewater treatment. For this reason, a starting point has been the inclusion of a specific question on farmers' biowaste management in the application templates for the Common Agricultural Policy (CAP)'s direct payments. The information gathered has been analysed to identify priority areas to implement measures for an efficient waste management at farm scale.

2. **Increase the number of bio-industries and biorefineries in Andalusia.** The starting point for this aim was the identification of the needs for the development of biorefineries through an assessment (report available upon request) and a subsequent analysis of case studies or best

[7] *https://www.juntadeandalucia.es/export/drupaljda/PLAN_DE_COMPETITIVIDAD_2020-2022.pdf*

examples of entities applying the bioeconomy concept (report not made public yet and under revision). The development of this last report faced more difficulties due to companies' concerns about sharing sensitive data.

3. **Increase markets and the consumption of bioproducts and bioenergy in Andalusia.** This is a greater goal to be divided into several actions starting by dissemination of what is the bioeconomy and actions to the general public. This was developed through a website and social networks with no remarkable issues. Market uptake is a more complex aim. In this sense, a survey focusing on consumer perception of attributes of food products related to circular bioeconomy is currently being carried out, with the main challenge being to include relevant information in a simple straightforward way to obtain conclusions easily identified. In addition, we identify the following general barriers: sufficient demand, promotion, competitive cost, functionality, process competitiveness, sustainability, lack of supporting policies, regulatory challenges in placing the product on the market and confusion in certification/standardization.

One of the main actions coming out from the approved Strategy was to build a panel of indicators to measure and monitor the implementation of the cited document actions. The final construction of indicators is under development to date. The set of indicators is already established; however, these indicators have to be calculated from information that is spread through several departments which makes the whole compilation difficult.

There are several types of indicators under construction. The first group stands for the indicators related to the available biomass for which one example is the available biomass resources derived from agricultural activity. Each of them is calculated by the difference between generated and consumed biomass for each group of biomass resources. Regarding bioindustry there is another series of indicators as well as for research and innovation in the bioeconomy.

Other experienced difficulties are related to the needs from the Regional Ministry to understand company issues (any type: start-ups, SMEs, big enterprises). Companies are in general full of other commitments to dedicate time to explain this and at the same time there is a lack of confidence in public administration initiatives to solve issues in the long term. However, other reasons are related to the need of to create networks of the main agents involved in the bioeconomy since many times the opportunities are not found by the users.

As mentioned before, a simple example was referred to the action within the Strategy to develop an analysis report of best examples in relation to the bioeconomy in the region, having difficulties to collect a complete range of companies as some did not seem to show enough commitment or interest to participate in this.

Sometimes it is the high bureaucratic procedures difficult to fulfil because of the lack of knowledge or time making processes too long.

An additional challenge to optimization of biomass utilization is the issue with categorization of that biomass. If for instance the sub-products are categorized as residues (legally) then they cannot be used in another process as biorefinery for high value product manufacturing. These "residues" would need to start a procedure to be considered as "by-products" or entities intending to use this "waste" are to

constitute themselves as “waste managers”, implying a long bureaucratic process in any of the cases. This leads to certification and standardization needs too.

A general aim is to involve all actors of the fourfold approach: knowledge centres, administration, companies and society and this is not always easy as the mobilization approaches are different for each type.

A primordial action of the ACBS is the establishment of a regional cluster to agglutinate entities from academia, industry, society and public sector related to the bioeconomy in order to foster the cooperation among them, this is under development due to two main reasons, (1) the update of internal responsibilities for the promotion of this cluster and (2) because of the difficulties to mobilize the high number of entities which can be involved in the many bioeconomy activities in a region as large as Andalusia. However, the initiative to foster this cluster has come from the Regional Ministry showing the interest in having such a cluster within the region.

One specific issue for the bioeconomy in Andalusia is the mobilisation of the secondary sector as there is a need to engage with chemical companies as an urgent action. Universities and technological centres are sometimes difficult to mobilise too. This makes the promotion of flagship initiatives to boost industrial involvement of a great interest. However, the bioeconomy is still seen as only related to biowaste in agriculture and of course is one of the main sectors because of the input to gross domestic product of the region but this shall go further to develop industry from the bioresources.

4.1.3 Proposed specific interventions for Andalusia

New items of inclusion revised by the Regional Ministry of Agriculture, Livestock, Fisheries and Sustainable Development of Andalusia for the ACBS update are related to biodiversity and soil conservation aspects, as well as digitization as a mainstream element of policies in the next multiannual financial framework. On the other hand, it must be highlighted that the COVID-19 situation has become an opportunity to promote the local component closely related to bioeconomy issues.

Another area to include is the key enabling factors and barriers for the development of circular bioeconomy entrepreneurial initiatives case studies in Andalusia. This is utterly useful but also particularly timely to incorporate more knowledge of the specific stakeholders in the region is required to promote and design the suitable proper incentives to them. In this regard, enabling factors can be summarised as social and public demands or business motivations by themselves while barriers are more generally related to several types of actions. Both, enabling factors and barriers are summarised in the tables below:

Enabling factors for realization of business based on circular bioeconomy	
Driving force / Social demand / Public policies	- Business motivation
Technology and innovation	- Specific technological knowledge.

Market organization	- Private profitability. - 'Recycling' of available fixed assets.
Pressure on ecosystems and climate change	- Ethical commitment to the environment. - Need for waste management.
Consumer preferences	- Corporate image / reputation.
Public policies	- Support from public administrations. - Mandatory environmental regulation.

Barriers	Limiting factors of circular bioeconomy activities
Policy and regulation	- Bureaucracy - Legislation regulating the activity
Technology and materials	- Technological - Logistics
Market and investment conditions	- Financial. - Market-competition.
Social acceptance	- Market-product.
Knowledge and networks	- Human Resources

Also, it is important to incorporate a review of the next financial policy framework and how the bioeconomy fits in the newest funding programmes in the context of Andalusia. Specifically, a wide vision of the new framework is needed as well as its coordination with not only circular bioeconomy but also circular economy.

Results from the preferences and knowledge of Andalusian citizens regarding circular bioeconomy indicate that to understand consumers' preferences for attributes of food products related to circular bioeconomy is very useful to shape marketing strategies and policies towards a more circular agri-food sector. CAGPDS carried out a large survey (N=1013) of Andalusian consumers of two key food products produced and consumed in the region, which are extra virgin olive oil (EVOO) and tomato salad, using best-worst scaling to rank attributes that determine consumers' purchase decisions of these two products. Questions about opinions, attitudes and knowledge are also included in the questionnaire. First results for the two products show that sustainable water use, no generation of plastic wastes, and contribution to rural economy rank high, while soil conservation and, especially, no generation of plant

wastes rank low, with intermediate intensity of preferences found for biodiversity care and carbon neutrality. Almost four-fifths of surveyed consumers do not absolutely know the term circular bioeconomy, and for a majority of them a zero-waste certification would determine the purchase of EVOO and tomato salad. These results will be very helpful for decision-making both within the agri-food sector and the regional government.

Planned interventions for Andalusian Bioeconomy	
Thematic	Interventions
Alignment with the Strategic Plan for Competitiveness with regards to some priorities in the circular bioeconomy. In particular considering series of strategic lines that comprise the corresponding programmes and measures to advance along the path of the values of the bioeconomy	Among the main desired actions are (not complete list): - Better market orientation and the opening of new markets for (bio)products. - The transfer of knowledge including the most recent and profitable innovations for the (bio)sector. - Improving financial training and specific products created for the sector by financial institutions, so as to increase business training. - A plan will be developed to support tangible and intangible investments in the Andalusian agri-food industry. This intended to support the expansion and modernisation of the sector, new facilities, organic growth, among others.
Sustainable agricultural production: aims to maintain environmentally beneficial activities in the face of the risk of abandonment, as well as the introduction of production systems that allow for a more sustainable use of natural resources and the sustainable development of genetic resources in the region.	- One of the objectives is to promote agricultural and livestock production systems and models that respect soil, water and biodiversity resources. - Restore, preserve and enhance biodiversity (including in Natura 2000 areas and areas with natural constraints high nature value farming systems and European landscapes). - Improving water management, including fertiliser and pesticide management - Preventing soil erosion and improving soil management - Achieving more efficient water use in agriculture and livestock farming - Reducing greenhouse gas and ammonia emissions from crop and livestock farming - Promote carbon conservation and sequestration in the agriculture, livestock and forestry sectors.

Sustainable production in the agro-industy: the aim is to increase the area dedicated to sustainable production by FVPOs (fruit and vegetables producer organizations). The aim is to support investment in environmental objectives.	Some of the measures to develop in this program of strategic line six on sustainability are: - Improved water use or management, including water saving and drainage. - Actions to conserve soil. - Actions to create or maintain habitats favourable to biodiversity. -

Table 4: Planned interventions for Bioeconomy in Andalusia

Additional information regarding planned interventions in Table 4, the corresponding programs, objectives and up to date planned measures for the ACBS update can be found in Annex D: *Andalusian bioeconomy planned specific interventions.*

Additional specific interventions have been recommended to Andalusia in POWER4BIO and have been revised by the Regional Ministry of Agriculture, Livestock, Fisheries and Sustainable Development (CAGPDS) of the region. These will be considered in the ongoing revision of the strategy and their possible integration as implementation measures for the updated roadmap of the regional strategy. The following is a highlight of the most relevant recommendations for the region:

Summary of recommended specific interventions to Andalusia	
Mobilization and cooperation among stakeholders	• Promote research projects among the existent centres of excellence, other research centres and universities in cooperation with established chemical industry and nascent companies (SMEs) interested in proving the valorisation of available waste resources in the region. • A supportive service to promote the use and valorisation of available waste streams in the region is the development of a business-to-business waste exchange platform. The platform should be designed to enhance the inter-sectoral and/or cross-sectoral exchange of waste, facilitating materials matching exchange and market uptake of waste streams between businesses.
Policy framework and legislation	• Policies towards incentivizing the demand of bio-based products or lead market initiatives[8] to bridge the demand gap in the region, improving clarity on used standards for bio-based and circular products and improve visibility to key segments of the market should be continuously revised. Identify with innovators, start-ups and SME´s and other bigger companies in the region the effectiveness of such measures and their current needs to access markets.

[8] https://ec.europa.eu/growth/content/lead-market-initiative-%E2%80%93-speed-time-market-innovations-and-pilot-new-innovation-policy-0_en

Business development and markets	• To increase competitiveness of bio-based products in the regional and national market in comparison to their fossil-based substitutes a recommendation to the national government could be started from the regional context to promote a tax exception on nationally produced bio-based products – it could benefit the B&B and B&C markets-. • Information regarding business models, identification of good bioeconomy business models in other regions and key aspects for their replication could be of great support for regional actors participating in diverse value chains. Other resources apart from those found in Deliverable 3.4 and 4.1 in POWER4BIO could be also consulted in Project BE-Rural[9], and use tools from Project Rubizmo[10]. • Innovation prize competitions should be reinforced for biotechnology, biochemicals and biomaterial innovations that utilize regional biomass resources and propose business models that impulse the attainment of SDG´s in the region. Linked to these competitions, new collaborations formats among universities, research centres and technology companies could be promoted such as the Intoa! Lean Business Programm in Finland[11]. This program proposes a new model of cooperation between companies and universities bringing a specific challenge of the company to be solved in multidisciplinary teams conformed by students and researchers[12].
Funding and Financial instruments	• Improve access to finance in the form of a guarantee portfolio. Guarantees represent suitable FIs for those MAs that are interested in addressing specific risk capacity constraints in a given market segment, setting up a new financial instrument with limited financial resources with low management costs and high leverage effect. More information about pros and cons of this type of financial instruments can be found in D4.4, page 16. • With regard to guarantees, consider the opportunity offered by the ***off-the-shelf financial instruments***. Off-the-shelf financial instruments provide standard terms and conditions, which are compatible with ESI Funds regulation and state aid rules and seek to combine public and private resources. • Activate services aimed at supporting a selected group of projects in improving their ***investment readiness***. This is particularly relevant with regard to Measure B.1 of the Andalusian Circular Bioeconomy strategy. **Technology transfer** is a priority for Andalusia Region. Promoting R&D+I+T is one of the 4 main pro-

[9] https://be-rural.eu/wp-content/uploads/2019/12/BE-Rural_D2.4_Regional_business_models.pdf
[10] https://rubizmo.eu/business
[11] https://www.utu.fi/en/news/news/intoa-lean-business-programme-enters-hacking-higher-education-competition
[12] https://www.interregeurope.eu/ecoris3/news/news-article/2201/the-intoa-lean-business-program/

	grammes in the bioeconomy strategy. Dissemination and exploitation play a key role in maximising the societal and economic impact of Research & Innovation activities in this field and to make sure that the economic system can benefit from the resources invested in these activities. • Equity can be complemented with additional financial products (loans and guarantees) including grants for lower TRL. Consider the opportunity offered by the off-the-shelf financial instruments. Particularly, the "Co-investment Facility" serves as a mean of attracting additional investments in SMEs through a partnership approach with Equity Investment funds or other market participants making investments. • Draw your attention to potential synergies with the new EIB/EIF finance instruments. This is key to set up financial instruments that can generate a relevant and durable impact on the territory. Access to these instruments for regional beneficiaries can be fostered and supported by regional policies and funding using either ESIF or other regional or national public funds to meet requirements in EIB's risk and due diligence assessments.
Biomass supply, availability, information and monitoring	• Assessment of technical potential of waste streams, as well as the gathering processes (waste management, waste collection centres, etc), and their availability to be used. Based on these strategies can be developed to reduce legislative hurdles for waste types that have been identified as alternative raw materials for energetic or material uses. • Identify geographically where are located the waste management centres, wastewater treatment plants and treatment facilities for sewage sludge. Identify the hurdles and opportunities for sludge management and further valorisation into fertilizers and phosphorus nutrients for the agriculture industry.

Table 5: Summary of recommended specific interventions to Andalusia

4.2 Bavaria (DE)

4.2.1 Regional Status

Bavaria defines the Bioeconomy as a viable, sustainable and bio-based economic system that takes the potential and limitations of natural resources into account. On the one hand, the bioeconomy is to contribute to environmental, resource and climate protection and, on the other, provide added value for locally sourced raw materials, create new workplaces, strengthen international competitiveness and develop new markets.

The region has identified that by 2018, regional cultivated area to supply renewable resources for energetic and material uses was around 451.000 ha, of which 91% is dedicated for energy production and 9% for material use. Bavaria has strong potential to provide many kinds of biobased resources from

agriculture (straw, hemp, cereals, potatoes, sugar beet, rape seed) and wood with a total of 2.6M ha of forest and important forest industry residues. Furthermore, food processing industries are present, such as sugar refinery, oils production, starches and starch derivatives. The region also provides excellent research infrastructure on bio-based economy, as well as a strong ecosystem for technology transfer. There are many R&D projects on valorisation of bio-based raw materials and there is competence centres and clusters for application and business development - Chemie-Cluster Bayern GmbH, Chemie Neue Werkstoffe-Bayern Innovativ, Cluster-Initiative Forst und Holz in Bayern GmbH, among others – offering a scene for technological development and impulse towards high-added value products.

The use of biomass already plays a role, e. g. biomass to energy, biomass to liquid, high-tech utilization of potato starch, bio-based coatings. While other residuals from agriculture from viticulture and hops, spent grains and grass clippings, as well as waste materials as liquid manure, animal and fat waste offer an untapped potential to contribute to current value chains and the establishment of new ones.

In November 2020 the Bavarian Ministry of Economic Affairs, Regional Development & Energy released the Bavarian Bioeconomy Strategy **"Future. Bioeconomy. Bavaria"**[13] after a strong participatory process during the same year that included key bioeconomy related sectors, namely agriculture, forestry, biotechnology, chemistry, environmental technology, forestry, nutrition, new materials and wood.

Development of the bioeconomy strategy in Bavaria

With the establishment of the Bioeconomy Council in 2015, Bavaria set the foundations for developing a Bavarian bioeconomy strategy. Simultaneously, the ever-increasing R&D achievements of Bavarian universities and companies, alongside the further development of the TUM Campus Straubing for biotechnology and sustainability, facilitated essential capabilities and best practice examples for the bioeconomy in Bavaria.

The Bavarian Ministry of Economy Affairs, Regional Development and Energy took over the strategy development process in 2019. Previously, it was being leaded by the Bavarian Ministry of Food, Agriculture and Forestry. On March 5th 2020, the Minister of Economic Affairs, Hubert Aiwanger, officially launched the development of a bioeconomy strategy for Bavaria. As part of a participatory process, representatives of agricultural and forestry production, business, science and society contributed various ideas for the transformation to a biobased economy. The process included workshops, interviews with experts from trade, communications, consumer protection, nutrition, recycling and waste management, among others, as well as input from associated ministries, Bavarian networks and clusters.

Workshop topics within the strategy development process were:

- Feedstock supply / availability
- Use of feedstock, industrial processes, product development
- Recycling, collection, circular economy
- Research, Innovation, Education
- Society, consumption, communication

[13] Available version in German: https://www.stmwi.bayern.de/fileadmin/user_upload/stmwi/Publikationen/2020/2020-11-23_Zukunft-BiooekonomieBayern-BF.pdf
Available version in English: https://www.stmwi.bayern.de/fileadmin/user_upload/stmwi/Publikationen/2021/2021-02-02_FutureBioeconomyBavaria_BF.pdf

Building on this, the Bavarian Bioeconomy Strategy was developed under the leadership of the Bavarian State Ministry of Economic Affairs and closely accompanied by the Bioeconomy Council Bavaria and the interministerial working group on Renewable Resources and Bioeconomy. On November 23rd 2020, the Bavarian Minister for Economic Affairs, Hubert Aiwanger, officially presented the Bavarian Bioeconomy Strategy.

With its bioeconomy strategy, the Bavarian State Government creates impulses for new ideas and actions and highlights political course adjustments for the bio-based future of Bavaria. Based on regional location factors, the strategy shows the way to a sustainable and ecologically responsible as well as socially just and thus sustainable way of life and economy. It defines 50 concrete measures to support all relevant actors for a bioeconomic transformation - society, administration and politics, agriculture and forestry, companies as well as science and research.

Goals of the Bavarian Bioeconomy Strategy

- Reduction in the consumption of fossil raw materials through the implementation of a sustainable, future-oriented economy and the development of sustainable, biobased technologies, processes and products
- Contribution to environmental protection, resource conservation and protection of biodiversity
- Contribution to the implementation of the objectives of the Bavarian Climate Protection Program 2050 and the Bavarian Climate Protection Offensive, in particular the legally binding objectives of a Bavarian Climate Protection Act
- Promote open dialogue and enable societal participation to achieve acceptance and understanding of the bioeconomy in society.
- Contribution to the Bavarian way of "protecting and using" domestic renewable raw materials. The bioeconomy adds value to these resources and creates or secures new income prospects and jobs in rural and urban areas.
- Securing international competitiveness and opening up new markets through progressive use of renewable raw materials as well as residual and waste materials, if possible, according to the principle of coupling and cascade use. This triggers the development of new technologies, materials and substances as well as the necessary processes for innovative products. This creates new jobs within the framework of a sustainable economic system.
- Efforts to be a leading location for sustainable products and production methods and thus a role model for other regions
- Strengthening of science for the further development of biological knowledge and targeted knowledge transfer to the industry

To achieve those goals, 50 measures were defined in seven sections:

1. Strengthening the circular, sustainable bioeconomy.
2. Strengthening the willingness of society for transformation
3. Administration and politics on the path of transformation
4. Strengthening agriculture and forestry on the path of transformation
5. Strengthening companies on the path of transformation
6. Strengthening science and research to support transformation
7. Strengthening cooperation

4.2.2 Barriers and challenges to regional bioeconomy

Key findings from the participative strategy development process were that Bavaria already has several bioeconomy-associated actors and very broad industries. Many good examples of bio-based solutions, activities and initiatives exist in the region. But the connection between those actors and the collaborations between them are a challenge. For this reason, cooperation between actors in the bioeconomy, both within Bavaria as well as across Germany and Europe, is addressed particularly extensive within the strategy. To stay cutting-edge, the Bavarian research landscape should continue to be strengthened and expanded.

Additionally, the legal framework and financial support structures in Bavaria are areas to improve in terms of bioeconomy. Furthermore, it became evident that the primary sector, the public and the financing bodies need to be better informed, involved and motivated for bioeconomic endeavours. For this reason, the strategy contains several measures that aim to revise legislation on the one hand and to attract investors on the other. There are also measures for addressing and involving the public: the establishment of information centres, such as museums, educational work, platforms and the anchoring of bioeconomy in the Bavarian education system. In order to improve the attractiveness of the bioeconomy, the public sector should set a good example and give preference to biobased technologies and products.

Other main areas of improvement identified through the SAT, correspond to:

- The lack of a comprehensive study regarding biomass availability - on the amount, location and characteristics (e.g. format, moisture content, energy value, etc) of feedstock - that could potentially be used for the bioeconomy in the long term, although this has been acknowledge in the newly disclose Bioeconomy Strategy. On the same line there is a lack of data on the extent to which the use of biomass for bioeconomy conflicts with the interests of agriculture and biomass heating plants.
- Furthermore, biomass in the region is quite scattered which implies a challenge to implement the feedstock's supply chain and need for further studies to assess the feasibility of this use. Considering there are already some initiatives that could be consulted to assess if the biorefinery concept could be applied or developed, taking advantage of previously carried out work.
- The region has a large academic offer for skilled workforce in R&D on biomass utilization concepts, including specialization post-graduate/master degrees in the field of waste use for the production of more sustainable chemicals. This builds a good base for biorefineries and bio-based initiatives. However, no explicit information was found if there is a lack of skilled workers for the expansion of the bioeconomy or unemployment in the sectors. Nor were any programs found to inspire young people to take up jobs in agriculture and forestry. This is true for both the primary and secondary sectors. In addition, there is a lack of information on the extent to which vocational training or further training measures for specialists in agriculture and forestry incorporate basic knowledge for the realization of bioeconomy projects.
- There are various institutions in Bavaria, which are envisioned to mediate and grant investments, loans, accompany project development and technology transfer and attract settlements. However, it is unclear how well they are interconnected with each other and with the bioeconomy ecosystem.

- The chemical industry in the region growths in importance towards a consolidation of sustainable chemical industry and the use of waste as feedstock. Support and financial conditions for start-ups are good in Bavaria. Ambition to start new businesses is also growing in natural sciences (although it still can be improved). The financial basis for investing in future technologies and scaling industrial processes appears to be provided in the region as well as existence of sufficiently capital-strong companies and banks, and the region itself has a positive balance sheet. There are private and public investors, loans, and equity funds that invest in sustainable projects or follow ESG principles. However, it is unknown how much funding bioeconomy projects receive from these investments and whether the investment volumes for bioeconomy projects are sufficiently high. In addition, most bioeconomy start-ups at 3-5 years of age face the challenge of making large investments in equipment. Without a market position, first sales or pilot customers, this is hardly achievable.

4.2.3 Proposed specific interventions for Bavaria

The Bavarian Bioeconomy Strategy is embedded within the context of several regional, national and EU strategies. In response to the global challenge, Bavaria is also becoming increasingly aware of the need for effective measures to protect the climate and preserve ecosystems. Economic systems must adapt and develop alternatives. Bavaria is already currently orientating its sustainability strategy according to the Sustainable Development Goals of the United Nations.

Bioeconomic measures can help in the fight against climate change and achieve related climate-policy goals enshrined in law, which specifically includes attaining climate neutrality by 2050 at the latest. Thus, the bioeconomy strategy is part of the Bavarian climate initiative, which aims for climate neutrality through "reduction, adaptation and research". Furthermore, the strategy contributes at the state level to achieving the goals set by Germany with its national strategy and by the EU with its bioeconomy strategy and the European Green Deal.

The strategy is also committed to the goals of the Bavarian Biodiversity Strategy for the conservation of species diversity and the preservation of habitats. Resulting limitations on the use of renewable raw materials should be taken into account. With regard to the material use of wood, the Bavarian state government has set itself targets for climate-friendly building and the exemplary function of public building.

Modern technologies of the future, such as industrial biotechnology, are particularly important for the sustainable, circular use of biomass. Thus, the Innovation Strategy of Bavaria is closely interwoven with the Bioeconomy Strategy. With its High-Tech Agenda, Bavaria promotes research and innovation and thus secures competences in promising technologies and the international competitiveness of the region.

In this context, technologies for CO_2-free energy, green hydrogen and climate-neutral mobility play a major role. The Bavarian hydrogen strategy is intended to bring hydrogen technologies into use quickly. The basis for the energy policy is the Bavarian Energy Action Programme, which addresses bioenergy in specific measures. Finally, the Bavarian Bioeconomy Strategy includes the production of bio-based raw materials from agriculture and forestry for food, material and energetic use. Environmentally compatible cultivation practices and usage recommendations are to be considered.

Together DBFZ and the Chemie-Cluster Bayern (CCB) analysed the results of SAT in the framework of the new Bavarian Bioeconomy Strategy. This resulted in a summary of considerations for the implementation of envisioned measures, for those areas of Bavarian bioeconomy that were found to need reinforcement. During the analysis it was found that the strategy had indeed consider several of the areas identified as in need of action in SAT, with ambitious measures leveraged on the regional strengths and setting the main paths to build further the regional bioeconomy. Further insights on the analysis is to be found in Table 6.

Summary of analysis regarding the implementation of Bavaria Bioeconomy Strategy	
Mobilization and cooperation among stakeholders	Under Measure 22, the analysis of available biomass and generation of scenarios to identify possible utilization paths are planned. • The biomass availability study and scenarios are seen as an opportunity to strengthen the connection between industries, research institutions and universities, if a collaborative network is created for these studies and collection of required information. This will in turn increase the transparency and confidence in final recommendations and criteria. • The strategy considers the promotion of exchange and collaboration by strengthening and establishing new bioeconomy networks nation-wide and internationally for innovation (measure 41 and 43). To boost the effect of those measures is key to find complementarities among the region and trans-regional networks in which Bavaria.
Training Skills and Expertise	Measures 12 and 13 in the new bioeconomy strategy promote the inclusion of bioeconomy in school curriculum and systemic components of bioeconomy in diverse university degree programs. • To further the creation of competences for bioeconomy, it is of great importance to address the knowledge gaps in vocational training, which can cover skills for biomass procurement and handling, among others. Taking these aspects into account will support the integration of primary sector, key for stability in regional bioeconomy value chains and establishment of new ones. Thus, enabling a successful regional bioeconomy. • Mapping needed skills to support bioeconomy value chains development should be the first step towards effective competence development. Skills areas can be related to the primary sector, manufacture, transport, biomass logistics, flexibilization of logistic hubs, as well as those skills for relevant sectors identified in the strategy. Furthermore, foreseeable trends in bioeconomy and specialization areas in the region should be taken into account to include in the mapping possible future needed skills. • This should be accompanied by a mapping of regional capacities to provide new technical and vocational training to local and regional actors. Identifying established institutions, existent training materials (developed in the region or from other sources such as EU projects) and whether specific groups in need for

	training are currently or not reachable by existent institutions and training plans.
Policy framework and legislation	• Measure 1 of the Bavarian Bioeconomy Strategy addresses a review with regard to the influence of the bioeconomy and necessary adjustments when amending laws. It would be advisable to extend the review of all laws and regulations in this manner, regardless an amendment process is active or not and in view of possible conflicting goals • The Bavarian bioeconomy strategy did not introduce new funding programs or regulations in favour of the bioeconomy. Existing funding programmes touch on parts of the bioeconomy, but fund mainly R&D than technology investment and process scale-up. These findings should be considered when implementing measures 32, which encourages to use existing funding programs that apply to bioeconomy projects, and measure 34, which announces the provision of financial means for pilot / demonstration and first-of-its-kind plants. • As stated in measure 5, the Bavarian state government will get engage in a sustainable product policy at federal and EU level. The aim is to design products in such a way that they are durable, consist of a high share of recycled materials, are easy to repair and can be recycled to a high degree. Rapid implementation of the action plan for the circular economy is expressly supported. These efforts can prepare the market for circular products and incentivize investments in waste management and recovery systems.
Business development and markets	• In order to implement the collection and utilisation of potential waste streams, the incentives and drivers that will motivate the owners or managers of subsidiary waste streams should be discussed and supported. This will require a key impulse in the short to middle term to markets that demand available and non-used biogenic residues and industrial side-streams to promote the creation of new business opportunities and income. • Specific actions coming from the new bioeconomy strategy should support the development of competitiveness in prices of bio-based products (intermediary and final). CO2 pricing internalize environmental cost as addressed in Measure 6 and it is an initial step towards balancing price disparities. Possible specific measures such as lower tax for bio-based products should be also considered. • Measure 31 emphasises the support of SMEs in their innovation activities. The Bavarian State Government offers access to e.g. innovation workshops, coaching, technology scouting, market analyses etc. An essential part in SMEs support is to guide them towards market driven innovation, providing key information about markets and trends at the beginning of innovation process. Beyond counselling and support in solely innovation aspects, the advice services should also consider future disruptive

	challenges that these young companies might face, such as climate change effects on biomass provision and fast technology changes, among others.[14]
Biomass supply, availability, information and monitoring	Measure 22 in the strategy responds to the need of a comprehensive study of biomass availability in the region. It will include a model to characterize material flows and be capable to generate scenarios with possible paths of biomass resources uses. Also, Measure 3 announces the state government support to optimize the logistics of regionally produced biogenic resources such as renewable raw materials, biological waste, food residues, among others. • The study should also consider the competing uses for biobased feedstocks, as the bioeconomy might affect current interests of agriculture and operators of biomass heating plants. For the dynamic modelling, it is also advisable to include scenarios under changed climate conditions and nutritional habits. Finally, the biomass availability study and scenarios are seen as an opportunity to strengthen the connection between industries, research institutions and universities, if a collaborative network is created for these studies and collection of information. • Next to finding possible utilization paths and possible products to be developed, planning and initiating a monitoring program is key to assuring that existing and new bio-based value chain are sustainable and, with regard to defined sustainability criteria, more sustainable than the comparable fossil products. • Logistics of agricultural products in Bavaria are closely embedded in the structures of cooperatives and agricultural trade. In this respect, it may make sense to involve these actors in the implementation of new logistic projects as announced by the bioeconomy strategy. It might even be necessary to integrate agricultural retailers in bioeconomy measures in order to get access to unused biomass, to raise awareness for alternative use of feedstock and to realize new supply chains. The Bavarian Bioeconomy Strategy has as one of its key principles the effective utilization of waste resources in application of the cascade use principle. Measures have been envisaged to directly or indirectly provide supportive environment for waste utilization and "closed-loops cycles" through supportive institutions.

Table 6: Summary of analysis regarding the implementation of Bavaria Bioeconomy Strategy

[14] Expert opinion in: https://cordis.europa.eu/article/id/129775-bioeconomy-innovations-tough-starting-up/pl

4.3 Central Germany (DE)

4.3.1 Regional Status[15]

The Central Germany region is integrated by the federal states of Saxony, Saxony-Anhalt and Thüringen. The bioeconomy is a high-priority for the region, being expected to become a core to its economic growth, with the expansion to new bio-based value chains based on regional renewable resources as well as its knowledge and capabilities. The region counts with variated sources of agriculture resources such as rye and winter cereals, barley, wheat, silage and green corn, winter rapeseed, sugar beet, potatoes, among other field crops. For the year 2018, the total production of crop fields from the three federated states amounted to approximately 19 M tons (fresh biomass), and about 8 M m^3 of harvested timber as further described in Table 7.

Biomass resources (2018) and land use (2019) in Central Germany[16]				
	Crop fields (t FM)	Wood (m^3)	Agricultural land (Ha)	Forest land (Ha)
Saxony	5.709.200	2.287.027	998.710	495.543
Saxony Anhalt	8.787.700	2.484.331	1.233.446	457.587
Thüringen	4.637.800	3.367.776	843.272	540.873

Table 7: Biomass resources and land use in Central Germany

Additionally, by-product of the wood industry (sawmill and wood-based materials) as well as recovered wood are of interest for the regional bioeconomy such as bark, sawdust, splinters and chips. Other resources such as livestock and aquaculture are also of interest. In Sachsen-Anhalt is overall representative poultry and pork livestock, while Sachsen has higher production of fish from aquaculture as the other states.

The region counts with numerous research centres and universities, raising the research environment in bioeconomy, with a total of 41 institutions although not uninformedly distributed. In the region, but overall in Sachsen-Anhalt the R&D+i activities are strongly directed towards biotechnology, biological resources and chemistry, with lighthouse R&D facilities and initiatives such as the Fraunhofer Center for Chemical-Biotechnological Processes CBP in Leuna, and the Science Campus Halle with specific bioeconomy focus in teaching and research. The Finnish company UPM[17] is settling in Leuna and will operate the world's first large-scale industrial biorefinery for the chemical processing of beech wood, among other areas, a result of the consistent development and settlement activities of the Bioeconomy Cluster in cooperation at the state level and with municipal stakeholders.

[15] Key source of information for this regional status for Central Germany has been the bioeconomy atlas developed by DBFZ, available at https://www.dbfz.de/projektseiten/biooekonomieatlas

[16] For further information and sources visit the bioeconomy atlas tool developed in the framework of Project MoreBio in https://www.dbfz.de/projektseiten/biooekonomieatlas

[17] https://www.upm.com/

These structural conditions and activities have made of Sachsen-Anhalt a pioneer in the promotion of bioeconomy in Central Germany. Motivated by the implementation of recently passed laws on coal phase-out and structural strengthening, one of the plans in Saxony-Anhalt is to establish a Bioeconomy Hub as a centre for sustainable chemistry in Central Germany. This should set up a network of demonstration facilities for various biotechnological processes at a central industrial location, in order to provide start-ups and SMEs the opportunity to further develop application and processes to industrial maturity and support in the introduction to market at a competitive cost. Furthermore, a strategy paper has been developed by the Innovation Region Central Germany and the Bioeconomy Cluster e.V in close coordination with the state government of Saxony-Anhalt provided, taking into consideration existing ideas, concepts and competences available among consulted experts. Likewise, the strategy paper takes into consideration the scientific competences, regional structures and relevant industries that characterise the region.

Given the is role in the Central Germany region and provided the initiative on a strategy paper, the following sections will be focused only on Saxony-Anhalt.

4.3.2 Barriers and challenges to regional bioeconomy

As for other regions in POWER4BIO, the status of regional bioeconomy in Sachsen-Anhalt was analysed with the support of the SAT. The analysis allowed to identify specific areas on need of improvement in relation to the other WE regions and in relation to the eight key factors of the test as follows:

- The results for the questionnaire for biomass show the region is above average in almost all key factors (KF) regarding *biomass-based* value chains. Sachsen-Anhalt scores are significantly positive in availability of feedstock (KF1) and availability of regional markets (KF6). Main areas on need of improvement are related to infrastructure for feedstock handling (KF2), access to finance (KF3) and support institutions (KF5)

- Similarly, the results of questionnaire for WASTE indicates strengths in the technical expertise and skilled workforce (KF4) as well as entrepreneurship (KF7) in the region. On the other hand, the insufficient access to finance (KF3), lack of regional markets for waste resources/residues (KF6) and supporting policies to promote waste resources utilization (KF8) prevent the sector's complete development.

- The regions do not count yet with a detail monitoring of regionally produced and imported biomass, nor information about the format (chips, shredded material, sawdust or bales) and qualities in which biomass is supplied or integrated in value chains. This includes also lack of information about most needed pre-treatment or other necessary steps for its valorisation in sustainable chemistry initiatives.

- The region counts with available financing options, through national and regional research programs as well as the presence of strong banking sector. Its availability to support industrial initiatives (technology scalability and market entry) that result as spin-overs from abundant research activities in the region are not ideal. There is a big financing gap experienced by most of the high

growth companies, in the region. Many start-ups are struggling to survive the valley of death and are at risk of failure.

- The region counts with knowledge and know-how transferring bodies, technical support and assistance institutions as well as R&D organisations that are key for new business development. This type of support in specific for the biochemical sector with regards to new business plans, risk assessment, market assessment, among other is not yet available in the region and new industrial initiatives would benefit from it.

Furthermore, the need for further knowledge transfer and cooperation among R&D institutions and the green chemistry sector is necessary. As well as, further awareness-raising among society actors, though educational programs and dissemination of bioeconomy concept to increase acceptance. Finally, as in other regions, the complexity of bioeconomy at policy level stills and issue being worked out by raising awareness of bioeconomy strategy and its synergies with circular economy directive and pointing at opportunities to raise willingness to prioritize bioeconomy in the regions.

4.3.3 Proposed specific interventions for Saxony-Anhalt

Summary of recommended specific interventions to Sachsen-Anhalt	
Mobilization and cooperation among stakeholders	• Promote applied research projects among the existent research centres, development facilities and universities in cooperation with established chemical industry and nascent companies (SMEs) interested in proving the valorisation of available waste resources in the region. • Continue with the development of flagship projects that demonstrate the benefits of cooperation among industries and sectors and potential of bioeconomy to support regional supply chains, business creation, between others. These types of projects will increase by example the interest of regional actors to cooperate in future projects and share their knowledge in a trustful manner.
Policy framework and legislation	• A long term, stable, consistent and cross-departmental political strategy needs to be developed together with all stakeholders. Policy areas such as energy, environment, education and research, waste and raw materials, among others, are required to join forces. • Discussion and exchange with stakeholders about the waste regulations, find common goals and possible ways to use it as a supporting element and not as a burden
Business development and markets	• Information regarding business models, identification of good bioeconomy business models in other regions and key aspects for their replication could be of great support for regional actors participating in diverse value chains. Other resources apart from those found in Deliverable 3.4 and 4.1 in POWER4BIO could be

	also consulted in Project BE-Rural[18], and use tools from Project Rubizmo[19]. • Innovation prize competitions should be reinforced for biotechnology, biochemicals and biomaterial innovations that utilize regional biomass resources and propose business models that impulse the attainment of SDG´s in the region. Linked to these competitions, new collaborations formats among universities, research centers and technology companies could be promoted such as the Intoa! Lean Business Program in Finland[20]. This program proposes a new model of cooperation between companies and universities bringing a specific challenge of the company to be solved in multidisciplinary teams conformed by students and researchers[21]. • Training and coaching activities might be provided on business modelling, entrepreneurship, how to present a business value proposition in a clear and convincing way and to catch the attention of different typologies of investors and/or potential customers and business partners, etc. Moreover, it would be advisable to set up collaborations with crowdfunding platforms, such as Doorway (https://www.doorwayplatform.com/en)[22]. The importance of crowdfunding in the investment ecosystem is increasing a lot, particularly for business opportunities where the social/environmental component is relevant. It follows that partnerships with organisations such as the European Crowdfunding Network-ECN must be taken into proper account.
Funding and Financial instruments	• Increase support to start-ups and scale-ups. Draw the attention to the role played by knowledge innovation companies, which are key for the diversification of the economic system and the development of bioeconomy. • Young intensive bio-based companies' value is based on an intangible and future cash flow. They need access to finance at the beginning of their life cycle that can be provided by revolving public funding schemes capable to attract private financial resources. Particularly, even in the region, there is the need to address the financing gap experienced by most of the high growth European companies. The equity and quasi-equity fund may be a viable option for those companies and can be complemented with additional financial products (loans and guarantees).

[18] https://be-rural.eu/wp-content/uploads/2019/12/BE-Rural_D2.4_Regional_business_models.pdf
[19] https://rubizmo.eu/business
[20] https://www.utu.fi/en/news/news/intoa-lean-business-programme-enters-hacking-higher-education-competition
[21] https://www.interregeurope.eu/ecoris3/news/news-article/2201/the-intoa-lean-business-program/
[22] Doorway is the Equity Investing platform founded and supported by Business Angels, with the aim of creating a diversified and profitable portfolio of companies in the medium and long term, as an investment opportunity for qualified investors.

	• Even with regard to equity, consider the opportunity offered by the off-the-shelf financial instruments. Particularly, the "Co-investment Facility" serves as a mean of attracting additional investments in SMEs through a partnership approach with Equity Investment funds or other market participants making investments. The financial intermediary is a private entity that takes all investment/divestment decisions with the diligence of a professional manager in good faith. The aim of the instrument is to combine public and private resources to provide equity to SMEs. More information about this instrument can be found in D4.4, page 35. • Activate services aimed at supporting a selected group of projects in improving their investment readiness. Dissemination and exploitation play a key role in maximising the societal and economic impact of Research & Innovation activities in this field and to make sure that the economic system can benefit from the resources invested in these activities. • Organise Investors' forum/meetings specifically for bio-based industry. This initiative could be done with the help of associations as Business Angels Europe (BAE), European Business Angel Network (EBAN) and/or Invest Europe. It could serve to identify the regional and national actors that are active in this field. This initiative could represent the right opportunity to present selected business opportunities to BA networks, such as AEBAN and the European Circular Bioeconomy Fund[23].
Biomass supply, availability, information and monitoring	• It is recommended to carry out an assessment of technical potential of waste streams, as well as the gathering processes (waste management, waste collection centres, etc), and their availability to be used. Based on these, strategies can be developed to reduce legislative hurdles for waste types that have been identified as alternative raw materials for energetic or material uses. • In general, bioeconomy scenarios can be developed to the region, with the participation of regional stakeholders (e.g. Hub), in order to assess the ideas and possibilities of the infrastructure development and their implementation options.

Table 8: Summary of recommended specific interventions to Sachsen-Anhalt

[23] https://www.ecbf.vc/

4.4 Flanders (BE)

4.4.1 Regional Status

The bioeconomy in Flanders includes all economic activities that make use of organic material or biological processes. These activities are very diverse and are part of different sectors, such as agriculture and food production, waste processing, the chemical and pharmaceutical sector, energy and material production. These sectors in turn form the basis of essential value chains for food, products, construction or energy and water supply.

Flanders has a number of unique assets that distinguish the region internationally. These assets form the basis for the considerable potential of a growing bioeconomy.

- Flanders is a strong knowledge region with a high density of research centres and universities of an international level. The Flemish research world has historically specialized in fundamental and applied research that forms the basis for an innovative bioeconomy. The Flemish position in Europe is very strong in fields such as biotechnology, food, materials technology and chemistry.
- These years of specialization have led to a great involvement of the business community in these areas, and has also supported the development of local specialized clusters. The Flemish spearhead cluster program supports various clusters that develop innovation processes within the bioeconomy. The strong local interweaving of actors from various sectors and the research centres create a very dynamic landscape in which new initiatives can be developed quickly. In addition, there are a large number of pilot installations for the bioeconomy in Flanders that are among the best in the world, and which make it possible for start-up companies to scale up faster. All this ensures that Flanders can accelerate the transition to a bioeconomy through system innovation.
- Further technological development is also generating strong interest from the Flemish ports. The long-term strategies of the Flemish ports integrally contain all these elements that can support further bio-based development.
- The Flemish agricultural sector has many innovative farmers who work with local partners to set up new technologies or value chains. A growing bioeconomy also creates the opportunity to build up new activities and income streams for Flemish farmers, and by extension actually the entire agri-food sector.

The new bio-economy activities help to protect the Flemish economy in the longer term against economic crises, such as those resulting from the Covid19 virus. The European Commission is reworking the Green Deal's plans to use it to relaunch the economy. The new circular economy action plan also focuses on stimulating a new sustainable economy and industry.

The bioeconomy is an important link in the transition to make the Flemish economy carbon neutral, by building new value chains that ensure a closed carbon cycle. A holistic stimulation of the bioeconomy can ensure that new bio-based alternatives with a minimal climate impact become available for products based on fossil raw materials.

The bioeconomy is an essential part of the sustainable circular Flemish economy, and can make a substantial contribution to the relaunch of the economy and can reduce dependence on international raw material chains. The transition to a bioeconomy also has the potential to make the local economy resilient and stronger, especially by placing a strong focus on supporting SMEs in the agricultural and agri-food sector. The bioeconomy policy plan is necessary to accelerate and stimulate this development. The plan must ensure that this development takes place in a sustainable and inclusive manner,

that the synergy between the different initiatives is strengthened, and that every actor and farmer involved can play a full role in the new value chains.

Starting points for the bioeconomy in Flanders

1. The bioeconomy is necessary because of the major societal challenges
2. The bioeconomy must form part of a more sustainable economy, and thus be economically, ecologically and socially sustainable.
3. The switch to an economy based on renewable raw materials requires a transition
4. Biomass as a factor in the energy mix
5. In the Flemish bioeconomy the available biomass streams will be used according to an accepted cascade
6. The European strategy and action plan for a bioeconomy serves as a framework for the vision and strategy of the Government of Flanders
7. Learning from cooperation opportunities and inspiration from the strategies of other countries and regions

4.4.2 Barriers and challenges to regional bioeconomy

Among challenges to the advance of Flanders regional bioeconomy, the region has identified the mobilization of farmers and the integration of primary sector with other industries challenging. This relates to learning how to cooperate among sectors, shift traditional roles of farmers as only biomass suppliers and build up understanding. This, might entail generating new relationships, building trust and type of interactions between farmers and industries of interest such as food and chemical industry. These learning process about on collaborating between stakeholders is also a pillar to generate a critical mass from the big farmers association for the bio-based industry. Thus, supporting the increase of farmers active in bio-based economy.

Similar to other regions in the EU, Flanders has identified a policy conflict with energy goals, given that the main sustainability criteria come from renewable energies and exert pressure to generate results regarding the CO2 reduction objectives and generates a conflict for the use of available biomass. Prioritization of biomass is for bioenergy use, reducing the capability to generate streams towards higher added value products, such as biochemicals. New sustainability criteria for the production and use of biomass, that considers the material use of as well as circularity principles has been identified as necessary for the region.

In addition, the analysis of the region with SAT pointed towards few additional aspects:

- The forest biomass potential might not be sufficient to cover the demand of new sustainable initiatives in the chemistry sector launched in the region. Despite counting with forest resources, most of the raw wood in the Flemish economy is imported from other Belgium region or from other countries. With potential increase of biomass demand it will be required first to assure an efficient application of cascade use principle of available wood (regionally harvested or imported), with a potential reconfiguration in key sectors that make use of those resources. If not additional wood imports.

- The region counts with biomass flow estimations, use tables per sectors and a suitable estimation method to analyse the availability of biomass resources, but it does not have detailed information on the format in which biomass is currently supplied. Even though the biomass flows are estimated, based on current data available it is not yet possible to have a whole overview of the macroeconomic effect of those flows in the Flemish economy. This will require a system that links biomass flows with their monetary value to identify which use paths are generating greater value for the region.
- There is potentiality for further use of biomass in chemical and biorefinery sector. This should be further assessed, jointly with the existing industrial application that can apply biorefinery concepts. Foremost, it should be analysed based on existing market opportunities and perspective market openings both in the region, other region where exported goods and services are already established (e.g. Wallonia and Brussels) and internationally.
- Inter-cluster interactions can still be boosted to promote innovation and entrepreneurship.

4.4.3 Proposed specific interventions for Flanders

Flanders has established a new bioeconomy policy plan, considering identified areas of improvement and also considering the current status of their economy. The plan must ensure that regional development takes place in a sustainable and inclusive manner, that the synergy between the different initiatives is strengthened, and that every actor and farmer involved can play a full role in the new value chains. The region has defined an ambitious vision of their bioeconomy to 2030.

The Flemish bioeconomy in 2030: vision of the future

1 By 2030 Flanders will be one of the most competitive bioeconomy regions in Europe
2 In 2030, Flanders will be one of the top regions in Europe for innovation and research relating to the bioeconomy
3 By 2030, Flanders will have created one of the most sustainable bioeconomies in Europe
4 Strategy Objectives
    - SO1: The development of a coherent Flemish policy that supports and facilitates a sustainable bioeconomy
    - SO2: To put Flanders at the top for education and training and research and innovation in future-oriented bioeconomy clusters.
    - SO3: Biomass is optimally and sustainably produced and used across the entire value chain.
    - SO4: Strengthening of markets and competitiveness of bioeconomic sectors in Flanders.
    - SO5: Flanders is a key partner within European and international joint ventures.

Thematic focus of the Flemish bioeconomy policy plan

In Flanders there is a great wealth of projects that work on research, development of bio-economic innovations and that prepare pilot or demonstration activities. Some examples of these projects are:

- Flexible industrial biorefinery for the production of lactic acid (basic chemistry) or biosurfactants (for detergents, cosmetics, etc.) from residual flows from catering, supermarkets and agriculture and horticulture. This new collaboration is based on industrial side flows from supermarkets &

restaurants, flexibly supplemented with ad hoc residual flows from agriculture and horticulture. The raw materials are collected and reimbursed.

- Protein transition: Cultivation of local protein-rich crops that are also locally processed into raw materials and products. Growers and processors jointly build up knowledge about cultivation, harvesting, storage, processing of raw material into product for concrete crops and new circular value chains with full valorisation of the organic material.
- Scaling up the production of biochar from waste streams to an industrial scale and cooperation with agricultural organizations for the cascade application of biochar as an additive for fermentation and / or composting, in cultivation substrates, or as a soil improver and for carbon storage in agricultural soils. Biochar production is still in its infancy in Flanders and Europe, which makes it possible to develop a unique value chain for Flanders on the European market.
- Alternative sustainable cultivation substrates in greenhouses. Various materials such as compost and plant fibres (wood fibre, miscanthus straw, heather chopper, flax loam,…) form a sustainable alternative to traditional cultivation substrates. Additions help disease resistance, provide renewable nutrients and are also valorisations of biomass residues. This leads to new upcycling of residual flows from agro, agri-food and fishing activities.
- Flemish rubber from the rubber dandelion. The root of the plant contains more than 10% natural rubber and also 40% inulin for the production of bioplastics. The industrial investment in a biorefinery unit and chain building is necessary to set up production.
- Lime hemp as a building and insulation material. The cultivation of hemp is not labour-intensive. Weed control is not necessary. In addition, hemp is good for climate mitigation and adaptation with its very deep roots and extra CO2 storage.
- Innovative processing, biorefinery and extraction of fruit biomass into food additives and non-food applications.

In addition to these examples, many other activities are under development, for example based on micro and macro algae, production of tagatose from whey, nutrient recovery (including phosphate) from animal manure, production of marigold for pharmaceuticals and chemistry, reuse of CO2 from industry in greenhouse horticulture areas , fibre production from miscanthus, hemp or tomato leaves, production of functional ingredients for food and drinks from forced chicory roots, extraction of bioactive components from biomass and use as a natural anti-oxidant in e.g. cosmetics or as a biopesticide, bio-stimulant, or as alternative to antibiotics in animal feed ...

The entire field of activities is extremely diverse. To structure the actions within the bio-economy policy plan, the field is shaped around 4 themes:

a. Biomass production

This theme focuses on new pathways for the primary production of biomass, and the increase in the yield of biomass production. After all, biomass is the raw material for the bioeconomy, can be diverse in origin, and can concern both food and non-food applications.

Increasing scarcity of raw materials such as water and land shows that an efficient use of these natural resources is necessary. Increasing the yield and quality of a primary production system must be achieved with due regard for agro-ecological principles. A higher biomass production yield naturally also guarantees a fair income for the farmer.

Crops that can contribute to higher agro-biodiversity (e.g. new crops such as marigold) and that are robust against climate change are developed for optimal valorisation of the biomass (for both conventional and niche markets). Breeding techniques and appropriate management can achieve this. Realization of cultivation systems (multi-valorisation, mixed cultivation, soilless systems ...) under low input regimes and / or limiting ecological conditions (biotic and abiotic) leads to yield optimization without depletion of natural raw materials such as water, minerals, nutrients and energy. In consultation with the processing industry, knowledge must be acquired about the optimal biomass quality (including physico-chemical composition) and this in function of harvesting efficiency and post-harvest processing.

Finally, biotechnological technologies can also support these developments. After all, a better insight into the molecular pathways in the production of complex molecules makes it possible to realize targeted biotechnological optimizations for bio-economy applications (e.g. lignin biosynthesis pathways lead to more accessible complex molecules that can be used in the chemical industry).

b. Synthetic biology and biological prospecting

In addition to looking for and increasing biomass production, there are also applications in synthetic biology that can increase the yield of valuable bio-based raw materials and products. This theme combines synthetic biology and active application-oriented prospecting in existing organisms. The scope varies over the focus of organisms or constituents (micro-organisms, or enzymes,…) and the natural environment in which they occur (lab creation, land, marine environments,…). Both activities share the building and use of large genomic databases, advanced computer techniques such as AI to detect solutions faster, and a direct focus on concrete industrial problems.

Microbial biodiversity is still poorly known because most bacteria (e.g. from the marine environment) cannot be cultivated on the traditional culture media. Using the recent next generation sequencing technology, the microbial diversity can now be investigated at the DNA level in a first step, so that functional properties become visible and new industrial applications come a step closer. Examples of this are bioremediation of marine contaminants (including pollution from oil spills) and the breakdown of (micro) plastics.

Marine resources / biomass and by-streams from various marine economic activities are hardly exploited. However, they contain a multitude of recoverable molecules. that can be obtained through biorefinery with enzymes or through fermentation with marine bacteria. Crustacean shells contain proteins, calcium carbonate and chitin. The proteins can potentially be used as aqua feed and can also be further hydrolysed with enzymes or via fermentation to bioactive peptides. Calcium carbonate has applications from the pharmaceutical world to agriculture, where the biological origin is of added value. Shell chitin is a fertilizer, but this versatile molecule also has activities as a plant stimulant, protecting plants against possible pathogens or nematodes. Chitin is also a potential raw material for a biodegradable plastic, with potential applications in food packaging, while the chitin derivative chitosan has antibacterial activity.

Microalgae and seaweed have a potential for food, feed or as raw material in the chemical and pharmaceutical industry. Both intact organisms can be used here, but extracts can also be used to improve nutritional, taste or other properties.

Natural bio-active substances (such as natural dyes, antioxidants, bio-stimulants, secondary metabolites with medicinal applications) can be extracted from primary raw materials (plants that produce

essential oil oils, oilseeds, ...) and / or residual flows and have a fairly extensive field of application ranging from tincture applications in the food, paint or textile industry, bio-stimulant in crop protection, medicinal and / or cosmetic applications. These bio-active components are still underused and have great potential to replace fossil raw materials.

c. Technological and chemical transformation of biomass and residual flows

In Flanders, both knowledge institutions and industry have very strong knowledge and expertise to valorise biomass through a technological and chemical transformation. This converts the biomass raw material into useful building blocks or finished products. These technologies focus on the valorisation of biomass, waste gases or waste flows. This group is very broad, ranging from catalytic (chemical) processing, thermo-chemical conversion, to various applications of fermentation.

Within this theme, projects can give rise to, for example, the following innovations:

- Catalytic technology for production of niche chemicals or bio-based materials. For example: converting lignin production into bio-based plastic.
- Electrification of biotechnological processes
- Green extraction methodologies for application to residual flows
- Transformation of post-extracted organic waste streams into porous materials

d. Supporting technology for bio-based value chains

In combination with different transformation technologies, there is also great expertise in assistive technologies in the bio-economic value chains. This theme covers all developments for support ranging from pre-treatment, digitization and process automation of various transformation steps, to filtration and purification, preparation for product design, and recycling.

In the available pilots in Flanders, innovative process technologies are used to enable new applications in the bioeconomy. Consider, for example, the low-oxygen grinding and fractionation of (residual flows from) vegetables, fruit, potatoes ... with the spiral filter press in Food Pilot for maximum retention of functional bio-active components in the obtained semi-finished and end products. Not only technological aspects are studied in this context, but also socio-economic aspects. Is small-scale decentralized biorefinery feasible or is it better to focus on centralized processing in biomass hubs of the most relevant residual flows? Which multi-valorisation can be realized, taking the cascade of value retention into account? How can we secure the sales market for the new bio-based products that arise from this biorefinery? The Flemish government can play a role here as "launching customer".

By using sophisticated analysis equipment (LC-MS, GC-MS, UHPLC-HRMS…) the impact of conventional and innovative processing methods can be monitored. State-of-the-art equipment also makes it possible to identify and quantify new molecules and to investigate their function and applications. This knowledge is indispensable in the process and product development of new products for the bioeconomy.

It is also possible to look here at the collection process of biomass residual and waste flows, and especially at ways to increase the yield, so less biomass waste is lost. For example, we also look at domestic waste.

Within this theme, projects can give rise to, for example, the following innovations:

- Stabilization of residual and waste flows from the food industry for further high-quality valorisation in bioactive components, and for (livestock) nutrition
- Down-Stream Processing techniques for the purification and isolation of bio-based products
- Advanced bioprocess control and analysis techniques
- Recovery of organic raw materials from polymer residual flows
- Valorisation of residual flows in sustainable cultivation substrates that do not contain peat and have additional characteristics such as induction of disease resistance.

Actions to stimulate the bioeconomy in Flanders

In order to realize the objectives of this policy plan, four pillars are used, as schematically represented in Figure 3:

1. Strategic research challenges at lower TRL levels.
2. Industrial development of bio-economic activity at levels TRL 4-9.
3. New collaborations between industrial actors, farmers and intermediaries on TRL 4-9
4. Accompanying actions in support and for essential policy alignment

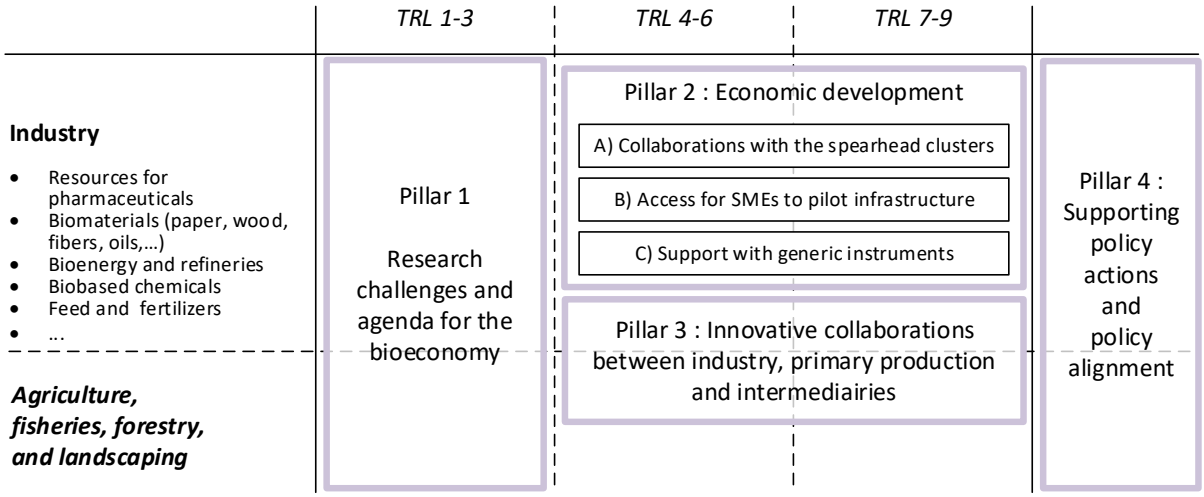

Figure 3: Flanders´ policy plan for bioeconomy

The plan is structured according to the evolution of the Technology Readiness Level (TRL) levels. But action is being taken in each of the pillars to work together with the other pillars, thus strengthening the link with the other TRL levels. In this way, the translation of research results into concrete innovation processes and collaborations must be accelerated.

A steering group with a quadruple-helix configuration will be set up to help monitor the structure and elaboration of the policy plan. The steering group is set up under the leadership of the EWI department with representatives from

- Agriculture and Industry (chemical sector, wood and textile sector, food sector, ...)
- Spearhead clusters
- Universities and research organizations
- Social representatives
- Government agencies

The steering group evaluates the operation and impact of the program and makes adjustments where necessary. Particular attention is paid to the economic relevance of the program by involving relevant companies from all relevant sectors as a sounding board.

At this point, the steering group gathers 35 organisations in total, each representing federations an innovation clusters for different value chains (agro-food, forestry, chemistry, marine, material production, ...)

PILLAR 1: EXCELLENT STRATEGIC BASIC RESEARCH

At lower TRLs, there is a great diversity of research trajectories that are being developed in Flanders. This research is of a high level and makes a major contribution to the European research landscape in the bioeconomy.

It is of great importance to realize a competitive advantage in selected scientific disciplines, which will lead to sustainable leadership in the longer term. In addition, it is very important that this strategic basic research ties in with the economic structure of Flanders, so that results can give rise to economic valorisation in Flanders in the future.

When solutions can be provided for the selected challenges, it is clear that they can find international resonance and adoption and place Flanders in a good competitive position by introducing the solutions early in products, processes and services. This ambition will be tested at the start and throughout the research program with the Flemish industrial partners.

Flemish research challenges are defined for strategic basic research in the Bioeconomy.

1. focuses on strategic basic research including socio-economic concepts;
2. enables first-of-a-kind demonstrators and introductions of technological solutions, based on the results of current research programs, by setting up collaborative projects with the Flemish economic and other actors;
3. ensures Flanders' international leadership and appeal for future investments in selected technology disciplines and their applications;
4. contributes to responses to major societal challenges and provides the Flemish economy and society with a sustainable advantage in these areas;
5. benefits from collaboration between different research groups at Flemish level in order to achieve results.

The research challenges are further elaborated and adjusted during the development of the Policy Plan. The research program is being developed by the EEMCS Department, under the supervision of the steering group. The implementation takes place in collaboration with the Fund for Scientific Research (FWO).

PILLAR 2: DEVELOPMENT AND INNOVATION BIO-ECONOMY FLANDERS

a. Interaction with the spearhead clusters and the moonshot

The themes of bioeconomy and circularity have already been included in the operation of various spearhead clusters and the Moonshot[24]. Various relevant projects are being developed by CATALISTI, Flanders' FOOD, VIL, Flux50 and the Blue Cluster, among others. Different cluster roadmaps already

[24] https://moonshotflanders.be/moonshot/

include the possibilities to include bio-economy projects in the cluster operation. All Flemish Spearhead clusters have made a commitment through the cluster pact to participate in the transition to a circular economy, industry 4.0 and sustainable energy. The renewal of the cluster pacts is currently being examined. This was expressed, among other things, in projects focused on these themes. The setting up of such projects is currently supported through an external assignment in which the possibilities for setting up intercluster projects were mapped out and projects are initiated.

Opportunities are being explored to support the bio-economy and circular economy through the spearhead cluster program and possibly through the Moonshot and the necessary incentives to initiate additional projects in this domain. After all, there is also a great deal of attention within the Moonshots for bio-based chemistry and related technological developments. The consultation must clarify how this theme can be built up complementary to and synergistically with the Moonshots within the bioeconomy policy framework.

b. Accessibility of high-quality pilot infrastructure

Much of the new business developments stem from research at companies and research institutions that is being scaled up. Accessible pilot infrastructure plays an important role in this. With installations such as the Biobase Europe Pilot Plant (BBEPP), the Food Pilot, Insect pilot, biorefinery pilot TRANSfarm, Lignopilot, etc., Flanders has a unique concentration of important pilot infrastructure. As a result, the innovation engine in this domain is nowhere in Europe running faster than in Flanders. This is an important strategic competitive advantage.

The accessibility of this infrastructure must be monitored. The focus is placed on the accessibility of the infrastructure for start-ups and SMEs. To this end, new possibilities can also be discussed to stimulate the access of SMEs and start-ups to pilot infrastructure. Accessibility consists of two elements:

- Support for SMEs that want to use open pilot infrastructure;
- Building activity around the infrastructure to publicize the possibilities for SMEs, to build networks, and to enable living labs that embed the pilot actions in a broader chain development.

Currently it is possible to support the use of pilot infrastructure within regular VLAIO (Flemish Agency for Innovation and Entrepreneurship) instruments, for example as part of an innovation or development project. It is being examined whether the accessibility of pilot infrastructure for SMEs can be supported more widely.

c. Support through generic instruments

Since the VLAIO toolbox is generic, it can also be used to support initiatives in the bioeconomy (and circular economy). In this regard, see the brochure "Towards a sustainable and circular economy" of December 2019, which also includes various bio-economy projects.

Partly on the basis of a further analysis of the needs in the field and the availability of resources, it is being investigated whether additional options, modalities or incentives can be introduced within the existing set of instruments. To this end, work will be carried out within the broader agendas of VLAIO towards adjustments and optimization of the instruments. The deployment of additional business advisers within the Business Trajectories Team as described under pillar 3, point b, will also contribute to the deployment of these instruments.

PILLAR 3: STIMULATING INNOVATIVE PARTNERSHIPS BETWEEN INDUSTRIAL ACTORS, FARMERS, AND INTERMEDIATE PARTNERS FOR THE CREATION OF NEW VALUE CHAINS

a. Implementation in Flemish agriculture

According to the policy document Agriculture & Fisheries (2019-2024), production for the bio-based economy can provide products with a high (er) added value. This production can create revenue models and ensure a fairer income for the farmer. Bioeconomy is also a specific goal within the European CAP after 2020 and the new European Farm to Fork strategy.

Today, the calls for demonstration projects or those of the European Partnership for Innovation can be used for this purpose.

The Flemish CAP strategic plan is also looking at providing instruments to support the Flemish bioeconomy in agriculture at the appropriate times.

b. Individual guidance and stimulation of collaboration for start-ups and SMEs

In addition to the need for excellent strategic basic research, a critical success factor within the policy plan is the further economic development of the bioeconomy in Flanders. The potential of biomass results in rethinking value chains, collaboration models and underlying business models. Many financial incentives are available both within the bioeconomy policy plan and in the generic operation of the EWI and LV (Department of Agriculture and Fisheries) policy areas. The challenge is mainly to reach and guide SMEs and start-ups to make use of these stimuli and to start up new partnerships in concrete terms. This applies to companies that aspire to new developments in the domain as well as companies that have the potential to translate these new solutions into their specific business context.

That is why, within the framework of the policy plan, a coaching assignment is provided by two thematic business advisers within “Team company advisors vzw”. “Team company advisors vzw” has been filling the VLAIO front office since 2018 for the target group of ambitious companies that work on sustainable growth through innovation and / or business transformation. The Flemish Government finances the non-profit association through a covenant. The current one will run until the end of 2022. The non-profit organization is managed by a Board of Directors, composed of nine directors: three representatives from VOKA (Flemish Chambers of Commerce and Industry), three from UNIZO and three independent directors. The administrator-general of VLAIO (Flemish Innovation & Entrepreneurship Agency) represents VLAIO as a member of the association and sits as an observer on the Board of Directors to monitor the correct implementation of the covenant. The core task of the non-profit organization is to ensure that the front office activities of VLAIO are implemented towards the target group of companies that want to realize growth ambitions through innovation and business transformation. To this end, companies are individually guided by a business advisor. Together with the entrepreneur, he analyses the business case, brings the entrepreneur into contact with relevant (knowledge) partners and provides guidance in putting together the financing mix (subsidies, financing). In 2019, 1,437 companies were assisted. Due to its strong insight into the available knowledge in Flanders and how to connect it with the SME, Team Business Trajectories also plays a role in the AI & CS policy program. 2 program advisers take on a coordinating role in setting up actions to connect SMEs with available knowledge in Flanders.

For the current operation of the team of business advisers, the emphasis is on the food sector and suppliers to the primary and processing sector. The (primary) agricultural and horticultural sector is a target group that is barely reached within the current operation. The supervision assignment here is

therefore indeed an extension, in particular because it involves establishing contacts with the primary sector and making connections with agricultural companies, something that falls outside the current field of activity of the non-profit organization. The supervision assignment of the two thematic business advisers for bioeconomy builds further on the basic operation, in the sense that the emphasis in their task is on mapping out the supply and setting up initiatives to match the needs of individual companies with the supply. within the bio-economy program.

Bioeconomy is a broad and transversal theme. The competencies and position of the business advisers allow them to fulfill an essential bridging function for innovative SMEs and start-ups, and primary agricultural companies.

On the side of the government, this bridging function connects the initiatives within the Flemish Government. “Team company advisors vzw” works as a virtual department closely with other VLAIO departments, such as the Support Department, the Enterprise Relationship Management Department, the VLAIO Network Department, the Project Cluster Policy and the Project Missions and Transitions. In addition, the advisers take a proactive role to also involve the initiatives and instruments of the Agriculture and Fisheries policy area, and work together with the agricultural sector advisers, agricultural investment support advice, income support, EIP, and advisers for the Common Agricultural Policy.

On the side of economic actors, the bridging function must ensure that new contacts are made within this policy program and that cross-sectoral actors for the bioeconomy are involved. Currently there is too little awareness among industrial actors about the possibilities of agriculture and horticulture as a supplier. Conversely, entrepreneurs in agriculture and horticulture do not always know the suitable industrial partners. The business advisers strengthen contacts with, for example, the pilot centres and agricultural federations, and involve new actors within the agricultural and fisheries sector. The thematic advisers are thus better able to establish a stronger connection with actors active within these sectors, in order to also connect this network to industrial SMEs and start-ups. The most important effect indicator should be an increase in initiated and supported business projects within the theme of the bioeconomy.

c. Thematic structure of chain cooperation by the facilitator platform for the Flemish Bioeconomy

The bioeconomy covers all sectors that use biological resources, including the production of biomass, the processing of residual flows, the processing into bio-based materials and bio-based products. They are highly integrated value chains with innovative revenue models. Bio-economic innovations and innovative business models often lead to new and highly integrated collaborations between sectors with different structures and cultures, such as chemicals, food processing and agriculture. Setting up a completely new value chain requires a joint leap of a large number of economic partners, minimum 5, but often more than 15. Thorough consultation between all partners is necessary to build a basis of trust, clarify these risks and make agreements about this. to make. These consultations are an essential step for new technologies to gain a foothold in new value chains.

A platform is being set up to accelerate this structure building (working name "B2BE" facilitator). On the one hand, the facilitator ensures broad communication to all relevant sectors about the potential of new bio-economic initiatives and technologies. On the other hand, the platform works bottom-up, by periodically going through a complete chain building process around a specific theme: from identification of initiators to guidance to concrete project proposals.

The facilitator is coordinated by ILVO (Institute for Agricultural and Fisheries Research), because ILVO is best placed within the Flemish research landscape to coordinate this action. ILVO has the most extensive experience with innovation projects that bring together partners from different sectors, including the agricultural sector. To ensure an interdisciplinary approach, ILVO involves a broad consortium of partners such as research institutions, practice centres, legal and economic specialists, federations and interest groups. This makes it possible for project development guidance to identify and solve specific bottlenecks. Due to its historical experience, ILVO is also sufficiently integrated within the Flemish innovation landscape and has already carried out innovation projects in the past in collaboration with all these partners. This allows to put together a sufficiently broad consortium for the facilitator.

PILLAR 4: SUPPORTING POLICY AND POLICY ALIGNMENT

The accompanying policy is aimed at (i) monitoring capacity, (ii) building up training courses for new skills and competences, and (iii) internationalization and interregional cooperation.

a. Monitoring capacity for the bioeconomy

The total gross added value of the bio-based economy in Flanders is currently estimated at 2.1 billion euros in 2017, which corresponds to 4.6% of Flemish industry. This group of actors employs about 15,000 people and includes about 600 companies. The bio-based economy is cross-cutting, so the figures are not exact as they are not specifically considered as a separate sector in national or European statistics. This lack of clarity also makes it difficult to monitor the policy. To get a clear picture of the full cross-sectional activity in the bioeconomy, the following elements are needed:

- Data collection about the biomass flows is necessary, specifically for the follow-up of the non-food applications, biomaterials, and bio-based applications within the chemical sector. This data collection builds on the existing data that has been built up within the Department of Agriculture & Fisheries, and at OVAM (Public Waste Agency of Flanders).
- Demarcation in consultation with research actors from the bioeconomy domain based on eCorda theme codes, and FWO science disciplines;
- Indicate the current scope of the bioeconomy in Flanders, including employment and economic impact.
- identify the priority development pathways for the future that current stakeholders are now strategically focusing on. These stakeholders (economic actors, research institutions and civil society organizations) are actively working on the realization of new technological developments and business models in Flanders and make choices for this so that the landscape is constantly evolving. The potential of biomass use in Flanders is therefore mapped out.

A study assignment is currently being prepared to build a monitoring framework for the Flemish bioeconomy. This study will be completed in the course of 2021. On the basis of this study, a regular monitoring can be set up to calculate the annual evolution of the bioeconomy within the Institute for Agricultural, Fisheries and Food Research (ILVO). It is envisaged to set up a collaboration between the executors of the study assignment and ILVO during 2021 in order to put the monitoring framework into practice as soon as possible.

b. Education and training for new skills and competences for the bioeconomy

Tomorrow's jobs will look different from today's. The world is changing at an unprecedented speed. Transitions, such as the advance of the bioeconomy but also new technologies and digitization, the

switch to a circular and carbon-neutral economy (cf. the ILO initiative, the European Green Deal, ...), have a serious impact on jobs and competences and will also create structural changes and challenges in the labour market in the coming decades. New professions arise and existing professions change under the influence of changing regulations, products and services, production processes, innovation, ... The availability of the necessary competences and skills and sufficiently qualified and flexible employees can be a strong catalyst for our economy.

To meet this challenge, the Flemish administration wants in the future, in consultation with other policy areas, to create more synergy between the various policy initiatives and:

- work towards a supported action plan "people-oriented transition approach: focusing on green jobs and competences" for Flanders, in consultation with social partners, and in collaboration with other policy areas. This action plan will pay sufficient attention to the specific challenges within the bioeconomy
- explore which building blocks for a people-oriented transition approach geared to the green transition we need to develop further and more strongly. We are investigating whether generic building blocks can provide a sufficient answer, or whether specific building blocks geared to the green transition are needed
- arm companies, sectors, training actors and other stakeholders to detect competence needs for a climate neutral economy and to work proactively on them
- Arm (future) employees to fill these new and changing jobs

In the context of the VIONA labour market research program, a call has been launched "a skills road map for the Flemish climate transition. Focus on the energy-intensive industry ". The focus is placed on the skills required of employees who are employed in the energy-intensive industry.

c. Internationalization and international cooperation

1. Collaboration with Flanders Investment and Trade (FIT)

Within the organization of FIT, various activities are planned to promote Flemish actors for biotechnology abroad, and to convince and guide foreign investors to Flemish partners.

These activities include targeted participation in specialized fairs on biotechnology and bioeconomy, or communication of Flemish success stories in foreign media.

2. Interregional cooperation

In the context of European projects, good contacts were established with governments and federations for the bioeconomy in various European regions. In addition, Flanders is also a member of European networks such as the European Chemical Regions Network (ECRN), where the development of bio-economic activities is also stimulated among the participating regions. On the basis of these contacts, further activities are being investigated to offer an advantage to Flemish actors and to put Flanders on the international map as a bio-economy region.

BUDGETARY IMPACT FOR THE FLEMISH GOVERNMENT

The present plan is financed from the provision of the “Flemish Resilience” plan (total budget 4.3 billion euros). From this recovery provision, 20 million euros will be reserved for this incentive program bioeconomy. The bioeconomy impulse program covers the following parts of the policy plan:

- Pillar 1: Under the management of the EWI department: Scientific research: 3 million euros

- Pillar 2: Under the management of the Flemish Agency for Innovation and Entrepreneurship (VLAIO) Development and innovation bioeconomy in collaboration with companies: 7 million euros
- Still to be decided in 2022: 10 million euros

An additional part of the policy plan is financed from the regular provision of the EWI Policy Domain and amounts to a total of 1 million euros. This amount is responsible for financing the following parts of the policy plan:

- Pillar 3: Stimulating innovation cooperation between industry and agriculture
  - Under the management of the Flemish Agency for Innovation and Entrepreneurship (VLAIO): Supervising assignment of "Team company advisors vzw" with 2VTE
  - Under the management of the LV department: Elaboration of tasks for the Institute for Agricultural and Fisheries Research (ILVO)
- Pillar 4: Supporting policy
  - Under the management of the EWI department: Elaboration of accompanying policy, monitoring, and interregional cooperation and international communication

4.5 Regions in SPRING Cluster, (IT)

Piemonte region

4.5.1 Regional Status

The Bioeconomy in Piemonte "aims at supporting the transition from a non-renewable, fossil-based, economic system to a more sustainable model, based on the rational utilization of biological resources (biomasses, in a broad sense). Bioeconomy thus sustains the development of a more sustainable economy, that can regenerate the ecosystems instead of draining them, with a more efficient use of resources, within a wider framework of development of the circular economy"

Piemonte already makes use of available waste feedstock such as wastewater (sewage sludge), biological fraction of municipal waste, non-food crops, non-food biomasses from livestock and agri-food by-products. For 2019 the available biomass from municipal waste of Piemonte was calculate as 560.000 ton/year, while the residues from agriculture (herbaceous crops) was about 590.000 ton/year. However, the potential availability is estimated much higher in 1.474Mtons/year with cultivation mainly of crops of cereals and grapes such as wheat, maize, barley, sorghum, vine grapes, among others. The region counts also with forest resources that cover 37% of the territory, although about two thirds is found in mountain terrain.

Piemonte counts with a dynamic R&D environment and industrial strength, with current bioeconomy activities concentrated in the Green Chemistry, cleantech and agro-food areas. Also, circular economy activities are being synergize with the regional bioeconomy through a cross-sectoral approach. The region has strived to boost the development of their bioeconomy by embedding strategic actions in the areas of agrifood, green chemistry and cleantech within their Smart Specialisation Strategy (S3) for the period 2014 – 2020 and the sectoral agri-food strategy. The main areas of intervention are strongly focused on R&D+i, addressing chemistry from renewable sources (development of new sustainable products, coming from agro-industrial non-food value chains, such as bioplastics and biofuels); foster the utilization of biomass to produce biochemicals that substitute the fossil-based ones and waste

management (management and treatment of wastes and waste waters aimed at recovering chemicals, fuels and sub-products from waste and scrap). While boosting the development of industrial biorefinery projects in the region as mentioned in the new Italian bioeconomy strategy[25].

The new Bioeconomy Platform has been launched within the technology platform scheme, considered to support R&D strategic projects with technological and industrial leaders of the region. The bioeconomy platform emphasizes not only the three major areas of priority for the current bioeconomy strategy (within S3) but includes circular economy as a synergetic area to reach regional circular ecosystems and sustainable supply chains in the region. In Piemonte the Green chemistry/Cleantech area is represented by enterprises with strong technological, innovation and productive expertise, working on the mainstream of European and international innovation fields.

In this area the S3 defined by Region Piemonte for the period 2014-2020 pointed out two main sectors that had developed expertise

- The development of new sustainable products from non-food agro-industrial value chains, such as bioplastics and biofuels

- Processes of waste and waste waters management and treatment, aimed at the recycling and reuse of chemicals, fuels and secondary raw materials.

The collaboration among industry, primary production, research, and the environmental and utilities services represents a good path for the development of the region. The strategic objective is to contribute to the development of a "Circular Economy" model for the innovation and sustainable growth. The agri-food sector represents a good part of regional economy and can express a strong potential in the optimization of processes, logistics, packaging, utilization of new materials and re-use of secondary raw materials, and it will be important to strengthen the collaboration between this sector and the bio-industries.

In this sense, in March 2021 the Region launched a call for proposal under the Rural Development Programme (EAFRD funds) to support Pilot Projects in the agricultural value chains aimed at:

- Promote the efficient use of resources, profitability, productivity, competitiveness, emissions reduction, environmental sustainability, and climate resilience in agriculture value chains;
- Improve environmental protection methodologies, mitigate and adapt to climate changes, promoting a sustainable use of resources.

The final objective is to develop horizontal and vertical integrations among the agricultural and no-food value chains, in order to reinforce the connections between on one side agriculture and food production, and on the other research and innovation, to improve environmental management and performances. Moreover, the aim is to support supply and utilization of renewable energy sources, by-products, waste materials, residues, and other non-food raw materials for the purposes of bioeconomy.

The evaluation of proposals foresees an additional reward for those proposals that can demonstrate a link with projects funded under the Bioeconomy Technological Platform (ERDF funds), and the call asks for projects taking in consideration both the regional rural development plan and the regional S3.

[25] A new Bioeconomy strategy for a sustainable Italy.
http://cnbbsv.palazzochigi.it/media/1774/bit_en_2019_02.pdf

The bioeconomy strategic areas embedded in the S3, are being revised and will be updated for the new programming period of 2021 -2017 seeking to improve and reinforce strategic activities with demonstrated good results and support the further development and upscale of R&D+i results.

The current actions related to support R&I through the ERDF, which have seen dedicated actions to the circular economy and bioeconomy, aimed at:

- promote collaboration between companies, in particular SMEs, and research bodies also through
- Clusters and Poles able to aggregate the demand for innovation, to identify technological trajectories and to develop the internationalization of R&D activities;
- promote the technology transfer of research results to the production system;
- mobilizing public and private investment in research, development and innovation;
- develop the competitiveness of the regional production system through research, development and innovation, by attracting significant innovative investments, promoting research and development aimed at commercialization, facilitating the acquisition of qualified skills by companies.

Such objectives have been pursued through:

- the support for innovation Poles managers for regional cluster development programmes;
- the support of research, development and innovation projects and activities within the regional system innovation Poles, to promote technology transfer and collaboration between SMEs and research bodies on topics at medium TRL;
- the promotion of collaborative projects between SMEs, large companies and research bodies within the innovative technology platforms on medium-low TRL themes, in order to promote the demonstration of innovative technologies in relation to the competitiveness of entire industrial supply chains;
- support for industrialization of research projects (IR² Instrument), with the aim of promoting industrial investments able to fill the so-called "valley of death" that separates the results of more promising research from their commercial development, on medium-high TRL themes;
- the qualification and strengthening of public research infrastructures and the promotion of access by SMEs to qualified research and development laboratories and services;
- the facilitation of innovative investments made by SMEs (Innovation for SMEs), with the aim of promoting investments in environmental sustainability and innovation of production processes.

4.5.2 Barriers and challenges to regional bioeconomy

The strategies and actions related to bioeconomy are embedded within the regional Smart Specialization Strategy, so they are monitored within the same framework. The observation of the first results related to the implementation phase and the analysis of the projects expressed by the business world (funded by ERDF measures) shows how innovation policy implemented to date has contributed to:

- mobilizing investment in research, development and innovation, with a focus on the transfer of technology and collaborative research, also through "enabling" tools;
- focus the interventions on the transversal trajectories already highlighted by the S3
- Promote greater integration between innovation initiatives and skills development (also combining ERDF and ESF measures)

Circular economy (including bioeconomy) is resulted to be (together with the digitalization area) a main driver for innovation projects through the Innovation Poles, Technological Platforms and IR2 instruments.

An interesting data emerged during the monitoring activities is the difficulty to link the funded projects to a single specialization area, as a consequence of the innovative practices of the enterprises, which combine multi-disciplinary competences.

An analysis of projects activated on trajectories related to bioeconomy (made by NUVEC, part of the national Territorial Cohesion Agency), indicates that in Piemonte region more than 200 projects related to bioeconomy have been funded (data November 2020) during the 2014-2020 programming period, of which 57% in the agri-food area and 41% in the green chemistry area.[26]

Beyond the results that can derive from the analysis of the number of the funded projects, what can be highlighted as something that has not reached the expected results is a lower involvement of large companies acting as "drivers" for the development of projects with a "value chain" approach, and the difficulty to directly involve the primary sector actors in the R&D projects, due to lack of skilled people and expertise. This leads also to examples of bioeconomy value chains that -even if effective- don not valorise local biomass, and, on the other hand, to available local biomass that is not valorised within the region.

Furthermore, during the SAT analysis for Piemonte main barriers were identified on:

- The infrastructure to handle feedstocks, in particular the readiness of logistic centres to handle the expansion of regional bioeconomy.
- The regions have been highly active in providing financial support to R&D+i, with grant contributions to nine projects through the Bioeconomy Technological Platform and about 109 projects supported through Innovation Poles. Although financing opportunities as well as the financial advisory service are present at the regional and country level, these are scarcely coordinated.
- Reinforcement of support institutions to promote inter-sectoral exchange for waste valorisation and to solidify the establishment of waste market among industries. Also, the existent gaps of regional chemistry and biorefinery industry with the regional biomass, in connection to lack of analysis regarding demanded biomass in that industry and assessment of market segments that is covered.
- Lack of SMEs operational, financial, technical and planning capacity to carry-on projects with a mid-long-term vision

4.5.3 Proposed specific interventions for Piemonte

Piemonte is undergoing the revision of the Smart Specialization Strategy and with it, the priority areas and goals related to bioeconomy for the region. The future implementation wants on one hand to capitalize on the already developed measures and instrument (for instance, the Innovation Poles and

[26] https://www.agenziacoesione.gov.it/wp-content/uploads/2020/11/Presentazione_Nuvec_11_11_2020_S3_-Bioeconomia-circolare.pdf

the Bioeconomy technological Platform). Such instruments have proved to be valuable, leading to interesting R&I actions and results, and helping in the creation of a larger collaborative network among the regional actors.

Beside the required new updated for the 2021-2027 programming period, linked to the Cohesion Policy, the reasons to review the aspects, activities and instruments related to bioeconomy are also related on one side to the opportunities that the bioeconomy can represent for the region (as already highlighted during the previous programming period), on the other to the European and national framework, where the need of sustainable and circular models represent a priority for the future development (as well highlighted in the Green Deal, Farm to Fork Strategy, Circular Economy Action Plan, European Bioeconomy strategy, and, at national level, in the Bioeconomy strategy and Action Plan).

In a moment where all the main policies influencing bioeconomy have been updated -or are under a reviewing process-, the importance to an action able to consider those different policies (CAP, sustainable development, EFRD, RDF...) and to find a way to harmonize them in order to support the different aspects and sectors involved in the bioeconomy system can represent an opportunity for the region.

Also, other structural funds, as the ESF, have proved in the past to offer the possibility of synergic actions, for instance through the combination with EFRD to support skill building and skilled workforce training within R&I projects.

Moreover, since bioeconomy is a meta-sector involving several different "traditional" sectors, other national and regional policies have to be taken in consideration, such as the National Plan for Energy and Climate, the Regional Plan for Energy and Environment, the plans for sustainable energy, the regional plan for Waste Management, the national Plan for sustainable production and consumption, only to name the main ones.

The region foresees to leverage the technological platform to introduce "value chain" platforms, supporting the development and implementation of mid-long-term projects, also fostering R&I activities with higher TRL, that can lead to more direct access to the market. In such way, capitalization of results developed during the previous programming period can be deployed. Moreover, support to more efficient collaboration with the primary sector will be foreseen, also in the view of better valorising biomasses available on the regional territory.

Summary of recommended specific interventions to Piemonte	
Mobilization and cooperation among stakeholders	• Consider the translation of information in the Single Agricultural Register to English. The accessible information on the regional biomass production volumes, biomass import/export, current biomass value chains and actors along the entire chain would help future investors to identify regional potential and find actors related to biomass value chain for future cooperation. The open database can also help solving a mismatch between the available biomass and the existing technological solution. • The Piemonte region could create favourable conditions for grass-root living labs – born from the initiatives of farmers and SMEs – and connect them with strong actors in the chemical industry that could support through the capital-intensive phases

	of a join project and technical expertise. The joint biomass production between industry and primary sector would build farmers expertise on biomass requirements for industry, while the industry would gain supply security.
Policy framework and legislation	• Consider revising bureaucratic procedures for new company creation and industrial projects. Efficiency of bureaucratic systems can be checked in the region in order to avoid long-term set-up processes for the companies and complicated processes. This can also apply to processes to access to financial resources in R&D and SMEs support. • Consider the revision of regulations regarding biomass production (e.g. regulation on energy crops on non-arable and arable land) to find obstacles for biomass supply and to reinforce sustainable practices and the use of cascade principle. Increase its effectivity by including relevant stakeholders during the revision process (e.g. farmers, foresters).

Business development and markets	• Consider sustainable public procurement to mobilize waste markets. Establishing sustainable procurement criteria for products with better social and environmental performance, as well as procurement of products that are the result of valorised waste as prioritized for public institutions.
	• In order to encourage both households and SMEs to undertake environmental projects, the best combination of financial instruments is represented by guarantees or loan instruments, with the environmental part combined with lower interest rates and/or Technical Assistance. In order to do that, the region should:
	  ○ Integrate environmental objectives into existing SME financial instruments;
	  ○ Dedicate financial resources to financial instruments within the Operational Programmes, with different eligibility criteria for grants, that should be stricter, and financial instruments, that should be broader. In this way, grants and financial instruments can be used in a complementary way;
	  ○ Integrate grants into financial instruments, in order to make projects more economically viable and bankable;
	  ○ Provide Technical Assistance, in order to facilitate the implementation of financial instruments from public authorities, project promoters and final beneficiaries.
	• Development of equipment rental business model could contribute to the flexibilization of biomass production and supply. For farmers transitioning towards new value chains, renting of necessary agricultural equipment can facilitate giving the first steps towards flexibilization (ENRD, 2018). Furthermore, the conditioning and/or treatment of certain biomass types often requires expensive and very specific machinery. The rental business

	model will break the inertia from farmers with small and medium processing quantities. This model – Product Service System PSS - could be arrange with the biomass logistic centres and in synergy with farmers cooperatives, to assure their involvement.
Funding and Financial instruments	• Enhance the role of the Innovation Poles as a contact points for all type of investors and industry regarding funding matters. Due to their expertise in SME support and regional industrial development, the Innovation Poles could provide advisory and coordination services between entities wishing to invest in Piemonte and/or seeking for funding. A group of experts within the Innovation Poles could specialise in funding application procedures and coordinate the application process to national and international funds. • The Innovation Poles could also activate an additional service, aimed at supporting a selected group of projects in improving their investment readiness. Training and coaching activities would be provided on business modelling, entrepreneurship, how to present a business value proposition in a clear and convincing way and to catch the attention of different typologies of investors and/or potential customers and business partners, etc. A dedicated section on the platform should be created, that could be accessed by both for-mal and informal investors. • Consider the possibility to offer a set of financial products: loans, guarantees and equity. One example is represented by the FOSTER fund of funds being designed and implemented by the Occitanie Region in France. Another relevant example is represented by FARE Lazio, a financial instrument designed and implemented by Lazio Region in 2018, to be financed by the EFRD Operational Programme 2014-2020. FARE Lazio is made up of FARE Credito and FARE Venture. FARE Credito has been managing a revolving microcredit fund, a reinsurance fund and a shareholders' equity guarantee. FARE Venture set-up a fund of funds (Lazio Venture) and a co-investment fund (Innova Venture) which provide equity and quasi-equity with the aim of developing the market of venture capital within the region and fostering equity investments in local start-ups and SMEs

Biomass supply, availability, information and monitoring	• Conduct a capacity check–up of biomass logistic centres. With the increasing demand for biomass and bio-based products, the storage capacity of biomass logistic centres should also expand or adapt. Additionally, the conditions of storage could contribute to solve the seasonality problem of some kinds of biomass (woody biomass or agricultural residues e.g. straws, etc). • Promotion of stable contracts between biomass logistic centres and biomass producers • Establish /regulate purchase agreements between industry and farmers – preferably these should be long-term agreements, which would give both farmers and industry a security for cooperation and would specify conditions of biomass grow (sustainability), payments and review periods for payments, etc.

Table 9: Summary of recommended specific interventions to Piemonte

Friuli Venezia Giulia.

4.5.4 Regional Status of Friuli Venezia Giulia.

The bioeconomy in Friuli Venezia Giulia comprises the "activities based on the sustainable use of renewable biological resources and their transformation in final or intermediate products/goods, for instance production of food derivates, transformation of applications in biodegradable polymeric materials sector, production of pulp material from non-food feedstocks, pharmaceutical and nutraceutical bio-based ingredients, bio-based chemicals and materials". The bioeconomy promotes a model based on the use of renewable biological resources from land and sea (crops, forest, fish, livestock, microorganism) and their transformation in products, goods, intermediates such as food, materials, and energy.

The region renewable resources are of key importance for the regional economy. Only agriculture activities generated and added value for the region in 2017 of 617 M€, which is also reflected in 160,000 ha dedicated arable land from a total of 223,000 ha of usable agricultural land. About 71% of agricultural land is used to harvest crops (forage, cereals, fallow, oleaginous crops), while 15% produces woody crops and 14% is dedicated to pastures and grassland.

Regarding forestry resources, the region counts with 320,000 ha of forest, most of it located in mountain areas. Annually, 145,000 m^3 of wood it originates in 126,000 ha of forest productive area. Further forestry resources potential has been estimated much higher if all forest area could be exploited, given that logistic, mobilization and profitability issues would be cleared.

Finally, the region counts with fishing activities and aquaculture, which represent a potential on non-consumable or discarded resources, as well as those from present food industry which includes 336 companies in the field of transformation and production of products of animal origin, 17,815 companies working in the field of production and commercialization of food products and 8,217 companies in the food & beverage industry.

Main utilization of available renewable resources in Friuli Venezia Giulia are related to bioenergy (biogas and bioelectricity), processing of solid and liquid biomass and wastes management. Indicating a still traditional transformation paths of available biomass, although initiatives for higher valorisation are starting to develop on transformation of applications in biodegradable polymeric materials sector, production of pulp material from non-food feedstocks, pharmaceutical and nutraceutical bio-based ingredients, bio-based chemicals and materials.

4.5.5 Barriers and challenges to regional bioeconomy

Friuli Venezia Giulia carried out an analysis of their region, guided by SPRING Cluster. Following findings have been encountered in the framework of a regional bioeconomy position paper.

The Autonomous Region Friuli Venezia Giulia presents peculiar characteristics linked to its heterogeneous landscape and its strategic position in central Europe, being at the border and representing a contact with the eastern Europe. The socio-economic and environmental aspects of the regions can represent, if correctly supported, an important opportunity of development.

The initial analysis conducted for the preparation of the position document has been intended as a starting point for the development of a structured regional strategy, agreed among all the interested parties, able to valorise the available resources and supported by a dedicated administrative activity.

During the implementation of the document, several moments of dialogue with representatives of different regional Directorates and Agencies took place, where the challenge was to find a common field of discussion, giving also an update on the most recent strategies, documents and actions in the field of bioeconomy at national and EU level. At the same time, it was important to take into consideration all the different aspects related to the development of a regional bioeconomy, in order to evaluate the status of the region in relation of such aspects, their relevance for the territory, and the possibility to implement integrated value chains.

More challenging aspects where related to the assessment of the regional bioeconomy potential, where the SAT questionaries' as well as POWER4BIO tools were used as support to set an initial methodology and assessment, to be then further investigated by engaging all the actors along the value chains, and the need of creating a strong dialogue and interaction among all the different regional Directorates and Agencies involved in such a transversal sector as the one of bioeconomy.

Such aspects were then summarized in two main pre-requisites, and indicated in the position paper:

- The need of an efficient organization of the regional governance in to build of a common vision for the implementation of the bioeconomy
- The need to foster the collaboration among all the actors of the local innovation ecosystem: research, civil society, productive activities (primary, secondary, and tertiary), and the local institutions

The position paper was then structured in order to give a first framework to all the actors mentioned before, in order to raise awareness on the opportunities that bioeconomy represents, as well as to give an initial indication of the challenges to face.

The document has been structured in four sections: the first give an overview on the general principles of bioeconomy and on the main related documents at national and EU level; the second describes the opportunities that the bioeconomy can represent for the regional development; the third indicates a

roadmap for the development of a regional strategy and the related action plan; the fourth give an initial list of financial resources and instruments available at regional, national and EU level to be considered for the support of the development of the regional bioeconomy.

4.5.6 Proposed specific interventions for Friuli Venezia Giulia.

The position paper of Friuli Venezia Giulia indicates agriculture, food industry, forestry, bioindustry and marine bioeconomy as main areas to valorise within a bioeconomy framework. Main indications reported are:

Agriculture

The primary sector of the region represents the opportunity for the creation of revenues for about 15,000 operators (data from the document of Economy and finance of Friuli Venezia Giulia, 2020).

The development of circular bioeconomy in the rural sector has thus a great relevance, especially in relation to marginal and peripherical areas, where, due to a difficult access to primary roads, the biomasses are transformed in conventional products, so that there is a lack in the creation of value chains where the biomasses are valorised in new bioproducts.

The possibility to deploy new bioeconomy models within the rural system of the region is also strictly related to the opportunity to offer a better profitability respect to the traditional models. It is then important to foster the innovation potential of the rural bioeconomy, re-thinking the traditional models with the aim to create activities integrated within a sustainable productive cycle able to ensure a long-lasting economic return.

The region will then develop strategies for the agricultural sector aimed at valorising all the outputs of the primary production, through the dialogue and an integrated and synergic programming among the different actors of the value chains.

This necessarily involves a constant monitoring of the sector, and the development of shared territorial strategies, keeping in mind the need to strengthen the synergy among different value chains, also belonging to very different productive sectors.

In this this sense, it will also be possible to take action towards traditional and low-technology sectors when they are integrated with other innovative activities on the same territory, with the aim also to develop skills and to transform some current costs into value (see disposal of waste, by-products, energy consumption, marginal areas with risk of abandonment...).

The aim is therefore certainly to encourage actors who already operate within rural bioeconomy and those who have not yet begun to do so, to talk and to start cooperating.

Some concrete examples for the sectors currently most developed in the FVG region:

- arable land: development of programming and valorization paths through the connection with the processors; inclusion of by-products in other supply chains such as those of the fine chemistry and Made in Italy;

- wine-growing: development of cultivation methods with a low environmental impact through the production of plant bio-stimulators (from biomass) and the reduction of treatments plant protection; enhancement of by-products of the wine supply chain for the production of high-value-added raw materials, for example for the cosmetics and nutraceutical sectors.
- dairy products: recovery of livestock activities in the mountain area with sustainable business models; recovery of by-products of dairy processing for the production of novel food and food supplements.

In addition, for marginal and public-owned areas that are predominantly uncultivated or unused, it will be possible to promote crops of alimurgic grasses, medicinal plants and native species intended for production of fiber (such as hemp and broom) or proteins (such as alfalfa and protein pea).

Food Industry

Friuli Venezia Giulia is a region that has always had a strong agricultural vocation and a particular attention to the issues of food and animal welfare. The focus on quality food and the long tradition in the oenology sector have led to the development of an articulated regional food industry. The sector has a value added for the year 2019 of 537.80 million euros (with approximately 810M€ of Exports, equal to 5.3% of the region's total manufacturing industry), and employs some 8,560 people (7.5% of the manufacturing) in 1,162 companies (9.7 % of manufacturing) throughout the region.

The industrial sector, as is also the case in the rest of Italy, is largely based on small and micro enterprises; nevertheless, it has shown a good ability to resist and to grow even in the current economic situation. The growth opportunities are mainly due to the presence of companies able to assert their products on foreign markets. Often the ability to offer high value-added products derives from the fact that regional products, in addition to being of high quality, carry within them the cultural and social values and environmental conditions typical of the territory in which they are produced.
Because of its characteristics, the RAFVG food industry certainly falls within the scope of the traditional sectors based on the transformation of biomass into products. As a result, the opportunities for the development of the bioeconomy in this area are:

- better exploitation of biomass through their transformation in the places of origin, shortening the supply chains with a view to sustainability;
- promotion of products on new markets considering the overall impact of supply chains;
- optimization of existing processes/products with a view to greater environmental, economic and social sustainability;
- local enhancement of valorization of externalities with a view to sustainable close cycles;
- cooperation for the implementation of innovative initiatives with the involvement of actors (farmers, rural SMEs, researchers, marketing experts, etc.) in order to create value-added elements on primary and secondary production streams, also taking advantage of the brand "Made in Italy" or "Friuli Venezia Giulia".

Forestry

Friuli Venezia Giulia region is a territory over 7,800 km^2 wide, and 43% of its territory is occupied by mountain areas. Regional forest area (about 40%) is therefore in line with the national forest area

which stands at around 37%. Forests are firstly a valuable asset as they are responsible for the absorption of a large portion of the carbon emitted into the atmosphere. They, moreover, represent the most important and fundamental carbon tank available on the earth's surface.

Forestry importance as biomass is mainly linked to the wood industry, that in the RAFVG has historically been of considerable importance although today the thriving regional industry wood is based to an important extent on imported wood.

The available data therefore indicate that the first sustainable circular bioeconomy operation to be applied to regional forests is to recover the use and valorization of local woods and raw material. From this point of view, poplar cultivation, conducted today according to sustainable production protocols, contributes to a clear increase in the amount of woody raw material.

Forests do not mean only products related to the wood sector, since there are also other products (mushrooms, honey, herbs, etc.) that are strictly connected to the forest ecosystems.

Last but not least, forests have always been the main source of solid fuel for the production of bioenergy. The sector of bioenergy within the sector forest/wood has certainly also had significant growth in RAFVG in recent years, becoming a very dynamic segment, which includes biomass producers and traders, manufacturers of stoves, operators of energy systems, etc., a segment that today must be considered to ensure the cascading use of wood.

Bioindustry

The bio-based industry is the component of the bioeconomy that uses renewable biological resources and, through industrial processes, it produces goods starting from biomass. It is so also related to the industrial sectors that traditionally use biological resources as material (sectors related to the use of forests, cellulose, oilseeds, biofuels/bioenergy, biotechnology) and others, for which biomass is part of the portfolio of raw materials (e.g.: chemicals, plastics, cosmetics, food supplements, etc.). In Friuli Venezia Giulia there are historical but also very recent examples of bio-based industries that have integrate very well with the characteristics of the regional productive system.

One of the production cycles to first move towards sustainable circular bioeconomy was the production, distribution and consumption of bioenergy. Also, public incentives associated with the production of energy from biomass have led, in the recent past, to the development of biogas production plants from biomass produced in the territory. In many cases, however, they are first generation plants that use corn shredded as a biomass, a biomass in competition with the production of food and feed, and thus considered longer sustainable.

The opportunities for the development of this sector from a bioeconomic point of view, therefore, will depend on the choices concerning the future of already activated bioenergy activities, that could be upgraded to more sustainable production structures, or alternatively closed and dismantled.

Marine and aquaculture bioeconomy

Friuli Venezia Giulia has about 93 of the more than 8,000 linear kilometers of coastline on Italian territory, just little over 1.1%, but in the region, there is a particular ecosystem, with an area of about 25% of the total regional land. In fact, the peculiarity of the coastline is to be constituted for a significant

share of shallow brackish lagoon connected to the system of Venetian lagoons that from the city of Monfalcone reaches beyond the mouth of the river Po.

Here historical fish farming and shellfish farming activities are present, facilitated by the low depth, and temperature of the water, as well as by the availability of phytoplanktonic biomasses activated by the presence of organic material, carried by rivers and underground waters.

The presence of important freshwater rivers and streams is also one of the hallmarks of the landscape, and the peculiar composition of the riverbeds allows the waters to filter underground forming a rich underground river basin, that come then to the surface in the plain areas. They represent an important water resource for the agricultural activities, as well as for the trout farming, typical of the region.

Attention will be paid to the preservation of such important ecosystems, valorizing also the logistic aspects offered by the sea, as well as by supporting the implementation of synergic value chains between the sea and the land.

OBJECTIVES OF THE POSITION PAPER

A. To activate a regional governance of the bioeconomic process, by involving all relevant regional structures, both political and administrative, making sure that they interact effectively with stakeholders and, more in general, to all the regional actors involved in the process**.**
B. To identify the required expertise and the best organization of human resources, in order to coordinate their ability to participate in any form in the activation of one or more regional circular bioeconomic systems, enhance their potential, promote their development and support their growth.
C. To better identify and define the short- and long-term challenges that regional territorial ecosystems and the communities of its inhabitants will face in relation to the climate, environmental, economic and social issues, as well as the possible opportunities for growth and development inherent in these challenges.
D. To stimulate and pursue collaborations with the neighborhood territories, also on the basis of territorial, historical and cultural affinities, in order to substantially accelerate the transition towards the activation of one or more regional circular bioeconomic systems, thanks to the mutual exchange of experiences and resource sharing.
E. Ensure the active presence of Friuli Venezia Giulia within the European and national strategic framework for bioeconomy, usefully integrating the intervention guidelines services already available to make the regional territory and its production activities "smarter", interconnected, attentive to the uses of the available resources, making them as diverse, clean and efficient as possible.

5 CONCLUSIONS

In the development of task 5.4 it was achieved a comparable analysis of Western and South European regions participating in the project. This was possible by applying the SAT as analysis tool, which all regions responded in the framework of the project during the first months of 2020 to be used in both Task 5.4 and Task 6.2. Independently from the SAT result additional challenges were identified from other sources of information facilitated by the regional partners – Template 2.1, interviews with regional representatives and workshops –. Similarities among regions were find with regard to challenges or disadvantageous aspects for the advance of regional bioeconomy, which leaded to a characterisation of challenges in eight groups. These challenge´s groups were then related to the Key Factors in the SAT for the development of recommendations for possible interventions to be applied.

On the other hand, it is important to remark that although not all WE and South regions had a regional bioeconomy strategy at the time Task 5.4 was initiated, all of them presented high standard of bioeconomy development, and had elaborated policies and initiatives towards the promotion of bioeconomy principles. Therefore, it was possible to find common aspects and draw conclusions from the comparison of the SAT results, because the five regions have similar levels of bioeconomy maturity (medium-high) with respect to the initiatives and projects that are currently being promoted in each region. Also, the five participant regions have given relevance to strengthen the contribution to SDGs, technological projects and the use of regional resources in green chemistry (sustainable chemistry) or biorefineries for the production of high-added value products.

There was no room for the actualization of regional bioeconomy strategies in all regions, as some regions did not yet have an initial strategy. In particular, the regions of Andalusia and Piemonte have carried out the revision of their initial strategies, in search of alignment with current policy updates and plans at national and European level. The finalization of the revision process of their regional strategies is beyond the duration of the project, but specific aspects that have so far been considered for the next program period, or for the update of their roadmap, have been described for each region in the respective chapters. On the other hand, Flanders, one of the regions with the highest regional bioeconomy development has developed a policy plan, which proposes a link between the circular economy directive, the EU green deal and regional revitalization policies. The German regions of Bavaria and Saxony-Anhalt, which did not have a specific strategy for the regional bioeconomy before the start of the project, have developed a new bioeconomy strategy and a position paper on bioeconomy respectively. Finally, it is worth highlighting the role that the SPRING Cluster has played in transferring knowledge and the impetus to guide other regions integrated in the cluster. This is the case of Friuli Venezia Giulia (FVG), which under the guidance of SPRING carried out an analysis of its regional bioeconomy and had the opportunity to use resources produced in POWER4BIO during the development of its bioeconomy position paper. Furthermore, it is clear that regional strategies serve a coordination tool. However, it is to be further analyse, whether these are prerequisites for a good and purposeful development of bioeconomy and its activities. Some participating regions are examples of highly developed strategies, which have reached flag-ship initiatives, high technological development and abundant actions without a defined bioeconomy strategy.

In addition, in the identification of motivations for improving and adapting existing either bioeconomy strategies or advanced and elaborated bioeconomy policy frameworks already in place, it is remarkable the fact that the same principles, which were used in those exercises few years ago, remain to be

valid at present. The same elements and priorities have not substantially changed. The market demands have shaped to some degree the search of new value chains in some cases. Nevertheless, in all the cases, it is acknowledged the need to enlarge the stakeholders 'engagement so as to foster the implementation of agreed priorities and actions in each region. The support of the users of any kind as well as the flexibility in the bioeconomy plans is a broadly accepted requirement by now. But also, they are key elements to maintain, sustain and carefully look after in the bioeconomy initiatives in the WES regions.

The immense work carried out in the framework of Work Package 5 by the regions, as well as the analysis and the collaboration between the other partners involved in Task 5.4 have allowed the definition of region-specific interventions for the benefit of the regional bioeconomy. These recommendations have been left to the consideration of the regions to be considered in the updating of the regional bioeconomy roadmaps in the case of Piemonte and Andalusia or in the evolution of the position papers (Saxony-Anhalt and FVG) and detailed implementation of strategic plans (Bavaria).

6 ANNEXES

Annex A: Template initial discussions with WE regions

Template WE regions (T5.3 - T5.4)

Teleconference in Task 5.3 and 5.4 with Western Regions

Date		**Attendees:**
Time		**Region:**
Which are the priority areas to be deal with revision of strategy and potential update?		
Which are the major bottlenecks/problems by implementing the regional bioeconomy strategy and specific measures? *List the identified ones during strategy development*		
To which sectors are the problems oriented: policy, business or stakeholder? Any other subjects?		
What kind of intervention would be required to solve the problems? Are there own recommendations, possible solution?		

Date		Attendees:
Time		Region:
Do you have an example, where the problem was (successfully) addressed?		
What kind of support could be helpful from the P4B to implement the strategy?		
Do you have any other comments, questions, recommendations?		

Annex B: Challenges to bioeconomy in EU regions

Challenges per categories	Description
Mobilization and cooperation among stakeholders.	- Mobilization of actors is difficult, particularly from the primary sector to cooperate with others in the value chain, but also present within specific sectors (e.g. forestry) when motivations and expectations diverge or are not clear. Also, when incentives (public or from market) are non-existent or not enough to incentivize the mobilization of certain groups of stakeholders. - Lack of time to participate in dissemination activities and dialogues about Bioeconomy. - To establish cooperation across value chains, and when requiring working in cross-sectoral arrangements has been identified as challenging. This is influenced by a lack of trust between actors and a lack of transparency about the myriad of regional bioeconomy initiatives, in various fields such as environmental, renewable energies, circular economy, new materials development and carried out by several institutions – ministries, clusters, R&D institutions, industries-. - Not being aware, or not having a centralized information/monitoring institution that includes all regional bioeconomy initiatives, influences also a disconnection between R&D+i activities – including the supportive funding- and the needs of industry. - Competition from key stakeholders in the regional bioeconomy for available public funding - between forest industry, agriculture, nutrition, chemistry, biotechnology, bioenergy, etc. - Learning to cooperate and to work together between different sectors and particularly between farmers/foresters and industries (e.g. food, chemical industry) requires the spaces and opportunities for the social construct and capacities to develop. Currently key aspects such as the dialogue between farmers/foresters with industries are considered challenging.
Lack of training, skills and expertise.	- Lack of specific set of skills in the primary sector, to involve them in R&D initiatives. This includes assuring that trained people remain in the sector and multiply the acquired knowledge. - Lack of required skills in other phases of the value chain to manage the non-traditional uses, pre-treatment and conversion of biomass. - Making sure that primary sector can put in practice and continues alternative use of biomass residues

Policy framework and legislation	- Stringent or excessive regulations that impede the promotion of the bioeconomy sector, by restraining the use of certain biomass residues (e.g. restriction to use biomass catalogue as waste). - Complexity of regulation - Contradictory goals within policies and areas of support. For instance, the support with subsidies to biofuels generates competition for biomass with other sectors of the bioeconomy - Lack of a common understanding of bioeconomy and all its embedded activities between policy makers and other supportive institutions. Even along the stakeholders active within value chains. - Lack of harmonization among forestry, agriculture, environmental programs – between others - and with specific regional bioeconomy objectives. The lack of harmonization within existing programs, strategies and regulations might delay the establishment of specific and tailored policies to support bioeconomy. - Bio-based product requirements differ between EU member states, hindering the establishment of cross-regional/cross-national markets (B&B and B&C).
Business development and markets	- Developing and strengthening new markets for novel bio-based products pose a challenge for regions. This is linked to the lack of information within civil society about bioeconomy, and lack of awareness about adjacent benefits to health and environment, as well as a low willingness to pay for those external effects. - Higher prices of bio-based products (in B&B and B&C) in comparison with fossil-base incumbent products, reduces market possibilities for biocommodities /bio-based building blocks / bio-based final products. - Lack of knowledge and information at regional and national level of specific markets for the bioeconomy. Not identifying/mapping market opportunities reduces the capacity to address them and incentivize them with appropriate mechanisms. - Low technological maturity and readiness of SMEs to shift towards bioeconomy initiatives (and projects), given also by their preference to invest in short-term projects. - Lack of existing infrastructure and technological capacity to process biomass. - Due to lack of statistical information it is difficult to analyse and monitor the contribution of biomass and in general shares of bio-based products in the economy, in activities such as liquid biofuels, bioelectrics, bioproducts in established chemical, textile and pharmaceutical sectors.
Funding and Financial instruments	- Difficult processes to access EU funding opportunities, which reduces the accessibility at regional level. - Difficulty to integrate certain regional programs with ESIF - Coordination between financial instruments is required (EAFRD , ERDF) - High level of complexity to integrate funding that supports agriculture as well as industry. This requires currently the sectors involved to work in parallel, generating problems of cooperation.

	- Bioeconomy is usually funded only through R&D&I activities and lacks to be integrated within the operational programs – Only renewable energies are part of programmatic plans- . As well as recognized the multidimensionality when establishing funding instruments. - Financing mechanism after a successful pilot project wants to scale up. Usually lab development is sustained through R&D+I funding as well as first stages of technologies/bio-based solutions (it might be complemented by seed capital finance resources). However, the first five years after opening to market usually are not financially supported – Valley of death –. - It is difficult to measure impacts of funding mechanisms for bioeconomy at regional level. This should include impacts on innovation, biodiversity, employment, etc. - There is a need for dedicated opportunities for primary sector R&D, addressing the multidimensionality of bioeconomy in those projects, not only tackling agriculture. - Subsidies are seen as temporary measures. More precise measures of economic support such as tax reliefs, or specific taxes to fuel based products are necessary.
Biomass supply, availability, information and monitoring	- Lack of a quantification of really available biomass (technical and sustainable potential) and systems of information to make that information public to interested industries (transparency). Indicating key characteristics of feedstock, such as quality, pre-treatments, form, etc. This reduces the possibilities of analyzing the potential of non-used biomass in bioeconomy activities and identifying possible actions for more efficient biomass production/collection and use (non-used agri-food and forest residues, municipal waste residues, side-streams from industrial processes, etc.) in a sustainable manner. - For some regions, biomass is often exported to other countries and being integrated within global value chains due to price profitability paid abroad. Thus, reducing the potential added value of that biomass for the region. - Local utilization of biomass requires the support of public and private funding
Sustainability	- Lack of a unified sustainability criteria for bioeconomy activities. This includes the missing sustainability criteria for the production and use of biomass (including import and export of biomass). - Missing analysis at regional level of the effects of bioeconomy and measures to increase efficiency in forest and agriculture land. - Environmental benefits of bioeconomy (including bioenergy) have to be more widely disseminated, across sectors and with the civil society

Annex C: Identification of key factors which lead to updating bioeconomy strategies at regional level

The CEE regions are starting their path towards the first consolidated and robust bioeconomy strategy. The activities to develop in this process includes a monitoring system of the implementation plans. It will allow them to measure and carefully follow the progress of their actions, and eventually, shape them into future updated bioeconomy strategies.

Meanwhile, the WES regions of Power4Bio project are reviewing their existing bioeconomy principals. They are then more advanced in measuring the transition from the first initiatives in the field of bioeconomy to the new challenges they face. How those advanced regions assess and prioritise their new policies and strategies would be of instrumental importance for CEE regions to foresee and design long-lasting thinking in the creation of their first bioeconomy strategies. The WES experiences in adapting and learning from experience would be a highly appreciated lessons learnt to those less mature regions.

As part of this exercise, the following questions have been answered by the WES regions to shed some light on what the main drivers are in updating their respective bioeconomy strategies.

1. GENERAL PRINCIPLES

In the evaluation of the previous bioeconomy strategy, some weak points have been flagged. Then, in the updated bioeconomy strategy, some elements have been included to speed up/support key elements, which were not working out as planned. Please, indicate below, how important the following elements (being 0 false, 5 very true), have been reinforced in the new bioeconomy strategy;

	Bavaria	SPRING	Flanders	Andalusia
To keep the momentum of the public awareness in the bioeconomy field	3	3	1	5
To increase awareness raising, communication, and the level of know-how	5	4	3	5
To improve the Policy coherence and consistency to avoid contradictory policy goals (in some cases, through various policy areas being converted into regulations with contradictory end-goals).	4	4	5	5
Increase of market demand of biobased products	5	4	3	5
To foster market pull, both for final bio-based products, and for agricultural feedstock as input to the bio-based sector	3	4	4	5
To keep of solving the difficulties inherent in the initial steps of new bioeconomy activities	4	4	5	5
To refer to identified successful business models which could inspire and set the baseline for new applications in your region	4	5	3	5
To boost structuring effect and mobilization of actors across the whole value chain	4	5	5	5
To integrate of food and non-food value chains for an optimized use of natural resources	4	5	5	5

To create cross-sector interconnections with sectors traditionally non bio-based (e.g. automotive)	4	4	4	4
To support sustainable sourcing of biomass	4	5	5	5
To valorise agricultural residues and side-streams from agro-food sector	4	5	5	5
To boost sustainable cultivation	3	4	2	5
To keep promoting a cascading use of biomass	5	5	5	5
To incentivise sustainable end-of-life	4	5	3	5
To facilitate market uptake through existing (maintaining) or increasing (with new complementary measures) incentives	4	4	3	5
To promote socio-economic impact assessments	3	5	4	5
To set up initiatives to rural revitalization (abandoned or underutilized land)	3	5	2	5
To stimulate jobs and growth of income of primary producers	4	5	5	5
To create key research infrastructure in central locations to attract and cluster companies	4	5	5	5
To foster cooperatives that extend their business from farm to market through food processing enterprises	3	5	5	5

2. HORIZONTAL AND COMPLEMENTARY ASPECTS

All the above should be crystallised in practical initiatives which are manageable and operated by policy makers. How those priorities have been shaped in the implementation phase of the updated bioeconomy strategies?

To facilitate the analysis, a simple matrix was developed, analysing two reference documents. On the one hand, the EC in the report "*A sustainable Bioeconomy for Europe: strengthening the connection between economy, society and the environment (Updated Bioeconomy Strategy)*". This document depicts, among others, the main elements to consider towards bioeconomy strategies development. Secondly, a key document in this field "Indicators to monitor and evaluate the sustainability of bioeconomy, Overview and a proposed way forward" (*Stefania Bracco, Almona Tani, Özgül Çalıcıoğlu, Marta Gomez San Juan and Anne Bogdanski*, FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, Rome, 2019) also expresses the need to harmonize the information collected and the interaction with related policies.

The following table illustrates several complementary elements, which might be part of the bioeconomy strategy definition. Comparing to the previous bioeconomy strategy, how much attention has paid to those elements in the updated bioeconomy strategy? (from "0" no changes with respect to previous bioeconomy strategy, to "5", many new elements to incentivise those aspects are included in the new bioeconomy strategy which were not part of the previous bioeconomy strategy).

	POLICY FRAMEWORK AND FAVOURABLE POLITICAL CONDITIONS			ACCESS TO FUNDING	ACCESS TO FEEDSTOCK				INFRASTRUCTURE/INDUSTRIAL FACTORS		
EC Bioeconomy Control Points	New jobs created at local level related to primary sector	Existing actions leading to promote revenue sources diversification of farmers, foresters and fishermen	Synergies with financial Instruments under the Invest EU Programme	Public investment liaising with private investment	Profit margins of bio-based products	Commercialisation of new technologies; availability of local and/or regional	Feedstock at competitive prices	New solutions and application for feedstocks converted in low added value products	Green infrastructure to reduce the urban pressure on agricultural and forest land	Nature-based solution as green infrastructure and as biomass generator	Develop and test living labs where multiple disciplines and stakeholders can exchange ideas and replicate solutions on different scales
Andalucía	5	3	5	4	3	4	4	4	3	4	4
SPRING	2	2	4	2	2	3	2	2	1	1	4
Bavaria	2	3	4	5	4	5	3	5	2	4	5
Flanders	5	5	2	5	2	3	2	5	5	5	5

	TRANSFER OF KNOW-HOW			MARKET CONDITIONS	
EC Bioeconomy Control Points	Active national funding to promote knowledge transfer	Active regional/local funding to promote knowledge transfer	Specific training (courses, masters…) on bioeconomy field	New jobs created at local level related to primary sector	Existing actions leading to promote revenue sources diversification of farmers, foresters and fishermen
Andalusía	4	4	4	4	4
SPRING	3	3	3	4	3
Bavaria	1	3	4	4	4
Flanders	1	5	3	4	4

3. REGULATION

It is broadly accepted that it is critical to develop the regulatory framework alongside technology validation, to monitor and address gaps and obstacles that slow down new knowledge from being used quickly.
How much attention have your region paid to the following related regulatory frameworks when defining the update bioeconomy strategy?

Please, rate from 0 (no relevant) to 5 (very relevant).

	Bavaria	SPRING	Flanders	Andalusia
End-of-waste criteria	**3**	**5**	**3**	**5**
Collection of bio-waste	3	5	3	5
Other requirements under Waste legislation: Please specify [….]	**1**		**NITRATE REGULATIONS**	
Renewable Energy [yes/no]	Yes	4	2	5
Climate Change (e.g. ETS)	**2**	**2**	**3**	**5**
Plastics	2	5	3	5
Water Management	**1**	**5**	**2**	**5**
Nature Directives (e.g. Habitats, Birds)	2	3	2	4
Other				

BAVARIA

So far, the region did not decide a regulatory framework to foster the bioeconomy. Nonetheless, measure 1 of the strategy proposes to find "A solution [..] to examine the amendment of laws and ordinances with respect to their influence on the development of the bioeconomy and initiate necessary changes that support the conversion process towards a sustainable, circular bioeconomy."

End-of-waste criteria
Biobased and biodegradable plastics cannot be degraded in the current conditions of industrial composting plants in Bavaria. This means that degradable material must be disposed of in residual waste. On the one hand, this compromises the goal of the circular economy. On the other hand, it leads to confusion among consumers. They have to weigh up whether it is better to recycle fossil-based plastic or incinerate bio- based plastic.

Collection of bio-waste:
For the reason described above, biowaste recyclers should be included in the bioeconomy to test possible ways to integrate bioplastics into composting facilities. The new strategy addresses this challenge by funding a pilot project in which bio-based, compostable plastic bags are being processed in an industrial composting plant.

SPRING

Need to disclose environmental costs and externalities of conventional existing products that do not meet sustainability targets.

Incomplete application of laws already in force and related sanctions and the lack of homogeneity of the authorization approach regarding End of Waste due to the discretion of the various local legislations.

The EoW regulations refers to an "old" economic model, and new regulation are now produced "case by case" (i.e. one legislative decree for one specific biomass/byproduct to label it as secondary raw material instead of waste), which is extremely time-consuming and create uncertainty for the commercialization of bio-based technologies

FLANDERS

End-of-waste criteria and collection of bio-waste: The main challenge here was the ongoing creation of sustainability requirements for treatment of organic waste streams. These sustainability requirements are under development and this process has a large impact on the market development for waste stream valorization. So, the alignment between innovative solutions for bio-based activities and new sustainability requirements demands strong cooperation between actors and administrations.

Nitrate regulations: The recent developments for the regulation of nitrate emissions in water, air or soils, puts a strong pressure on the legal system for environmental permits. This creates a lot of business uncertainty and decreases the viability of new bio-based ventures.

Climate change: It is a frequent question how much the bioeconomy contributes to mitigate climate change. The quantification however is much more complicated than in the case of renewable energy for example. This makes that much more detailed monitoring is necessary to account for climate change impact.

ANDALUSIA

- *Compliance with administrative procedures is an obstacle for companies.*
- *European regulations leave many aspects of relevance to national criteria -> lack of coordination and lack of harmonization. This occurs in a similar way at the national level with the autonomies, being difficult to find univocal definitions.*
- *The EU is hyper-regulated and the standard-setting processes are very long -> little agility and flexibility. These long times also happen at the national and regional level.*
- *At a general level, the use of perfectly valid raw materials is disabled due to compliance with regulations due to their origin.*
- *There are still no instruments that discourage the use of resources of fossil origin.*
- *In line with this, Art. 30 of the Draft Law for Circular Economy in Andalusia (LECA) there is the objective to streamline administrative measures as the declaration of by-products and the end of the waste condition, aimed at reducing the administrative procedures prior to its declaration, guaranteeing the protection of the environment and health, within the framework of the regional powers established by the basic state regulations on waste.*

4. ADAPTATION TO NEW PROMISING VALUE CHAINS

As part of the updating process of the existing bioeconomy strategy, a review of selected value chains is suitable. The new scenario in the field of bioeconomy at regional level might have been changed. In this regard, which value chains have been identified as promising new pathways, which were not part of the scope of the previous bioeconomy strategy, and now, have paid a stronger role?

Please, rate from 0 (no relevant) to 5 (very relevant).

	Bavaria	**SPRING**	**Flanders**	**Andalusia**
CO2/CO as feedstock – And other industrial streams for production of advanced fuels and/or chemicals, materials	5	3	5	4
Reuse / Recovery of Waste for industrial production and / or energy use (consumer and / or industrial waste)	**5**	**2**	**5**	**5**
Recycling of Plastic containing materials	4	2	3	5
Reuse of different grades of Wastewater for industrial purposes	**2**	**2**	**2**	**5**
Algae (using CO2 and nutrients from industry as feedstock)	3	2	3	5
Others...	**5**		**4**	

Continues below

BAVARIA

The Bavarian Bioeconomy strategy addresses the question of new value chains as following:

"Value chains and cycles must be redeveloped and restructured while also taking the aspects of climate protection into account. The primary sector that creates and provides renewable resources is regarded as an especially important player. All participants benefit from the bioeconomic added value when agriculture and forestry are actively integrated as equal partners. At the same time the logistics of renewable resources must be taken into account for the establishment of new value cycles. Forestry and agricultural resources are mainly harnessed in a decentralized manner. New logistics chains must be established for thus far underused or unused resources as e.g. from food production or organic waste products. Establishing and transforming these capabilities towards new value cycles constitute core aspects of the bioeconomy. Implementation occurs by making adjustments along the entire value chain. […]

The usage of renewable resources that are produced by the local food and agricultural industry and also processed in Bavaria build up interconnected value chains and create new knowledge. Cooperation between farmers and foresters, processors and the agricultural machinery industry make innovations possible and in further consequence create new workplaces while ensuring added value and new perspectives for the rural region. New potential opens up for resource producers as integral players within the bioeconomy. The support of farmers and foresters for the development of innovative cooperation and the build-up of sustainable value chains has thus far already provided an essential basis for the further development of the bioeconomy. Economic perspectives for resource producers are linked to sustainable and viable cultivation."

There are also some explicit passages regarding specific value chains.

1. & 2. &3. 6 : CO2 and other industrial streams for biofuels, materials and energetic use, reuse and recycling

"Cascade usage, recycling as well as reusing waste and refuse materials are central aspects for a sustainable, circular bioeconomy in order to utilise products for as long as possible in a technological and ecological cycle based on biogenic resources. The goal is to decouple economic growth from resource consumption […]

Subsidiary flows from agriculture and forestry as well as food production – such as residuals from viticulture and hops farming, spent grains and grass clippings – are significant regional resources that can be used as cascade and by-products. Previously used agricultural residual and waste materials such as liquid manure, animal and fat waste can also be utilised. […]

Subsidiary flows from other industry branches (e.g. lignin, biogenic CO2, vinasse) can be recovered as cascade and by-products. Examples include the Power-to-X procedure for the generation of platform chemicals and basic chemicals from CO2 as well as processes for the usage of lignin for bio-based materials. […] CO2 can be used as a starting material for the production of basic chemicals, polymers, materials and fuels and thus prospectively contribute to greenhouse gas reduction and independence from reliance on fossil resources

ANDALUSIA

There is a certain limitation on the different uses to which the variety of biomass resources existing in Andalusia can be put and their introduction into alternative value chains. Due to the lack of detailed analysis of the applications of the available resources, there is also a need to identify the industries and companies that may be potentially interested in them.

On the other hand, there is uncertainty about the development of possible markets arising from the productive areas that should form part of the Andalusian bioeconomy. As this is an economic model that is already being developed in Europe, the difficulties for the business sector in general, and for the business sector in general, and of innovative companies in particular, to access new markets or to maintain their leadership new markets or to maintain the leadership quotas achieved in certain areas, in the face of international competition.

This situation can be aggravated both by the low yields that often characterise the production of bio-based products and by competition with cheaper products derived from fossil energy or with products from other markets affected by more favourable affected by legislation that is more favourable to the use, logistics and transformation of biomass resources. biomass resources.

In Andalusia, some industries have their own anaerobic digesters integrated to produce energy from waste and use it in their processes.

Also there is a commitment to the reuse of waste water by the industries themselves. On the subject of algae in Andalusia, there are several important companies that are making great advances in this sector giving rise to high value products, some of them applying them to the purification of waste water.

In the Draft Law for Circular Economy in Andalusia (LECA) there are several objectives related to the value chains of key products focusing in critical raw materials. The products to focus are electrical equipment, vehicles, plastics, textiles, food, nutrientes and bioproducts.

Plastics objectives:

a) Before December 31, 2025, a minimum of 65% by weight of all waste will be recycled. packaging.

b) Before December 31, 2025, the minimum recycling weight targets for materials specified below, contained in packaging waste:

1st. 50% plastic. 50% plastic.

2nd. 25% wood. 25% wood.

3rd. 70% ferrous metals. 70% ferrous metals.

4th. 50% aluminium. 50% aluminium.

5th. 70% glass. 70% glass.

6th. 75% paper and cardboard. 75% paper and cardboard.

c) Before December 31, 2030, a minimum of 70% by weight of all packaging waste will be recycled Before December 31, 2030, a minimum of 70% by weight of all packaging waste will be recycled.

- *cycle for water utilised. Revalorisation of sewage sludge.*

d) Before December 31, 2030, the minimum recycling weight targets for materials Before December 31, 2030, the minimum recycling weight targets for the specific materials listed below, contained in packaging waste: specified below, contained in packaging waste:
1st. 55% plastic. 55% plastic.
2nd. 30% wood. 30% wood.
3rd. 80% ferrous metals. 80% ferrous metals.
4th. 60% aluminium. 60% aluminium.
5th. 75% glass. 75% glass.
6th. 85% paper and cardboard. 85% paper and cardboard.
- *Reduction of food waste- 30% reduction by 2025 y 50% by 2050.*
- *Selective separation for biowaste.*
- *Actions to foster home composting of wastes mainly in rural areas.*
- *Water management- focusing in saving water and efficient*

FLANDERS

CO2/CO as feedstock – And other industrial streams for production of advanced fuels and/or chemicals, materials.
The bioeconomy in Flanders is expected to contribute heavily to CCU and to transformation of industrial CO2 streams to chemicals and materials.
2. Reuse / Recovery of Waste for industrial production and / or energy use (consumer and / or industrial waste)
This is the main block. As there are few primary resources in Flanders, all focus goes to recovery of waste streams from all types of areas (nature management, landscaping, food and feed industry, marine sources,…
3. Recycling of Plastic containing materials
Not in this phase. Research is ongoing on bacteriological degradation of plastics, but at the moment not yet at the necessary TRL levels.
4. Reuse of different grades of Wastewater for industrial purposes
The bioeconomy actions are part of the Flemish circular economy policy. Water and wastewater is a complementary neighbour activity to the bioeconomy policy plan.
5. Algae (using CO2 and nutrients from industry as feedstock)
We had an algae phase some 10 years ago in Flanders. This did not deliver sufficient amount of industrial activity, so the enthousiasm has declined a lot for this topic.
6. Others...
Industrial biotech and synthetic biology

5. OTHER RELATED INITIATIVES TO SUPPORT THE BIOECONOMY ECOSYSTEM IN YOUR REGION

Each region boosts different initiatives to support the bioeconomy ecosystem. Among the following trends, a classification from 1 (low) to 4 (high importance) per region has been carried out;

	Bavaria	SPRING	Flanders	Andalusia
Promote market for sustainable products through regulation	3	4	3	4
Incentivize industrial clustering	**4**	**3**	**4**	**4**
Promote Industry 4.0 benefits in the bioeconomy arena	3	3	4	4

Legislation to improve use of specific new products for different applications (e.g. algae).	**3**	**4**	**2**	**4**
Regulatory environment should promote innovation acceptance rather than focusing on risk avoidance	3	3	2	3
Application of the national end-of-waste criteria established	**3**	**4**	**3**	**4**
Establish mandatory certification schemes for recyclers of certain waste streams	2	3	2	3
Bounded 'waste' regulations preventing secondary use	**2**	**4**	**4**	**3**
Definition of by-product in the bioeconomy strategy	2	4	4	4
Development of waste treatment networks leading to local overcapacities or under-capacities for different types of waste treatment	**2**	**4**	**2**	**3**
Integration of urban environments in the bioeconomy analysis	2	3	4	4
Differing taxes or fees leading to internal or cross border "shopping behaviour"	**3**	**3**	**2**	**2**
Ensuring that environmental burdens are allocated consequently along the whole value chain, sector or life cycle stage.	3	4	4	3
Agreement upon fair rules for the recycling and the associated credit/burden in cross-sectorial collaboration.	**2**	**4**	**3**	**3**

BAVARIA

Market for sustainable products + Regulations and Legislation, Taxes/fees: *the strategy recognizes the importance of a market environment that is favorable to the sustainable recycling-oriented bioeconomy. It announces to advocate for supporting regulation, which will allow companies to develop and create new business models and products. The strategy measures, however do not entail, specific regulations for Bavaria to favor biobased products.*
Measure 6: *At the federal and EU level, the Bavarian State Government advocates for international CO2 pricing. It must also be taken into account that biogenic carbon has a different intrinsic value than fossil carbon. Maintaining international competitiveness of European producers as well as fair pricing for external environmental costs must be taken into account.*

***Clustering**: **Measure 33:** The Bavarian State Government utilizes cluster structures to initiate projects in the bioeconomy for players across industries and sectors. For example, cross-cluster projects promote the development and establishment of bio-based value chains, the support and networking of Bavarian start- ups in the topical field of the bioeconomy and support for the transfer of scientific findings.*
***Industry 4.0:** Digitization is regarded as a converging technological area for the bioeconomy. The deployment of artificial intelligence and machine learning, big data analytics or blockchain technology offer tremendous potential. These technologies can be used for digital land management, precision farming and more sustainable cultivation methods due to the conservation of fertilizers, optimized logistics and resource management. They are used for analyzing material flows, for the establishment of material databases, material simulations and process control.*
Measure 37: The Bavarian State Government placed strong emphasis on the high-tech agenda, which promotes research and development of new technologies for innovative climate protection. Thus, artificial intelligence is to be interlinked and advanced by means of bioeconomic research

SPRING

Please note that some regulatory issues are managed at national level (where their importance has been stressed within the National bioeconomy Strategy and related Implementation Action Plan). Nevertheless, regions recognize the relevance of such aspects.

ANDALUSIA

Promote the market for sustainable products through regulation: one of the actions aimed at the promotion of these products is action A 1.2 of the Andalusian Circular Bioeconomy Strategy, in addition to regulatory support.
In the Draft Law for Circular Economy:
Article 44 Efficient use of resources: Public Administrations shall ensure the reduction of the consumption of plastic containers in their public purchases, prioritizing the purchase of products without packaging or with sustainable packaging, especially those that do not contain chemicals harmful to health.
In Chapter II, it presented the aspects related to green public procurement, incorporating considerations environmental and circular in Andalusian public procurement.
Design and implement promotion and publicity (marketing) campaigns for bioproducts, bioenergy, services and processes related to the bioeconomy, publicising the labels that identify them.
Incentivize industrial clustering: the importance of this incentive is reflected in action D.1.1 of the Bioeconomy Strategy, which is the creation of the Andalusian Bioeconomy Cluster.
This is also a priority as in the new Strategic Plan for the Competitiveness of the Primary Sector ("Plan Estratégico para mejorar la competitividad del sector agrícola, ganadero, pesquero, agroindustrial y del desarrollo rural de Andalucía 2020 – 2022") in Andalusia (December 2020):
https://www.juntadeandalucia.es/export/drupaljda/PLAN_DE_COMPETITIVIDAD_2020-2022.pdf
Promote Industry 4.0 benefits in the bioeconomy arena: to promote the benefits of this industry, campaigns are carried out to promote bioproducts, tools are designed to favour technology transfer between the different actors in the bioeconomy, and research, innovation and technological development are encouraged.
Legislation to improve use of specific new products for different applications (e.g. algae): Algae is one of the value chains of great importance in Andalusia that gives rise to high value products and therefore it is to be promoted as the rest of the value chains.

Regulatory environment should promote innovation acceptance rather than focusing on risk avoidance: in this sense, work is being done to promote research, innovation and technological development by means of for instance the abovementioned Strategic Plan.
Application of the national end-of-waste criteria established: special emphasis is being placed on the issue of waste at both national and regional level, and this is a very important aspect to be tackle within the new (Draft) Law for Circular Economy.

Definition of by-product in the bioeconomy strategy: we use the definition from Law 22/2011:

Article 4 of Law 22/2011 of 28 July (BOE) A substance or object resulting from a production process, the primary purpose of which is not the production of that substance or object, may be considered as a by-product and not as waste as defined in Article 3(a) where the following conditions are met:

(a) it is certain that the substance or object is intended for further use,

(b) the substance or object can be used directly without further processing other than normal industrial practice,

(c) the substance or object is produced as an integral part of a production process; and

(d) the subsequent use complies with all relevant requirements relating to products as well as to the protection of human health and the environment, and does not give rise to overall adverse impacts on human health or the environment.

We do have a new regulation of application for the case of specific cases of autonomous competence for which according to the Draft Law on Circular Economy, Art 31: in the case of specific cases of regional competence, a substance or object of a specific production process developed in the Autonomous Community of Andalusia, may be considered as a by-product through the administrative procedure that regulations are established by the Regional Ministry responsible for waste, in accordance with the provisions of basic state regulations.

Ensuring that environmental burdens are allocated consequently along the whole value chain, sector or life cycle stage: according to the Draft Law on Circular Economy, Art 15 creation of the Andalusian public registry of life cycle analysis, attached to the competent Regional Ministry in environmental matters, which will aim at the voluntary registration of the life cycle analysis of the products, works and / or services.

6. FINANCE

Prices of new bio-based products are still a serious hurdle for bioeconomy. Several options might have been considered to unlock potential technologies which could increase efficiency in conversion processes. Thus, reduce the overall final cost of targeted new bioproduct. How much do you have integrated those elements in the updated bioeconomy, which were not so clearly included in the previous bioeconomy framework?

	Bavaria	**SPRING**	**Flanders**	**Andalusia**
Grants for end users to trial new technologies	2	3	4	4
Funding for large scale demonstration programs	**3**	**3**	**4**	**4**
Grants for deployment of innovative technologies and higher taxes on energy use	3	2	3	4

Any policy that taxes non-renewable energy consumption	**3**	**1**	**1**	**3**
Support in bringing solutions to TRL level 9, e.g. financial de-risking for SME/institutes.	3	3	4	3
Post-project support of demonstrators to support roll-out	**3**	**3**	**4**	**4**
Use financial instruments to lower capital costs	3	3	3	4
Financial reward for the use of recycled, secondary raw material in a finished product	**3**	**3**	**1**	**3**

BAVARIA

***Financing**: The Bavarian Bioeconomy Strategy recognizes the importance of an attractive financial environment for startups and investors. It emphasizes companies' financial needs for establishing new technologies, products and services. To address this challenge, the strategy focusses on internationally attracting investments of funds, investors and companies.*
When publishing the bioeconomy strategy, no new Bavarian grants, or financial schemes have been introduced. Nevertheless, the strategy proposed to explore possibilities to introduce new grants.

***Measure 28**: As an important topic of the future, investor networks are to be sensitized for the bioeconomy. Activities for the transfer of knowledge are initiated so that investors and fund managers can receive current information about the potential of the bioeconomy. Cooperation is ongoing with other federal and national actors. Foreign investors are also to be connected with Bavarian companies in a targeted manner.*

***Measure 36:** Investment incentives must be provided for building up capacities for the production of sustainable bio-based productions. The Bavarian State Government will develop initiatives in order to modify EU stipulations on assistance for the promotion of investments, economic growth and employment. The goal is to not predominantly use available state funding in the energy sector within the context of public environmental protection assistance but also consider it for material usage.*

Taxes in non-renewable energy-consumption:
***Measure 6:** At the federal and EU level, the Bavarian State Government advocates for international CO2 pricing. It must also be taken into account that biogenic carbon has a different intrinsic value than fossil carbon. Maintaining international competitiveness of European producers as well as fair pricing for external environmental costs must be taken into account.*
Demonstration programs, high TRL, lower capital costs:
***Measure 29:** Companies and investment funds can also use the Bavarian Transformation Fund for investments in the bioeconomy. The fund contributes to the strengthening of the equity base of these companies and thereby acts as an investor.*
***Measure 34:** The Bavarian State Government provides funding for the financing of pilot, demonstration and first-of-its-kind plants in order to support companies with the development of necessary infrastructures for the (further) development of innovative, sustainable/biotechnological procedures. Moreover, laboratory to production-relevant scaling and the production of large-scale test amounts are made possible. The goal is to establish biorefineries or bioproduct plants in Bavaria.*
Rewarding use of sustainable feedstock: Measure 25: The Bavarian State Government is examining whether a funding programme for the material usage of biomass is to be initiated. The focus is on projects that process and utilize regionally produced resources

FLANDERS

The financing part focuses on:
- *New cluster activities and collaborative projects with industrial partnesr*
- *Creation of new SME through support for the use of pilot infrastructure*
- *Generic guidance of new start-ups*

For all other elements, generic subsidies are available (investments, loans, help with patenting ...)

7. SKILLS AND COLABORATIVE FRAMEWORKS

How important skills and collaborative platforms are to foster the bioeconomy strategy are now, if you compare with the previous bioeconomy strategy in your region? (1-4)

	Bavaria	SPRING	Flanders	Andalusia
Promote skills programs to educate early-stage researches with new skill sets and symbiosis of experimental and theo-retical research	**3**	**3**	**3**	**4**
Promote social acceptance of innovations and supporting such innovations from lab to application.	4	3	4	4
Industrial Sectorial roadmaps specific for each market niche	**2**	**3**	**4**	**3**
Lack of coordination/Communication between companies from the same sector	4	3	4	4
Lack of coordination/Communication between companies from different sectors	**4**	**4**	**4**	**3**

BAVARIA

Social acceptance and skill programs: The strategy aims to establish a broad knowledge base in order to raise awareness for the bioeconomy and promote innovation, which is, among other things, also made possible by anchoring basic concepts and topics within the education system.

Measure 8: The Bavarian State Government is initiating the development of an information campaign on bio-based products that also discusses their impacts on sustainability. The goal of this campaign is to raise awareness for the bioeconomy and for climate protection while concurrently increasing the practical knowledge of consumers.

Measure 10: Dialogue platforms are created in order to allow for an open discourse with the public and dis-cuss questions related to the bioeconomy, its advantages, framework conditions and economic perspectives. Current environmental changes, economic stipulations, planetary limits, biodiversity and ecosystem services as well as man's reliance on nature are especially taken into account

***Measure 12**: The implementation of the developing LehrplanPLUS curriculum of all school types makes it possible for the Bavarian Ministry of Education and Cultural Affairs to develop comprehen-sive competences with respect to the topics of the bioeconomy.*

Measure 13: *The Bavarian State Government aims to integrate bioeconomic topics in university degree programs while taking the academic autonomy of educational institutions into account. The goal is to embed the teaching of fundamentals and correlations of the bioeconomy at a commercial, political and ecological level in all natural science and economics programs. Bioeconomy students are to learn commercial, political-science and financial knowledge.*

Measure 14: *Education offers for teachers are being further expanded by integrating the topics of environmental education and climate protection (including bioeconomic topics) in the priority program that is binding for all levels of state-required continuing education for teachers.*

Measure 15: *The Bavarian State Government is in favour of institutions such as museums (specifically Deutsches Museum and BIOTOPIA) providing background knowledge on the sustainable bioeconomy to adult education centres, CICs, social groups and interested citizens of any age and thereby raising awareness for this topic. The new permanent exhibition at Deutsches Museum on the topic of agriculture and food supply can provide a role model function as planning for the integration of bioeconomic aspects has already been concluded.*

Measure 16: The Bavarian State Government is establishing "NAWAREUM", a modern information, learning and consultation centre at the Technology and Support Centre in Straubing at which visitors can prospectively receive comprehensive and illustrative information about the central topics of the bioeconomy

ANDALUCIA

In the Draft Law for Circular Economy in Andalusia, development and research that supports the bioeconomy is expressed as well as company symbiosis:

Article 71 Development and research in the industry of key products.

The Administration of the Junta de Andalucía will promote the development of innovation projects technology, knowledge improvement and research in the field of subject recovery critical premiums and the search for alternatives, as well as entrepreneurship, through the valuation positive on the current grant and funding lines granting requirements of these activities.

Article 37 Industrial symbiosis relationships in key product value chains

1. The Administration of the Board a of Junta de Andalusia will establish the regulatory and administrative mechanisms suitable for the establishment of industrial symbiosis relationships, facilitating connections industrial and promoting intersectoral meetings with the participation of waste managers.

2. Likewise, it will promote the creation of companies and entities of diverse nature, which establish or promote relationships of industrial symbiosis.

Skilled work-force is also a priority, for instance in the primary sector is needed as they are at the core and initial stages of the bioeconomy development. In the Strategic Plan for the Competitiveness of the Primary Sector in Andalusia, it is one of the objectives:

Program 3.3 KNOWLEDGE GENERATION, TRAINING AND TECHNOLOGY TRANSFER PROGRAM TO THE AGRI-FOOD SECTOR. Objective 4. Improve the training level and business skills of agents in the agri-food sector with the creation of a collaboration table between the Ministry of Education and Sports and the Regional Ministry of Agriculture, Livestock, Fisheries and Sustainable Development (pag 118).

Regarding collaboration among companies (Plan for Strategic Plan for the Competitiveness of the Primary Sector in Andalusia, page 92):
Program 2.5. Fostering Circular Economy Objective 6. Increase agri-food production under more sustainable production systems and promote circular economy. General objectives of the Program:
• Increase the number of circular economy collaboration processes of companies and professionals in the sector.
• Increase the number of entities (of the cluster) participating in international projects.
Measures to be developed:
• Create an ecosystem facilitating the circular economy.
• Create an online platform for collaboration and public-private cooperation.
• Creation of services on said platform for the companies that make up the cluster.
• Participation in European networks.
• Presentation of proposals for participation in cooperation projects with other countries.
• Execution of circular economy projects that are approved in collaboration with other countries where the Andalusian Administration participates.

FLANDERS

Skills are very important, but it is very difficult to develop a program for the bioeconomy. There are sufficient academic and technical education programs going on, but the big challenge is life-long learning and on-the-job training for persons who already left school and are working in related companies. We did not yet figure out what the optimal way is to increase skills and awareness for them. (moreover, the diversity of necessary skills in the bioeconomy is so large, that a single program could not cover it.)

The other parts on platforms and collaborations are correctly filled in fortunately. There are cluster organisations up and running, with sufficient number of adherents and large numbers of projects in the pipeline. There are also platforms for communications and exchange to tap in to. So that is OK.

SPRING

As an average on regional level, all those aspects are relevant.

More advanced regions (for instance, Piemonte), already put in place actions in this direction, that will be further implemented in the new strategy.

In the national bioeconomy strategy (that is the reference document for regions) underline the importance of this aspects, which were already present in the previous version of the document

Annex D: Andalusian bioeconomy planned specific interventions

Some priorities in regard to the circular bioeconomy are to be taken from the mentioned Strategic Plan for the Competitiveness. This plan includes a series of strategic lines that comprise the corresponding programmes and measures to advance along the path of the values of the bioeconomy and respond to these needs. The main general needs/desired are:

- Better market orientation and the opening of new markets for (bio)products.
- The incorporation of the culture of quality and added value leading to the creation of processing industries and new (bio)products.
- The transfer of knowledge including the most recent and profitable innovations for the (bio)sector.
- The growth of the internationalization of the (bio)sector.
- The development of electronic administration and the simplification of administrative procedures.
- Increasing the supply of formal training in bioeconomy related themes.
- Improving financial training and specific products created for the sector by financial institutions, so as to increase business training.
- The development of the circular (bio)economy.

The objectives more directly related to the bioeconomy are the following:

- Increasing agri-food production under more sustainable production systems and fostering the circular (bio)economy; creation of new companies and modernization of the existing ones. This has to be done by supporting the processes of transformation, commercialisation or development of new products, investments in waste reduction, energy efficiency, circular economy with the strategic objective of energy efficiency, circular economy, with the strategic objective of increasing the competitiveness of the agri-food sector and increasing the added value of Andalusian agricultural products, in Andalusian agricultural products, within the framework of a new, more sustainable and efficient business model. To this end, a plan will be developed to support tangible and intangible investment in the Andalusian agri-food industry, aimed at:
- Organic growth of industries.
- Consolidation of the excellence of the agri-food industry.
- Expansion and modernisation of agri-food industries.
- New agri-food industrial facilities.
- Promotion of renewable energies and the use of alternative energy sources.
- Environmental management system and environmental audits.
- Promotion of reductions in the environmental footprint of agri-food products.
- Minimisation of by-products and waste.
- Promotion of eco-design.
- Promotion of the implementation of the ISO 26000:2010 standard for social responsibility, social traceability of agro-industrial products, as well as the "Equality in Business" label.
- Promoting the optimisation of the management and recovery of by-products and waste generated by the agri-food industry.
- Promoting the circular (bio)economy, with the aim of converting biological waste generated by the agri-food industry into value-added products, either for food or other uses.

Regarding sustainable agricultural production, it aims to maintain environmentally beneficial activities in the face of the risk of abandonment, as well as the introduction of production systems that allow for a more sustainable use of natural resources and the sustainable development of genetic resources

in the region. One of the objectives is to promote agricultural and livestock production systems and models that respect soil, water and biodiversity resources.

The measures to be developed in this programme are as follows:

- Restore, preserve and enhance biodiversity (including in Natura 2000 areas and areas with natural constraints high nature value farming systems and European landscapes).
- Improving water management, including fertiliser and pesticide management
- Preventing soil erosion and improving soil management
- Achieving more efficient water use in agriculture and livestock farming
- Reducing greenhouse gas and ammonia emissions from crop and livestock farming
- Promote carbon conservation and sequestration in the agriculture, livestock and forestry sectors.

Regarding sustainable production in the agro-industry, the aim is to increase the area dedicated to sustainable production by FVPOs (fruit and vegetables producer organizations). The aim is to support investment in environmental objectives. The measures to be developed for this programme of strategic line 6 on sustainability are as follows:

- Organic production.
- Integrated production.
- Improved water uses or management, including water saving and drainage.
- Actions to conserve soil.
- Actions to create or maintain habitats favourable to biodiversity.
- Actions to promote energy saving or improve energy efficiency; transition to renewable energy sources.
- Actions to reduce waste production and improve waste management.

Looking at organic production, the aim is to increase agri-food production under more sustainable production systems and promote the circular economy. Other secondary objectives:

- To increase the number of young people and women entering the agricultural, livestock and fisheries activity.
- To improve the image and appreciation of the agricultural, livestock and fisheries profession by society and the visualisation of women's work.
- To improve the level of training and entrepreneurial skills of actors in the agri-food sector.
- Increase agricultural, livestock and fisheries income and the resilience of farms.
- Increase the employment rate in rural areas, especially among women.

Andalusian organic production is highly developed in terms of production, processing and marketing for export, although it still has the prospect of achieving a greater market share. In particular, it is still insufficiently developed in the market. For this reason, the marketing of organic products on the domestic market should be promoted, as well as export, as a way of improving the profitability of farms.

It is a production method that provides environmental services and positive externalities, which need to be exploited and which also has a very positive influence on mitigating and adapting to climate change, and for this reason has higher start-up costs. In this sense, it is proposed to incentivise conversion from conventional production and the maintenance of those who already practice it.

These agricultural practices are not always well known by producers, so in order to increase the number of operators, it is necessary to increase the effort in advice and training, as well as in the development of new technologies, the exchange of experiences and innovative ideas.

A sector of the population demands sustainably produced food and their demand is in turn an incentive factor for production. Consequently, by increasing domestic consumption, the surface area and also the number of producers increase. The measures to be developed are as follows:

- 1. Aid for conversion to and maintenance of organic production increase of aid for conversion to and maintenance of organic production, prioritised for those who have received specific training in organic production (IFAPA, vocational training and universities) and who are young people and women.
- 2. Improvement of the advisory structure through entities coordinated by the CAGPDS.
- 3. Specific technical advice, elaboration of technical materials, adaptation of facilitating regulations, line of aid for on-farm composting and support for composting plants in the lines to composting plants in the lines of aid to agro-industry, to improve access to and recycling of organic matter from organic farms with a circular economy perspective.
- 4. Agroecology classrooms, publication of technical materials, network of farms collaborating with research, as well as regulated and non-regulated training, to increase the technical knowledge of organic operators.
- 5. Institutional social consumption, school/social gardens, HORECA channel and institutional campaigns to promote the consumption of organic food, in order to promote and improve knowledge about organic products among the consumer population.
- 6. Promotional campaigns in specific sectors, support for local markets, guide and mobile application for organic sales outlets, and dissemination of registered organic operators. and dissemination of organic operators registered in the direct sales register, in order to increase domestic consumption of organic products in small, medium and large-scale retail outlets, as well as in small, medium and large-scale retail outlets, medium and large supermarkets, as well as in local markets and through direct sales.
- 7. Support for the organisation of and participation in national and international trade fairs and meetings, through technical support and collaborations with public and private entities.

Integrated control: to increase agri-food production under more sustainable production systems and to promote the circular (bio)economy. The general objective of the programme is to increase the number of farms with integrated pest and disease management. The idea of this programme is to provide farmers with an information exchange platform (RAIF: Red de Alerta de Información Fitosanitaria; Phytosanitary Information and Early Warning Network), where they can access all information related to plant health, such as new pests, phytosanitary products and information on pest identification and control, among others. Information on plant health, such as new pests, phytosanitary products and information on pest identification and control, among others, so Andalusian farmers can use it to consult any aspect related to the health of their crops.

This exchange platform also includes innovative plant health tools such as a system of alerts to mobile phones via SMS on plant health information, a link to the information, a link to social networks and the sending of phytosanitary reports to users who request them.

The development of this platform is aimed at actors in the agricultural sector, in particular farm owners.

- Improving water use, especially by increasing the use of reclaimed water. The objective is to improve water use, especially by increasing the use of reclaimed water in Fruit and Vegetable Producers' Organisations (FVPOs). The idea of this programme is to support FVPOs in investing in environmental objectives related to water management. The measures to be developed to implement this programme are aid for the improvement of water use or management, including water saving and drainage.

- Increasing the use of renewable energies in the primary sector and the agri-food industry from the irrigation and general perspective. The objective is to increase the use of renewable energies in the primary sector and agro-industry.

In irrigation: the aim is to make more efficient use of the water-energy binomial, minimising the effects of agricultural activity on the environment. To this end, the aim is to reduce the energy dependence of irrigation installations, increasing the efficiency of installations or contributing to the generation of energy for self-consumption. The objective of this programme will be carried out through aid aimed at Irrigation Communities for the execution of investments that increase the energy efficiency of their installations or contribute to the generation of energy for self-consumption.

Renewable energies in agro-industry: this programme establishes a line of incentives to facilitate the financing of agri-food companies for the improvement of energy efficiency in their facilities and processes, as well as the use of renewable energies and the production and/or logistics of biomass and biofuels. The objectives of this programme are to increase the use of renewable energies in the primary sector and the agri-food industry in addition to agri-food production under more sustainable production systems and to promote the circular economy.

Improvements in irrigation systems: this programme aims to improve water distribution infrastructures in irrigation communities in order to reduce water consumption by supporting the improvement of water distribution and regulation infrastructures, which are necessary to enable water savings in irrigation communities. The aim is to increase agri-food production under more sustainable production systems and to promote the circular economy. The measures for the development of the programme are based on aid for the improvement of irrigation in general actions and are aimed at the Irrigation Communities.

FINANCIAL INSTRUMENTS

- The general objective of the Programme is to improve the financing conditions of loans granted to the sector for investments linked to the rural environment.
- The specific objectives of the programme are:
- Increase agricultural, livestock, and fisheries income and farm resilience.
- Increase the number of young people and women entering into farming, livestock and fisheries activities.
- Increasing the number of enterprises engaged in innovation activities, especially in digital technologies.
- Increase the use of renewable energies in the primary sector and the agri-food industry.
- Increase the added value and value of agro-industrial production.

The aim of this programme is to create a financial instrument in the form of a guarantee portfolio, which will make it possible to provide the Andalusian agri-food sector with financing under better conditions through risk coverage. In addition, it will be possible to grant loans at zero interest through financial institutions. This will allow financial support for investments in physical assets, aimed at improving the performance and overall sustainability of agricultural and livestock farms and investments in processing, marketing or development of agricultural products. It will also be possible to finance working capital.

Farmers and livestock farmers, as well as agri-food companies, will be able to use this financing to invest in technology, machinery, production systems, internationalisation (including promotional actions that serve to open up to new markets) or working capital needs.