

AlpLinkBioEco Inventory of Policy Instruments

Synthesis of regional reports about state-of-the-art strategies, policies and clusters related to circular bio-based economy

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Table of Content

List of acronyms and definitions	4
1. INTRODUCTION	5
1.1 AlpLinkBioEco project in a nutshell	5
1.2 Purpose of the document	5
2. BIOECONOMY – A QUESTION OF DEFINITION	6
3. KEY FINDINGS	7
3.1 The regions and their biomass potential in brief	7
3.2 Bioeconomy strategies in the Alpine region	15
3.2.1 Funding	24
4 FUTURE OUTLOOK AND IDENTIFIED OPPORTUNITIES	32
4.1 Conclusion	32
4.2 Recommendations	37

List of acronyms and definitions

Acronym	Definition
AS ¹	Alpine Space: 7 Countries, of which 5 EU Member States (Austria, France, Germany, Italy and Slovenia) and 2 non-EU countries (Liechtenstein and Switzerland), and 48 Regions.
Bio-based economy	The production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, biobased products and bioenergy', including both traditional and emerging sectors, i.e. 'agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries ² .
Biomass	Biomass is defined as "the biodegradable fraction of products, waste and residues from biological origin from agriculture (including vegetal and animal substances), forestry and related industries including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste" ³ .
Cluster	Clusters are generally described as groups of companies, mainly SMEs and other actors (government, research and academic community, institutions for collaboration, financial institutions) co-locating within a geographic area, cooperating around a specialized niche, and establishing close linkages and working alliances to improve their competitiveness.
EUSALP	EUSALP is the Alpine macro-regional strategy that provides an opportunity to improve cooperation within the Alpine region. It has identified common goals and approaches for implementing them more effectively through transnational collaboration. EUSALP constitutes a strategic agenda that should guide relevant policy instruments at the EU, national and regional level by closely aligning and mutually reinforcing them ⁴ .
PP	A Project Partner within this project
Region	Regions within the project and which are represented by the Project Partners (namely 9 regions of the AS, i.e. Canton of Fribourg, Baden-Württemberg, Autonomous Province of Trento, Lombardy, Austria, Auvergne-Rhone Alps, Slovenia, Bavaria, Autonomous Province of Bolzano-Bozen (South Tyrol). It is worth to mention here the white paper also include the whole Switzerland as it includes 26 out of the 48 regions of the AS.
S3	Smart Specialization Strategies (S3): Smart Specialization is a strategic approach to economic development through targeted support for research and innovation. It involves a process of developing a vision, identifying the place-based areas of greatest strategic potential, developing multi-stakeholder governance mechanisms, setting strategic priorities and using smart policies to maximise the development potential of a region ⁵ .
SME	Small & Medium Enterprise
VC	A value chain is a set of activities that a firm operating in a specific industry performs in order to deliver a valuable product (i.e., good and/or service) for the market. The concept comes through business management and was first described by Michael Porter in 1985 ⁶ .

¹ <https://www.alpine-region.eu/7-countries-and-48-regions>

² European Commission (EC) - What is the Bioeconomy? (2017) <https://ec.europa.eu/research/Bioeconomy/index.cfm>. (Accessed on April 30th, 2017).

³ (source: [Renewable Energy Directive](#)).

⁴ <https://www.alpine-region.eu/>, last access: 29 November 2018

⁵ Foray, D. (2015). Smart Specialization, Opportunities and Challenges for Regional Innovation Policy, Routledge.

⁶ Porter, Michael E. (1985). Competitive Advantage: Creating and Sustaining Superior Performance. New York.: Simon and Schuster. ISBN 9781416595847. Retrieved 9 September 2013.

1. INTRODUCTION

1.1 AlpLinkBioEco project in a nutshell

A key objective of EUSALP Alpine Space (AS) is the transition from a fossil-fuel based economy to a bio-based economy. The AS regions have significant biomass resources, strong industry sectors and knowledge centers; this gives them an important comparative advantage in achieving the objective. Unfortunately, no holistic cross-regional approach exists to connect all relevant value chain (VC) actors. The biggest obstacle for different actors from very diverse sectors is to cooperate transnationally/regionally along various sectorial bio-based VCs. The AS regions have a common challenge to bring together bio-feedstock producers, intermediates processors, product developers and end users to address pressing societal needs with novel cross-regional and sectorial VCs for implementing a bio-based economy.

In this context the AlpLinkBioEco project aims to develop a cross-regional bio-based economy strategy that includes a roadmap and demonstrators for intelligently assessing, selecting and creating innovative VCs. The project shall analyse different regions and clusters with respect to their size and value in the “Agriculture” (Agro), “Wood”, “Packaging for Food and Pharma” and “Chemistry” sectors. To reach the ambitious final objective, the following specific objectives will be reached during the project:

- to map existing resources, actors and relevant policies to set-up a cross-regional database. This will allow to identify the missing links within the VCs and boost the synergies between small and large actors and enhance the economic sustainability to ensure local employment;
- to manually develop a methodology (VC generator) to match actors along new VCs. The VC generator will be developed manually, tested and automated throughout the project to generate numerous potential new VCs;
- to generate new business opportunities within and/or across the regions using the links as shown in the new VC's descriptors.

The project targets all relevant stakeholders including policy makers, cluster initiatives, sectoral agencies, research centers and Universities, all enterprises including SMEs, interest groups including NGOs and individual actors, who can benefit from the specific tools and engagement in the novel VCs.

The project concentrates on bio-based economy and industry. Consequently, biodegradability will be reported, but they are not selection criteria for actors, VC's, and sector VC's, discussion, funding and recommendations. Since the Cluster analysis was not available during the preparation of the White Paper, the Sector analysis using the industry clusters will be a specific topic of the Cluster analysis and shall amend the White Paper.

1.2 Purpose of the document

The document represents a synthesis report based on the regional policy reports developed in WP T1 of this project. This synthesis report forms the basis for setting up a common policy dialogue scheduled for the second half of the project. The content of the regional policy reports prepared by the PPs is based on publicly available studies and databases, the current knowledge on regional strategies, and existing policy instruments. The reports provided the inventory of policy instruments and are publicly available <https://www.alpine-space.eu/projects/alplinkbioeco/en/project-results/regional-policy-inventory>.

2. BIOECONOMY – A QUESTION OF DEFINITION

Bioeconomy describes a concept that acknowledges the full potential of biotechnological research and innovation for the economy and society at large. Bioeconomy, often referred to as the ‘bio-based economy’, encompasses the production of bio-based resources and their conversion into food, feed, bioenergy and bio-based materials. A bio-based value chain includes the primary production of bio-based resources, their conversion to higher-value goods via processing and commercialization on the market. The Bioeconomy uses biomass resources — originating directly or indirectly from plants, microorganisms or animals—and biological knowledge. Bio-based resources are all resources containing non-fossil, organic carbon, recently (<100 years) derived from living plants, animals, algae, microorganisms or organic waste streams. These are summarized in the term “biomass”. These elements are at the heart of circularity and sustainable development that delivers strong regions by creating a flourishing economy that respects the environment. This is done by reducing dependence on fossil fuels and finite materials without overexploiting renewable resources. It is also based on efforts directed at preventing biodiversity loss and land use change, regenerating the environment and creating new greener, circular based, economic growth and jobs⁷.

The Alpine space macro region does not currently have a specific aligned Bioeconomy strategy, with regions defining Bioeconomy in a variety of ways. While the differences between definitions are slight, the definitions used might include / exclude different economic sectors as sectors pertaining to the field of the Bioeconomy⁸. The overview shows that definitions range from very technically focused interpretations to expectations of an economic paradigm shift and the realization of a decarbonized economy through Bioeconomy⁹.

The reports use different definitions and it seems that only in certain cases consensus on regional/national level about the definition of Bioeconomy exists (Upper Austria, Baden-Wurtemberg and Trentino). Lombardy is following the definition of the national Bioeconomy Strategy, whereas Fribourg region uses the definition used at the European Commission (EC) level and its variations. Other regions operate with certain regional definitions (Upper Austria, under development in Bavaria), others use national definitions (Trento, Baden-Württemberg). Upper Austria and Fribourg, like Rhone-Alps, also refer to other definitions, while Slovenia provides no definition at all. As can be observed in Table 1, the definitions of Bioeconomy provided build on and complement each other, thus forming an all-encompassing overview of how the regions perceive Bioeconomy.

Table 1: Overview of Bioeconomy definitions and their building blocks

Region	Building blocks of the definitions used
Lombardy	<i>Bioeconomy as production of renewable biological resources and their conversion into value added products, advantages of the Bioeconomy</i>
Fribourg	<i>Bioeconomy as an industry. Adding emerging sectors to those traditionally considered as Bioeconomy, focus on materials, chemicals and energy, additionally mentioning health products</i>
Upper Austria	<i>Bioeconomy as products, processes and services. Future outlook of a sustainable, resilient and climate-neutral economy, addition of circularity principles and cascading uses of biomass</i>
Bavaria	<i>Bioeconomy as an economic system, adding a socioeconomic aspect, the importance of changing societal values, focus on research and application of results in industry</i>
Baden-Württemberg	<i>Bioeconomy as knowledge-based production and utilization of biological resources within the framework of a sustainable economic system, adding biological processes and principles to production and utilization of biological resources, including products, processes and services</i>

⁷ M. Dermastia, D. Osvald (2018), Study to Prepare a Synchronised Funding Scheme for Bioeconomy Development in the Alpine Region, <https://www.alpine-region.eu/results/study-prepare-synchronized-funding-scheme-Bioeconomy-development-alpine-region>, last access: 18 March 2020

⁸ Fribourg report

⁹ Upper Austria report

Trentino	Bioeconomy as a <i>socio-economic system</i> that includes and interconnects different economic activities using biological resources. Adding renewable resources from the sea (marine (micro)organisms), focusing on materials as a value-added product,
Rhone-Alps	Focusing on the <i>function of Bioeconomy</i> as satisfying our basic needs (food, housing, clothing, warming, moving, ...)
Slovenia	No definition provided.

As the Alpine Region has certain specifics relating to the Bioeconomy, the evident question to be posed is, whether a definition of the Bioeconomy covering these specifics could be formed, in order to encompass the current state and potentials in the region. There is, without a doubt, a high potential for sustainable, knowledge-based production, utilization and conversion of renewable biological resources (plants, animals, microorganisms) and waste streams into value added products (such as food, feed, bio-based products and bioenergy in both traditional and emerging sectors)¹⁰.

A common definition could form the basis for analysis, evaluation and monitoring of the resource availability and potential, as well as the successes of the regions when it comes to their transition to a sustainable, resilient and climate-neutral socio-economic system that rationally uses biological resources, reduces its dependency on fossil fuels, mitigates environmental impacts of primary production and along the supply chain. A common understanding within the Alpine Region is also beneficiary when introducing circularity and cascading principles and approaches, increasing its international competitiveness, creating new jobs and business opportunities, and changing the societal value system in favor of sustainable production, trade and consumption as an essential part of the Bioeconomy (Bavaria, Lombardy and Upper Austria report).

3. KEY FINDINGS

The following chapter presents the key findings of the synthesis report taken from the individual regional reports prepared by the project partners (PPs).

3.1 The regions and their biomass potential in brief

A closer look at the size of each region, the number of inhabitants living in each region and the region's GDP (as summarized in Table 2) shows that the regions could roughly be split into two groups – the bigger regions (in size but also in inhabitants and significantly higher Gross Domestic Product (GDP) and smaller regions. However, it must be noted that these two groups are still heterogeneous, which makes comparison difficult.

Table 2: Comparison of regions based on size, number of inhabitants and GDP

Region	GPD (in billion EUR in 2017)	Size (in km ²)	Inhabitants (in million)
Bavaria	594	70.000	13
Baden-Württemberg	495,2	35.751	11
Lombardy	368	24.000	10
Auvergne-Rhône-Alpes	263	69.711	7,7
Upper Austria	63	11.982	1,5
Slovenia	43	20.273	2
Trentino	19,5	6.200	0,54
Fribourg	18	1.671	0,312
South Tyrol	22,3	7.397	0,53

¹⁰ European Commission, 2016 & 2017, Freiburg report, Lombardy report, Upper Austria report.

In their regional reports, regions described biomass resource potential based on the current resource availability and use. Table 3 summarizes the information provided, based on common denominators, as the information provided does not provide data that allows comparison. The table shows a general overview, based on which it can be concluded that:

- agricultural biomass is a strong resource in Bavaria and Fribourg, and a significant resource in Trentino, Auvergne-Rhône-Alpes, South Tyrol and Upper Austria;
- forestry biomass is a strong resource in Fribourg, Upper Austria, South Tyrol and Slovenia, with high potential in Bavaria. An interesting case are Lombardy with a lack of the resource but with high demand (due to its highly developed furniture industry) and Baden-Württemberg which harvests a large amount of wood for bioenergy and acknowledges the small contribution of the resource to the GDP;
- biowaste and residuals are identified as an important resource to different extents in all regions;
- biomass from fisheries are mentioned by Lombardy and Trentino, with Slovenia also mentioning algae.

Table 3: Comparison of regions based on current state of biomass resource availability and use

Region	Biomass resources			
	Agriculture	Forestry	Biowaste & residuals	Fisheries & other water organisms
Bavaria	Very strong resources with unleveraged potential - cereals (wheat and barley), corn, winter rapeseed, hops - livestock (pigs, cows)	High potential due to not meeting annual maximum cutting rate and the fact 36% of total surface covered in forests (harvest 4,79 million m ³)	Biomass & residual materials from - food industry including trade of foods and gastronomy - cattle raising (manure) - forestry and wood processing industry - agriculture	Low relevance
Baden-Württemberg	Medium potential - agricultural land & certain livestock breeding in decline - increase noted in poultry, goat breeding and organic farming	Annual harvest is 11 million m ³	Biowaste & residual materials - household organic waste, - green cuttings, agriculture, aquaculture and forestry side streams	Low relevance
Lombardy	Strong agricultural sector - Agrifood industry accounts for € 8.3 billion and more than 124.000 employees.	Insufficient resources due to high divergence between natural resources and industrial sector use (harvest 0,53 million m ³). Thus, wood sourced from abroad.	Although a high potential exist, focus is given on reduction and production of bioenergy	Aquaculture is one of the three most important freshwater markets (trout, eel, sturgeon)
Auvergne-Rhône-Alpes	Good potential - Livestock (dairy beef, pig), - Plant sector (vegetables, fruits, vine, seed, lentils, nuts)	Although there is a high potential, only 5,2 million m ³ are harvested every year	Good potential animal dung, intermediate crops, waste from agri-food industry - sludge treatment - biowaste - end-of-life wood	Low relevance
Upper Austria	Medium potential - Cereals, root crops, oil plants	Very high potential with harvest 17.65 million m ³	Good potential - Organic residues (biowaste and unused plant/animal by-products, household, industry, trade waste,	Low relevance

			sewage sludge, manure, slurry...)	
Slovenia		Good potential since 58% of total surface covered in forests. Annual harvest 6 million m ³	Good potential - agriculture - organic waste from municipal landfills - biodegradable waste from food processing industry, - waste from public utilities, - organic kitchen waste, - wood waste from abandoned agricultural land and wood processing industry	Good potential due to algae production
Trentino	Good potential - 13.1% cultivable area (permanent and ligneous crops, especially fruits & viticulture) - 62% pastures and grasslands (livestock: dairy, non-dairy cattle, sheep)	Low potential Although 63% of total surface is covered in forests, only the harvesting is just 0,34 million m ³ (almost 40% firewood) p. a.	Good potential - Waste residual biomass from sawmill processing 26%, - woody agricultural residuals from apples and vines, - manure, - agri-food waste, wastewater sludge, food waste - Woody residuals from vineyards and apple cultivations (mostly destroyed)	Some potential due to aquaculture
Fribourg	Strong agricultural sector - poultry - cattle farming - fruits & vegetables	Forestry sector represents an important economic sector and an important supplier of biomass ¹¹	- by-products of poultry and cattle farming (feathers, manure)	
South Tyrol	Strong agricultural sector: - 89% grassland, pastures, meadows - 10% apples and vineyards More relevant: dairy farming (37% of total Province revenue), apples and vine	Strong forestry sector: - 42% territory covered by forests - 60 million m ³ of wood - uses: energy production (23%) and industry	Good potential: - animal waste - urban organic waste - agri-food waste - woody agricultural residuals from apples and vines - wood waste from wood processing	Low relevance

When it comes to regional biomass potential, regions identified their potential in more biomass resources. This can be observed in Table 4, which summarizes biomass potential for all the regions (one * equals one region) and identifies possible priority areas for the Alpine region. These areas include:

- crops for energy,
- biomass from forestry as a primary resource,
- wood as a secondary source (from wood processing, sawmill industry),
- residuals from agriculture, forestry and food industry,
- municipal waste and
- digitalisation.

¹¹ No economic figures available.

Table 4: Biomass potential for all regions with possible priority areas for the Alpine region identified

Theme/Sector		High potential for the region	Good potential for the region	Not important for the region
Biomass from agriculture	Crops for materials: hemp	**	***	** flax/hem, miscanthus
	Crops for energy: intermediate crops with energy recovery, corn canes, oilseeds	***	****	** flax/hem, miscanthus
	Crops for food (fruits) / feed: apples, grapes, sugar beets	**	*	
Biomass from forestry	Primary source	*****	*	* coppice
	Secondary (from wood processing, sawmills)	*****	**	
Residuals	Agriculture: viticulture and wine sectors, streams of agriculture, livestock effluents (manure slurry 2x)	*****	*	* by-products from fishing, potato, cider house, malt, protein straw, grain straw, beet haulm, from grain industry
	Forestry (class B wood waste ¹² , bark, sawdust, used wood from wooden packaging, furniture, construction)	*****	*	* class A wood waste
	Food (large retailers, catering, meat industry, side streams from fruit, grapes, cereals, oilseeds, potatoes, maize)	*****	**	* used edible oils, catering, meat industry
Aquaculture	- (Micro)algae (4x), fish, aquaculture waste	*	***	**** by-products, crustaceans
Municipality waste	- garden waste, - public plantings (parks, roadside vegetation(2x), - OFMSW (Organic Fraction of Municipal Solid Waste (2x), - construction waste, - separated recycling waste, - separated organic waste (3x)	*****	*	
Digitalization of Bioeconomy supply chain	- Linking actors - Transparency and traceability - Optimization of supply chains - Optimization of internal processes - New business models - Transition	*****		

Note 1 on thematic areas not important for the region: The identification of thematic areas not important for the region may be misleading as it is not clear whether the identification of specific products is an exception to the non-importance or that is the least important biomass resource.

Note 2 on applications of biomass sources: All identified biomass sources and their applications are summarized in the second column. Whenever the application occurs more than once, this is noted.

Note 3: South Tyrol did not provide separate answers for Annex 2.

The regional biomass availability and potential is interesting to analyze when juxtaposing it with the existent industries and potential applications related to biomass. Table 5 presents current industries related to the

¹² For classification of wood waste see: Alakangas, E., Koponen, K. Sokka, L. & Keränen, J. Classification of used wood to biomass fuel or solid recycled fuel and cascading use in Finland, Book of Proceeding Bioenergy 2015, p. 79 – 86, For Boost for Entire Bioenergy Business, 2 – 4.9.2015, Jyväskylä, Finland

Bioeconomy per region. Most of the industries are traditional, related to the agri-food, wood and bioenergy sectors, with most regions (Bavaria, Lombardy, Auvergne-Rhône-Alpes, Slovenia and Fribourg) also having industries in some emerging sectors (e.g. chemical, biotech, pharmaceutical sector). There is an existent bioenergy sector in all regions, with many still using wood biomass for the production of bioenergy (Bavaria, Baden-Württemberg, Auvergne-Rhône-Alpes, Trentino, Slovenia, South Tyrol), with organic waste gaining on prominence in Bavaria, Lombardy, Upper Austria, South Tyrol and Trentino (production of biogas, biodiesel, ...).

Table 5: Industries related to the Bioeconomy classified per region

Region	Industries			
	Agri-food	Wood	Bioenergy	Other
Bavaria	No information provided	<ul style="list-style-type: none"> - forest companies (logging and trading), - wood industry - paper industry 	<ul style="list-style-type: none"> - biogas plants (total number: 2500) - wood-based biomass plants 	<ul style="list-style-type: none"> - rubber / plastic - bio-based chemistry (more than 1/5 of total resource input) - red and white biotech
Baden-Württemberg	Minor contribution to GDP	Minor contribution to GDP	- Over 35% of timber harvested used for bioenergy (also some from organic side streams)	
Lombardy	15% of Italian total in sector <ul style="list-style-type: none"> - Agri-production and food processing, - sustainable agri-food supply chain, - food safety and security 	20% of total Italian wood and paper industry (supply from abroad!) <ul style="list-style-type: none"> - wood processing (sawmills) - sustainable building - furniture 	<ul style="list-style-type: none"> - energy from biomass/organic waste including sewage sludge - biogas - solid biomass (largest production among Italian regions), heat pumps and derived heat - 13 energy production plants 	<ul style="list-style-type: none"> - pharmaceuticals, - green chemistry - textiles
Auvergne-Rhône-Alpes	Agriculture Food processing industry	<ul style="list-style-type: none"> - timber and industrial wood for wood construction, joinery, sawing and wood working, paper boards 	- wood energy: leading producer of pellets	Industry for <ul style="list-style-type: none"> - chemical production (including green chemistry) - pharmaceuticals - plastics (including bioplastics)
Upper Austria	Industry dealing with <ul style="list-style-type: none"> - food and animal feed - agricultural materials (small amount for material purposes) 	No information provided	Industry that provides <ul style="list-style-type: none"> - small amount from oil plants for biodiesel production, sugar cane & sugar beet, corn, potatoes and cereals+ miscanthus giganteus) - biogas from waste (sewage + other organic residues, wood and production waste + algae) 	
Slovenia	No information provided	Several industries dealing with <ul style="list-style-type: none"> - primary biomass production (wood) - civil engineering (eco, biobased material production & construction) 	Renewable Energy industry <ul style="list-style-type: none"> - Bioenergy from biomass (briquettes and pellets) and landfill gas 	Chemical industry <ul style="list-style-type: none"> - polymer industry: - biochemical and phyto-pharmaceuticals: leading role of R&D institutions

		- pulp and paper industry		- chemicals and polymers for medical and automotive sector - biopolymer production (in infancy)
Trentino	Agribusiness and Agroprocessing industries dealing with - first stage processing industry - fruit growing - viticulture - cattle breeding - 50% of wastes from vineyards go to distilleries- for grappa production	Wood and furniture industry - timber - beams - boards - pallets	Renewable Energy Industry producing - residual biomass from forestry, agri-cultivation (exploited only 38%) and first-stage wood processing through thermochemical processes and anaerobic fermentation - firewood and chips (with + 16 % forest at saturation level) - manure (6 biogas plants owned by farmers /cooperatives – incentives, but being reduced)	
Fribourg	Agroprocessing industry for - meat processing and preserving, - dairy products - fish, crustaceans and molluscs - processing and preserving of fruits and vegetables	Various industries - sawmills - construction (wood, metals, energy) - paper, cellulose derivatives - products of wood, cork, straw and plaiting	Renewable Energy Industry producing - bioenergy	- chemical industry - pharmaceutical industry - plastic industry
South Tyrol	Primary production mainly: - dairy farm - fruits Food processing mainly: - milk (yogurt, cheese, etc.) - apple processing (juice, etc.) - wine	Wood and wood processing for furniture, construction and energy	32 biogas production plants (animal waste + urban organic waste) represents 1/3 of potential energy production Wood biomass (wood chips) used for heating and electricity generation	

Table 6 gives examples of different applications (products and processes) related to the Bioeconomy being produced when the data was gathered. The table shows there are higher value-added products being produced based on material revalorization, advanced technologies and principles of circularity and cascading. This can be noted also in the traditionally low cascading industries (often related to the called 4F crops for food, feed, fiber and fuel).

Table 6: Examples of applications (products and processes) related to the Bioeconomy grouped per region

Region	Applications			
	Agri-food	Wood	Biowaste	Other
Bavaria	- new biomass and material revalorization (whey, starch, sugars) to be used in nutrition, food stock, energy	- insulation applications - wood based composites	- extraction for lining from biowaste prior to energy use	- biotechnology (e.g. tannins as precipitating agents)

	<ul style="list-style-type: none"> - protein feed as side product - Lobsters for aliment - perfume from iris 	<ul style="list-style-type: none"> (move from chipboards!) - building and construction - wood manufacturing - corrugated paperboards - surface treatments based on natural raisins - packaging based on materials from bio-based polymers (e.g. for food) 	<ul style="list-style-type: none"> - municipal waste (composting, energetic recycling, new applications based on the extraction of recyclable substances) 	<ul style="list-style-type: none"> - basic chemicals (e.g. bioethanol from straw) - fine chemicals and commodities (e.g. surfactants from carbohydrates) - sustainable process engineering (biocatalysts) - bio-base coatings, paints - fatty acids from natural fats/oils - microbial production of proteins - silicone polymers on sugar based raw material, - biobased lubricant - biodegradable polymers - technological biofilms - textiles and other materials that are not packaging (industrial and clothes)
Baden-Württemberg	<i>No information provided</i>	<ul style="list-style-type: none"> - high tech applications for forestry and construction - bio-based monomers (from lignocellulosic materials) 	<ul style="list-style-type: none"> - innovative products from biowaste (biochar, biorefinery applications) 	<ul style="list-style-type: none"> - biobased textile and clothing - packaging (biopolymers for specific packaging applications) - hydrochloric acid (biotech / biorefinery) - high-tech automotive sectors (distance-sensors, car interiors, engine covers, exhaust manifold)
Lombardy	Valorisation of food / beverage industry wastewaters and other waste streams in primary (harvesting, storage, transport prior to primary processing), secondary (during primary processing) and tertiary production (during production/consumption).		<ul style="list-style-type: none"> - circular economy for side streams of processes falling into other processes as inputs replacing primary materials (waste-based sub-supply chains consolidated economically and technologically), e.g. recovery of waste textiles in clothing and other sectors (e.g. secondary raw materials in the built environment -a material insulator) 	<ul style="list-style-type: none"> - biodegradable plastics production

Auvergne-Rhône-Alpes	<ul style="list-style-type: none"> - Digital agriculture - Phyto reduction - corn with no phyto - Valorization of food industry waste waters - Biodigester - New food processing 	<ul style="list-style-type: none"> - wood based composite - islands of experimentation for testing the species able of better adapting to climate change - construction - building weight reduction - packaging - composite - energy - ... <p><i>Example: process to manufacture wood walls and floors with straw insulation won the regional bioeconomy trophies 2020</i></p>	<ul style="list-style-type: none"> - reuse of side stream - biorefinery - sorting of waste - industrial composting - reduction of food waste - ... 	<ul style="list-style-type: none"> - biodegradable plastics - applications in medical, aeronautic, automotive sector - use of biomaterial for textile - biotechnology - ...
Upper Austria	<i>No information provided</i>	<i>No information provided</i>	-Algae biomass production for energy	<i>No information provided</i>
Slovenia	<i>No information provided</i>	- Construction	<i>No information provided</i>	- Applications in the medical and automotive sector
Trentino	<ul style="list-style-type: none"> - Residues from apple industry used in juice, vinegar production and zootechnical sector - Omega 3 from trout farm waste - Residues from grape industry used for feedstock, valuable chemical compounds (polyphenols) - NO info that this is actually done - Organic and bio-fertilizers - Natural cosmetics from organic compounds 	<ul style="list-style-type: none"> - Wood for building - environmental sustainability and energy efficiency (wood-based buildings, insulation) 	<ul style="list-style-type: none"> - Co-generation plants using wood production waste, biogas - Thermal plants using apple cultivation residuals - Industrial wastewater treatment plants for waste regeneration - Biomethane, biogas, electric energy and compost in anaerobic biodigester - Technologies to transform organic waste into hydrochar 	<ul style="list-style-type: none"> - Textiles from grape marc and apple skins
Fribourg	<i>No information provided</i>	<i>No information provided</i>	<i>No information provided</i>	<ul style="list-style-type: none"> - Production of paints, varnishes, other coatings, printing inks and mastic with biomass - Biopharmaceuticals - bioplastics
South Tyrol	<ul style="list-style-type: none"> - manure for energy production - manure for nutrients production 	<ul style="list-style-type: none"> - furniture - eco-friendly construction material 	urban organic waste for compost and energy production	<ul style="list-style-type: none"> - bio-based leather from apple skin - bio-based chemicals (polyphenol) from

	- food processing (mainly apples, grapefruit, milk)	- energy (wood chips)		apple, not commercial - organic amender (biochar), not commercial
Note on the comprehensiveness of applications covered: The overview of applications in the table might be incomprehensive due to a lack of consistency of information provided by the partners. However, the table nicely illustrates many relevant examples, even if it does not visualize the entire landscape.				

Information above provides good evidence that the Alpine Region has a high potential for the bio-economization of the selected industries. The key biomass resources of the PP regions with the highest potential, but also well backed by strong regional industries are:

- Biomass from forestry;
- Residuals from agriculture;
- Municipal waste.

3.2 Bioeconomy strategies in the Alpine region

As has been concluded by other studies comparing Bioeconomy-related strategies in the Alpine space macro region¹³, only a few regions follow a systematic approach. This is surprising if we consider the fact that bio-based industries and the Bioeconomy assume high positions on policy agendas in the Alpine Region¹⁴. Table 7 shows the different strategies related to the Bioeconomy. They can have a wider scope (related to climate change, sustainability, the circular economy and resource efficiency) or a narrower one (sectoral, related to agriculture, forestry, energy, waste). Most strategies are embedded in the so-called Smart Specialization Strategies (S3).

What can be observed from careful analysis of Table 7 is:

- Four regions have national Bioeconomy strategies (Bavaria, Baden-Württemberg, Auvergne-Rhône-Alpes and Upper Austria),
- One region has a regional Bioeconomy strategy (Baden-Württemberg) and two regions are in the stage of preparing a strategy (Bavaria and Lombardy).
- Most regions also follow (national and/or regional) wider strategies that relate to the Bioeconomy (except for Bavaria and Lombardy)
- Five regions include Bioeconomy related priorities in their S3s (Baden-Württemberg, Lombardy, Upper Austria, Slovenia, South Tyrol and Trentino)
- Fribourg is the only region, which has in place only strategies of a wider scope (related to competitiveness and regional development).

Table 7: Overview of strategies directly or indirectly related to the Bioeconomy per region

Region	Wider	Bioeconomy	Sectoral	S3
Bavaria		- 1 national - 1 regional (in preparation)		The Bavarian S3 has a broad scope. Bioeconomy is not an individual topic. Aspects of Bioeconomy are covered by Clean Tech, which has

¹³ M. Dermastia, D. Osvald (2018), Study to Prepare a Synchronised Funding Scheme for Bioeconomy Development in the Alpine Region, <https://www.alpine-region.eu/results/study-prepare-synchronized-funding-scheme-Bioeconomy-development-alpine-region>, last access: 18 March 2020

¹⁴ M. Dermastia, G. Meier zu Köcker, (2019) Study on Available Funding Opportunities for Bioeconomy in the Alpine Region, <https://www.alpine-region.eu/results/study-available-funding-opportunities-Bioeconomy-alpine-region>

				highest priority in the S3.
Baden-Württemberg	<ul style="list-style-type: none"> - 1 regional (sustainability) - 1 regional (resource efficiency) 	<ul style="list-style-type: none"> - 1 national - 1 regional 		Priorities related to the Bioeconomy include sustainable mobility, biotechnology, ICT - green IT, energy and resource efficiency - sustainable mobility, environmental technologies, renewable energies & resource efficiency
Lombardy		<ul style="list-style-type: none"> - 1 regional (in preparation) 	1 (green chemistry for the Bioeconomy)	Priorities related to the Bioeconomy include circular economy, eco-industry, agri-food, advanced manufacturing, sustainable mobility
Auvergne-Rhône-Alpes	<ul style="list-style-type: none"> - 3 national (low-carbon, circular economy, biomass mobilization with regional scheme in preparation) 	<ul style="list-style-type: none"> - 2 national 	<ul style="list-style-type: none"> - 1 national (energy for green growth) - 6 regional (regional development/sustainable development/territorial balance, waste, circular economy, forests and wood, agro-ecology/ sustainable agriculture, economic development/innovation and internationalization) 	Priorities related to the Bioeconomy include eco-efficient factory; grids and energy storage; smart building with high energy-efficiency; mobility systems of the future; personalized healthcare
Upper Austria	<ul style="list-style-type: none"> - 3 national (sustainability, climate change, resource efficiency, with 1 action plan Action Plan for the Use of Renewable Resources) 	<ul style="list-style-type: none"> - 1 national 		Priorities related to the Bioeconomy include renewable energy, residual flows, biogenic processes, economic policy in the field of energy and environmental technologies, industrial production processes
Slovenia	<ul style="list-style-type: none"> - 2 national (development, climate & energy) 			Priorities related to Bioeconomy: circular economy, technologies for sustainable biomass transformation and new biobased materials, technologies for use

				of secondary and raw-materials and reuse of waste, production of energy based on alternative sources
Trentino	5 regional (sustainable development, climate change, regional development, rural development)		5 regional (energy, waste, health, forest/mountain resources exploitation)	Priorities related to the Bioeconomy include Quality of life, Energy & environment, Agri-foo
Fribourg	2 regional (competitiveness, regional development)			
South Tyrol	3 regional (ERDF) related with 3S (energy and environment, food technology, medical technology end medical treatment) Research Südtirol/AltoAdige Joint research projects Seal of Excellence	national: Strategia italiana per la Bioeconomia, Fondo nazionale Innovazione, Cluster Agrifood		Priorities related to the Bioeconomy include Energy & environment, Food technology and Medical technology end medical treatment

Table 8 summarizes the content of the most relevant strategies in the areas where they relate to the Bioeconomy.

Table 8: Summary of the most relevant strategies relating to the Bioeconomy

Region	Content of Bioeconomy related strategies
Bavaria	<p>Bavaria's strategy is currently being elaborated in a participative way and will be published by the end of 2020.</p> <p>The Bavarian Expert Council on Bioeconomy gives recommendations to the Bavarian government in this process.</p> <p>1. 14 position papers on Bioeconomy focusing on sustainable optimized and full production and use of biological raw material, residuals and waste covering all economic sectors of producing, using and trading products based on sustainable resources (plants, animals, microorganisms and their derivatives), including agriculture, forestry, industry sectors, production and services in the 4F sectors (food, feed, fibre, fuel) + nutrition, chemistry, pharmaceuticals, automotive, paper and textile industries, energy generating companies.</p> <p>2. <u>5 action fields</u> (sustainable production of food and biomass: improvement in farming, potential of cascaded utilization, development and improvement of bio-based products, promotion of a policy framework supporting framework conditions for science economy and consumers, (inter)national networking interlinking with German and EU strategies on Bioeconomy (leveraging chances of international projects), communication of socio-economy advantages of Bioeconomy and integration of consumers in transformation processes.</p> <p>3. <u>5 thematic key areas</u> (from document: Principles of the Bioeconomy in Bavaria): science, supply and use of renewable resources, ecosystems and climate protection, society. Among important issues is tackling resource efficiency (with focus on investigations of resource loss along the value chain and ways to avoid, recycle reuse them), providing information on sustainable agriculture and forestry to consumers and political means favouring local production and taking into account potential conflicts in the use of biomass.</p>
Baden-Württemberg	<p>1. BW sustainable Bioeconomy strategy: supporting the transition to a resource-efficient and cycle-oriented economy based on renewable and biological raw materials by developing renewable and recyclable sources of raw materials, reducing greenhouse gas emissions,</p>

	<p>conserving natural resources and strengthening biodiversity using innovative biological concepts. Being a role model for sustainable and circular regional economy, achieving a climate-neutral economy, focusing on innovative economic fields and regional value chains.</p> <ol style="list-style-type: none"> 2. BW sustainability strategy: sustainability as a key decision criterion for all activities. <u>Key areas:</u> climate and energy, use of resources, education for sustainable development, sustainable mobility, integration. <u>3 initiatives:</u> initiative of the economy on sustainability, youth initiative on sustainability, municipal initiative on sustainability. 3. BW resource efficiency strategy: intelligent use of scarce resources to ensure decoupling of economy growth and resource use (while maintaining manufacturing industry), double resource productivity by 2020, develop regional economy towards a leading market / supplier of resource productivity technologies, ensure a safe and stable supply of resources for the region's economy by enhancing efficiency of primary resources and accelerating the use of secondary resources. Five areas of action: innovation and technology development, material and energy efficiency in companies, sustainable sourcing of resources and stable supply of region's economy with resources, use of secondary resources and strengthening of the circular economy, developing control indicators and performance parameters to account for resource efficiency. 4. BW research strategy Bioeconomy: development of innovative and sustainable economic strategies that use biomass instead of fossil resources, and at the same time avoiding negative effects on the environment, climate, and society. Interdisciplinary and systemic approach to develop sustainable products and processes analysing the entire value chain (from genotype selection, biomass production and conversion, to product development and analysis of economic, ecological, ethical and societal aspects. Topics: selecting and breeding suitable strains for enhanced biomass production, developing new extraction and processing methods to improve biomass utilization in production of new materials and of a higher share of components, use of waste products for production of platform chemicals and biofuels, evaluation of new materials and products for health, climate and social impact, consumer acceptance of new products/processes, encouraging unconventional approaches towards Bioeconomy (focus on lignocellulose, microalgae, bioeconomic modelling, making use of regional potentials for innovative bioeconomic applications). 5. S3: recognizes sectors/sub-sectors of the Bioeconomy as fields of innovation and future economic prosperity, with priorities in sustainable mobility, biotechnology, ICT: green ICT, energy, resource efficiency, environmental technologies, renewable energies and resource efficiency.
Lombardy	<ol style="list-style-type: none"> 1. Smart specialization strategy: identifying 6 action areas to be addressed by companies and policymakers to accelerate the transition to circular economy (regenerate, share, optimize, loop, virtualize, exchange) in 4 relevant areas of specialization: Eco-Industry (including sustainable catalytic processes for industrial applications, creation of biorefinery for integrated production of value added products from non-food crops and waste biomass, Bioeconomy of the future), Agri-food (including safe foods for sustainable consumption and high nutritional efficiency foods), advanced manufacturing (including manufacturing systems for environmental sustainability) and sustainable mobility (including energy efficiency and reduction of environmental impact in transport) 2. Regional strategy for Bioeconomy (in preparation): creation of integrated biorefineries to obtain high added value products (biochemicals, biomaterials), development/optimisation of innovative technologies and efficient processes through R&D and scale-up activities to pilot plants and demonstrators construction, development of new biobased products with low environmental and high ecological and social impact, new functionalities and superior performance compared to traditional products, development of new markets for biobased products, through measures boosting productivity and resource efficiency, stimulating development of innovative technologies, promotion of intra-sectoral collaboration along actors of the value chain, facilitating exchange of knowledge between different stakeholders, creating an environment conducive to investment and facilitating access to finance. 3. Research and innovation work program: strengthening the Bioeconomy in areas of advanced agriculture and nutrition (new technologies to reduce food waste, ensure greater transparency in the agri-food supply chain, adoption of advanced sensors/instruments to analyze soil, meteorological and irrigation conditions to reduce use of fertilizers, optimization of water resource) environmental sustainability (big data use to ensure development of predictive models, smart sensor networks to monitor use of water resources in urban and industrial areas, use of innovative technologies for reduction of atmospheric pollution and for the realization of autonomous factories from an energy point of view), advanced manufacturing and intelligent factory, transfer of knowledge and technologies.

Auvergne-Rhône-Alpes	<ol style="list-style-type: none"> 1. National low carbon strategy: Climate change mitigation (reducing GH emissions and their impact, and boosting efforts to trap GH gases in carbon sinks, developing sustainable, resilient territories, restoring biodiversity, combating atmospheric pollution, establishing conditions conducive to the development of Bioeconomy (diversity of agricultural production, promotion of agroforestry, replacing fossil fuels with biomass for energy and materials, development of economically and environmentally efficient supply systems that allow best use of bioresource – planting intermediary crops, effective use of excess crops, planting low-carbon crops), a circular low-carbon economy. 2. National Bioeconomy strategy (includes an action plan): bio-resources production, mobilization, use and environmental issues 3. National Biomass Mobilisation strategy with regional plans: measures guaranteeing sustainability of resources involved (forestry, agriculture and waste) and biodiversity with respect to competing uses of biomass (energy production, food and materials) and taking into account economic, environmental and social impacts. 4. ADEME strategy for Bioeconomy covering agriculture, food, forestry, algae production, development of biobased products, bioenergy and biowaste structured around the following axes: sustainable management of soils, agricultural and forestry systems, development of sustainable food systems, support for sustainable bio-sourced sectors. 5. Regional scheme of economic development of Innovation and internationalization (2017-2021): with 8 priority sectors (“domaines d’excellence”) chosen for the operational roadmap of the Region (Industry 4.0., construction and public works, digitalization, health, agri.agrofood and forest, energy, smart mobility, sports/mountain and tourism) mentioning the development of quality products from organic farming, innovation on new non-food markets including anaerobic digestion / other bioenergy, biomaterials, food-health
Upper Austria	<ol style="list-style-type: none"> 1. Austrian Bioeconomy strategy: part of the Austrian climate and energy strategy (flagship project 12), focus on research, technology and innovation as a basis for structural change from an oil-based to a bio-based economy (to be expanded to include solutions for an export-oriented economy and society towards sustainability). The goal is optimal use of opportunities offered by a knowledge-based Bioeconomy and sustainable economic growth. The strategy in preparation envisions the <u>establishment/promotion of an Austrian Bioeconomy platform</u> (research, industry, other actors along the entire value-added chain), the usage of regional strengths based on availability of resources – wood processing, pulp industry, construction, food industry, technological and infrastructural strengths and RDI competences, linkages with existing national strategies/action plans (environmental services, forest strategy, renewable resources and resource action plans, biodiversity strategy), international networking (e.g. within H2020 and further development of the EU Bioeconomy strategy), providing opportunities for international companies to participate in regional Bioeconomy platforms, promotion of bio-economy startups, formation of an Austrian Bioeconomy cluster. The strategy and action plan based on the strategy will cover biobased products, biorefinery concepts, resource efficiency measures, bioenergy, associated technologies and services (water management, agriculture and forestry, waste management, processing industry, consumers) and will focus on the systemic combination of technical-scientific, economic, socio-political, ecological and ethical aspects, the dissemination of knowledge on bioeconomics and the support of green jobs. 2. Innovative Upper-Austria 2020 (S3): renewable energy, residual flows, biogenic processes (e.g. material and energetic use of biomass and residual flows, energy from organic secondary raw materials, renewable energy technologies, energy efficiency), economic policy in the field of energy and environmental technologies (also through cross-border initiatives), industrial production processes (recycling, cycle times, hybrid components, fiber and material composites, joining technology, structural health monitoring, virtual component development, rapid technology, high-performance materials, renewable raw materials, bionics, resource efficiency and raw materials recovery).
Slovenia	<ol style="list-style-type: none"> 1. Development strategy of Slovenia 2030: Preserved natural environment as strategic guidelines and 2 relevant goals: low carbon circular economy (including share of renewable energy in gross final energy consumption, material productivity and GDP per total GH gas emissions) and sustainable natural resource management (including utilized agricultural area and ecological footprint). 2. Smart specialization (S4): Promoting networks for transition to circular economy, connecting stakeholders into value chains according to principle of closed material cycles economy to develop new business models to transition to CE. (with focus areas / technologies: technologies for sustainable biomass transformation and new biobased materials,

	technologies for use of secondary and raw-materials and reuse of waste, production of energy based on alternative sources.
Trentino	<ol style="list-style-type: none"> 1. Provincial development plan: sustain organic methods, support tech transfer from research to agriculture and forestry, improve water management, growth focus on green economy (increasing energy efficiency, liveability and safety, reduce pollution, control hydrogeological and environmental risks), large investments in energy efficiency and use of renewable energy, research and development of innovative systems for energy production and transportation, creation and use of agricultural biogas plants. 2. Provincial plan for Energy: valorising residual agricultural biomass, reducing the share of exported biomass to use it in new plants, improvements in collecting agricultural waste, improvement of biogas value chain (realization of new plants), promotion and valorisation of local wood value chains 3. Plan for waste management: creating a plant to realize refuse-derived fuel from waste. 4. Rural development plan 2014-2020: fostering competitiveness of agriculture, ensuring sustainable management of natural resources and climate action, achieving a balance territorial development of rural economies and communities through linking agriculture to tourism, innovation of productive systems, sustainment of renewable energy value chains, valorisation of biodiversity and cultural heritage. Support for knowledge transfer, information actions, investments in farms, in the development and modernization of agriculture and forestry, including accessibility to areas of biomass collection, investment in creation/development of extra-agriculture activities. 5. Trentino zero emission program: fund for the promotion of sustainable development, fight against climate change, encouraging R&I, education, waste management, environmental certifications. 6. Trentino health plan 2015-2025: health is directly influenced by environmental aspects (relevant intervention lines: urban health and living environments, food for health and environment, including sustainable food production, valorisation of the food value chain, food consumption and reduction of food waste). 7. Trentino position paper on sustainable development: circular economy, agriculture, decreasing carbon emissions. 8. Smart specialisation (S3): 3 out of 4 areas related to Bioeconomy, without explicitly citing it: energy and environment (increasing energy efficiency of woody biomass plants with development of gasification instead of combustion systems, enhancing construction techniques and energy efficiency of buildings with wooden structure or using bi-based composite materials), agri-food (fruit/vegetables production, livestock, fisheries, food and beverage processing, mechanical and food industry, packaging and packaging material industry, distribution and other services, energy recovery from food waste and by-products), quality of life.
Fribourg	New regional policy fostering regional innovation systems and activities that support product and business model innovation, not specific to Bioeconomy.
South Tyrol	<ol style="list-style-type: none"> 1. Smart specialization strategy: most of South Tyrol's research initiatives and attempts to innovate are being made in the sectors that were identified as strategic in the region's Smart Specialisation Strategy, released in 2014 for the 2014-2020 European Programming Period. The sectors identified were Energy and Environment, Alpine technologies, Food technologies, Medical Technologies and Natural Treatments, ICT and Automation as well as Creative Industries. At least three of these sectors are linked to the bioeconomy in some way, in the sense that they require or may require the use and the processing of biomass at some point in their value chain. In the field of Energy and Environment, the need to make further and better use of biomass as a source of renewable energy in the future is explicitly stated in the province's S3 Strategy. In the field of Food Technologies, biomass is even more crucial, as it constitutes the primary input of any industrial process. Finally, the use and processing of biomass also plays a key role in the field of Medical Technologies and Natural Treatments. 2. National strategy for Bioeconomy: Italy's national bioeconomy strategy (Strategia Italiana per la Bioeconomia), in line with the European Bioeconomy Strategy and last updated in 2019, aims to improve by 15% the performance of the country's bioeconomic sector by 2030. To achieve these goals, the country's governing institutions plan to rely to on a wide range of financing tools designed to support research and innovation, mostly within small and medium enterprises (SMEs). Both national and European programs can be found among these tools. 3. National innovation program: At the Italian level, a new national fund for innovation (Fondo Nazionale Innovazione) was created in 2019 and makes € 1 billion per year available for the financing of innovative small and medium enterprises through venture capital, either directly

	<p>or indirectly via venture capital funds. The targeted sectors are those considered strategic for the competitiveness of the Italian economy, of which some are directly linked to the bioeconomy, like New Materials (which can include biomaterials), EcoIndustries and AgriTech/Foodtech. In addition to this fund, the Italian Research Grant Programme for Smart Manufacturing, Agrifood, Life Sciences and High Performance Computing (Bando Fabbrica intelligente, Agrifood, Scienze della vita e Calcolo ad alte prestazioni) makes funds available to enterprises that conduct research and development projects in the fields previously mentioned.</p> <p>4. National Clusters (Cluster Tecnologici Nazionali): Once again, the goal is to stimulate innovation and competitiveness in sectors that are seen as crucial for Italy's future economic development. Among the clusters relevant for the bioeconomy are the Agrifood cluster (CL.A.N), which the Free University of Bolzano is part of as research partner, and the Green Chemistry (Chimica Verde – SPRING) cluster. Although no South Tyrolean enterprise has registered in any of these two clusters yet, future participation remains a possibility.</p> <p>5. Research and innovation program: For the support of scientific research, three main programs are in place: Research Südtirol/Alto Adige, Joint Research Projects and Seal of Excellence. For the support of innovation, most of the provincial administration's programs are geared towards sustaining innovation directly within enterprises. In fact, the Province offers financial support for the conduction of research and development inside enterprises, whether it be fundamental research, industrial research or experimental development.</p>
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Clusters, networks, platforms and other related entities are an important mechanism to turn the above-mentioned strategies into practice. Therefore, it is important to see whether the related landscape of the PPs is mature enough to take such a role. Table 9 summarizes different national and regional platforms, clusters and associations related to the Bioeconomy. All regions have developed different ecosystems/innovation frameworks that provide the relevant stakeholders along the value chain with the conditions necessary to optimize resources and focus them in the development of products, processes and services in the Bioeconomy. Some regions are also connected transnationally through different initiatives (e.g. smart specialization platforms, Vanguard initiative, macroregional networks and cooperation programs, Interred projects, etc.). Transnational connectivity is an important indicator, as it provides for knowledge, best practice and lessons learned transfer, as well as an opportunity to align activities.

Table 9: Overview of local, regional and national platforms, clusters, associations and transnational networks and initiatives

Region	Platforms, clusters, associations	Transnational initiatives
Bavaria	Bavarian Cluster Initiative: - Chemie-Cluster Bayern GmbH - Cluster Energietechnik – Bayern Innovativ GmbH - Cluster Neue Werkstoffe – Bayern Innovativ GmbH - Cluster Biotechnologie – BioM GmbH - Cluster Industrielle Biotechnologie – IBB Netzwerk GmbH - Cluster-Initiative Forst und Holz in Bayern gGmbH - Umwelttechnologie-Cluster-Bayern e.V. - ZLV e. V. Kempten - BIOCAMPUS STRAUBING GmbH (Center of Excellence for Renewable Resources (KoNaRo), Straubing Science Center, WZS (2001-2017), Campus Straubing TUM, Technology and Support Center, TFZ, Coordination Center for Renewable Resources, Renewable Energies and sustainable Use of Resources C.A.R.M.E.N. e.V., Biocampus Straubing GmbH)	- Bioeconomy Regional Strategy Toolkit (BERST) - EUSALP (Strategy action group2)
Baden-Württemberg	- Allianz Faserbasierte Werkstoffe Baden-Württemberg e.V. - Automotive-Initiative RheinMainNeckar - Automotive-Initiative Ostwürttemberg - Automotive. Engineering. Network - AutomotiveDIALOG Wirtschaftsraum Heilbronn - Automotive_NETZ - Bioenergie-Region Hohenlohe-Odenwald-Tauber GmbH - Biomastec: neue BiomasseEffizienz	- EUSALP (Strategy action group2) - VANGUARD INITIATIVE

	<ul style="list-style-type: none"> - BIOPRO Baden-Württemberg GmbH - Cluster Energie & Umwelt - Cluster Green City Freiburg - Cluster Verpackungstechnologie – International Packaging Institute (IPI) - Clusterinitiative Clean Tech der Region Stuttgart - Cluster Nutzfahrzeuge Schwaben e. V. - Cluster Technische Textilien Neckar-Alb (techtex) - Clusterinitiative Automotive Region Stuttgart (CARS) - Commercial Vehicle Cluster – Nutzfahrzeuge GmbH - EnergieForum Karlsruhe - Engineering – Life Sciences – Automation (ELSA) - Focus.energie e.V. - Fotec – Netzwerk Funktionale Oberflächen - ForstBW - Forst und Holz Allgäu-Oberschwaben - Holzkette Schwarzwald e. V. - IHK-Chef Arbeitskreis “Druck, Verpackung, Medien” - IHK-Netzwerk Automotive - INNONET Kunststoff® - Innovations- und Effizienzcluster Klimapartner Oberrhein, INNOeff KPO - KITE hYLITE: Karlsruher Innovationscluster - Kompetenznetz Medtech & Biotech - Kompetenzzentrum Umwelttechnik – KURS e. V. - KunststoffDIALOG Wirtschaftsraum Heilbronn - Modell Hohenlohe – Netzwerk für betrieblichen Umweltschutz und nachhaltiges Wirtschaften e.V. - Netzwerk Umwelttechnik & Ressourceneffizienz - Packaging Excellence Region Stuttgart e.V - Packaging Valley Germany e.V. - Plattform Umwelttechnik - proHolzBW - proHolz Schwarzwald - Regioholz Nordschwarzwald - TechnologyMountains e.V. - Umweltkompetenzzentrum Rhein-Neckar e. V. (UKOM) 	
Lombardy	<ul style="list-style-type: none"> - Lombard Technological Clusters - Lombardy Green Chemistry Association-LGCA1 managing the Regional Green Chemistry Cluster with the goal to create at regional level the best framework conditions for the setting up of a Bioeconomy based on the use of biomass from agriculture, forest and waste following the principles of sustainability and cascading use and through the active involvement of the whole value chains. 	<ul style="list-style-type: none"> - EUSALP (Strategy action group2) - VANGUARD INITIATIVE - SMART SPECIALIZATION PLATFORMS (Industrial modernization, agri-food, energy) - SCREEN -Synergic Circular Economy Across European Regions - CircE –European Regions towards Circular Economy - Circularalps (project on activating new timber value chains – CSALP with Salzburg Uni) - Agrifood and technology for smart communities’ national clusters - European innovation partnership: City and Smart communities - EIT Climate KIC

<p>Auvergne-Rhône-Alpes</p>	<p>Bioeconomy Trophies (national and regional initiative)</p> <p>Clusters located in Auvergne Rhone Alps working in the bioeconomy or on related topics/projects:</p> <ul style="list-style-type: none"> - Plastipolis (plastics and composites) and Elastopôle (rubber and polymers) to be merged in June 2020 under the name "Polymeris" - Terralia (agri and agrofood, plant technologies); - Vegepolys Valley (agriculture) integrated the former cluster "Cereales Vallee" in Auvergne Rhone Alps; - Axelera (chemistry and environment); - Cimes (mechanics) integrated the former cluster "Viameca"; - Cluster Eco Energies (eco-building); - Cluster bio (organics food); - Pole Eco Conception (eco-conception); - Tenerrdis (energy); - Techterra (technical textiles); - Xylofutur (wood); <p>Other networks/platforms in Auvergne Rhone Alps</p> <ul style="list-style-type: none"> - ECLAIRA network with Innov'R program; - Club of the energetical transition in Auvergne-Rhône-Alpes <p>Clusters/platforms in other regions</p> <ul style="list-style-type: none"> - IAR, "the French Bioeconomy cluster" and the "agrobiobase platform" - Novachim (chemicals) in Sud Provence Alps Côte d'Azur Region 	<ul style="list-style-type: none"> - EUSALP (Strategy action group2)
<p>Upper Austria</p>	<ul style="list-style-type: none"> - Cleantech Cluster - Food Cluster - Furniture and timber construction cluster - Plastics cluster 	<ul style="list-style-type: none"> - EUSALP (Strategy action group2) - Cooperation Programme Interreg V-A Slovenia-Austria
<p>Slovenia</p>	<ul style="list-style-type: none"> - SRIP Smart Cities and Communities partnership - SRIP Smart buildings and homes including wood value chain - SRIP Networks for the transition into circular economy - SRIP Sustainable food production - SRIP Sustainable tourism - SRIP Factories of the Future - SRIP Health –Medicine SRIP Mobility /Mobilnost - MATerials as end PROducts - Wood Industry Cluster Construction - Cluster of Slovenia Plasttechnics - Section of Slovenian manufacturers of prefabricated wooden buildings 	<ul style="list-style-type: none"> - EUSALP (Strategy action group2) - Cooperation Programme Interreg V-A Slovenia-Austria
<p>Trentino</p>	<ul style="list-style-type: none"> - Association and Cooperation initiatives at local and national level to which the industries and companies participate (Federlegno, Federforeste, Coldiretti, Forest Consortium, Confindustria) - Progetto Manifattura (an industrial innovation hub in the fields of environmentally friendly constructions, renewable energies, green technology, and the management of natural resources) - Green Innovation Factor (cluster made up of startups, enterprises, research centers, training facilities, public administration services, with the aim of creating a reference point in the field of clean tech at a national and European level) - Habitech (a technological district in Trentino for Energy and Environment) - Wood Portal (Legno Trentino) (web platform managed by the chamber of commerce to share information about products, companies, wood auctions, events and other relevant news regarding the wood sector in Trentino) 	<ul style="list-style-type: none"> - Cooperation Programme Interreg V-A Slovenia-Austria
<p>Fribourg</p>	<ul style="list-style-type: none"> - Cleantech-FR - Innosquare (Bluefactory) 	

	<ul style="list-style-type: none"> - Biofactory competence center (BCC) - Agri&co challenge - Food & Nutrition cluster, Swiss plastic Cluster, Energy & Construction cluster - Plastic innovation competence center (PICC) 	
South Tyrol	<ul style="list-style-type: none"> - South Tyrol's research infrastructure are the Free University of Bolzano, the Laimburg Research Centre, which directly impacts the bioeconomy through applied research in agriculture and food technology, Fraunhofer Italia, which mostly carries out applied research for the province's small and medium enterprises, as well as Eurac Research, which conducts research on a wide range of topics linked to the particularities of the South Tyrolean society and territory, but which contrarily to Fraunhofer Italia, obtains funding for its projects uniquely through public channels. - NOI Techpark - IDM Südtirol/Alto Adige - Bolzano Chamber of Commerce - Association and Cooperation initiatives at local and national level to which the industries and companies participate (sectorial associations) 	no specific programs but single initiatives in the framework of wider sectorial programs (i.e. Interreg, Alpine Space, other EU programs, etc.)
<p>Note on the comprehensiveness of networks covered: The overview of initiatives in the table might be incomplete due to a lack of consistency of information provided by the partners. However, the table nicely illustrates many relevant examples, even if it does not visualize the entire landscape. It is under discussion among the PPs to double check the comprehensiveness of the list and add any other transnational initiatives and platforms they are part of (technology platforms, Smart specialization platforms, Interreg, H2020 projects, ...).</p>		

3.2.1 Funding

Platforms, clusters and networks are important actors in turning regional strategies and related policies into practice, but impact can only be achieved if relevant and comprehensive funding exists. Table 10 summarizes different funding programs relevant for the Bioeconomy, even if in most cases they surpass the objectives of S3 and the operational plans. Table 10 thus includes different national and regional programs supporting research and development, technical and non-technical innovation, access to finance for SMEs, support for the creation of new innovative companies, knowledge and technology transfer, support for SME capacity building, support for highly educated workforce to increase knowledge/experience in an research, development and innovation (RDI) context, support for cluster initiatives, platforms focused on circular Bioeconomy, support for joint infrastructure (technology centers and joint research centers for a circular Bioeconomy) and other relevant programs and schemes.

Table 10: Funding for the Bioeconomy on national, regional and transnational level

Region	National	Regional	Transnational
Bavaria	x	x	
Baden-Württemberg	x	x	x
Lombardy	x	x	
Auvergne-Rhône-Alpes	x	x	
Upper Austria	x	x	
Slovenia	x		X
Trentino	x	x	
Fribourg		x	
South Tyrol	x	x	

Table 11 summarizes the number of programs per region according to category. Whenever the programs support the Bioeconomy, circular economy or sustainability focused topics, those programs are further presented in terms of topics they support.

Table 11: Regional / national funding programs

Region	no. of funding programs with national/regional focus	Focus on Bioeconomy, Circular Economy or Sustainability	Funding level and cumulative amount (when relevant data provided)
support for r&d projects			
Bavaria	x (6 regional)	<ul style="list-style-type: none"> - Hi-tech for the 21. Century: Life science, energy & environment, material sciences, nanotechnology, - BayMed, StMWi: Bioinformatics, sensorics, lasers, - BayBionik: robotics, AI, material science for optical use, functional surfaces, energy efficiency, sustainable production technologies, - BayKlimafit: plant breeding, innovative breeds, innovative planting, - BayMED: life science, biomaterials, biotechnology 	<p>Regional: 1.8 million EUR</p> <p>Regional 2.4 million EUR</p> <p>National: BMBF</p>
Baden-Württemberg	x (5)	<ul style="list-style-type: none"> - Bioeconomy as a societal challenge (social, political and economic science/research to deepen and broaden the understanding of biobased and natural circular economies - Microbial bio-factories for an industrial Bioeconomy: R&D projects to identify new, robust, versatile microorganisms for industrial biotech - New products for a Bioeconomy: feasibility studies for new product ideas for a bio-based industry - BIOCHANCE - Innovative SMEs: development projects for all sectors of modern biotech, with special focus on National Research Strategy Bioeconomy 2030. - GO-Bio – Bioökonomie 2030 funding for teams of scientists to star-up a new enterprise 	National: BMBF
Lombardy	x (12 regional and 2 national)	<ul style="list-style-type: none"> - Programs with focus on Bioeconomy, Circular Economy, new bio-based products and sustainability: <ul style="list-style-type: none"> - FRIM FESR 2020 Research and Development in areas of S3 - FRIM FESR 2020 for SMEs in areas of S3 with focus on construction, manufacturing and business services - FASHIONTECH: R&D for sustainable fashion, focusing on industrial research and experimental development supporting innovation in textile, fashion, accessory sector with the principle on sustainability (design, material selection, production and distribution) and respect for the environment - SMART FASHION AND DESIGN LINE up to industrialization of results - INNOVATION LINE aimed at industrialization of R&D results to improve and existing or create a new product or production line - HUB call promotes strategic projects of industrial research / experimental development with one of the aims being promotion and sustainable development and competitive growth by strengthening innovation for technological maturity and knowledge transfer - TT AGRILAB call for SMES to support tech transfer in agricultural, food and bioeconomic sectors through company collaboration with R&D institutions SMART LIVING call for development and innovation projects in construction, home furniture, home appliance and high-tech sectors SUPPLY CHAINS IN CIRCULAR ECONOMY: promoting and upgrading supply chains, their innovation and competitive repositioning of entire sectors in terms of circular economy (projects promoting the reuse and 	<p>Regional: 1.12 billion EUR (cumulative, not just Bioeconomy)</p> <p>2,61 billion EUR national (cumulative, not just Bioeconomy)</p>

		<p>use of recycled materials, products and by-products deriving from production cycles as alternative to virgin raw materials, reduction of waste, eco design throughout the whole cycle)</p> <ul style="list-style-type: none"> - Fund for sustainable growth for programs and interventions with a significant national impact on competitiveness of the production system with call aimed at realisation of new / improved products, processes or services through the development of key enabling technologies in 3 application sectors of the S3 strategy: Intelligent factories, agri-food and life sciences 	
Auvergne-Rhône-Alpes	x (3 regional + 3 national)	<ul style="list-style-type: none"> - Support and transformation of industries: structuring key regional industries by funding shared investment and R&D expenses in areas of agriculture, agri-food, forest and energy - Support for independent VSEs and small and medium-sized businesses support the realization of projects doing experiments in the field in real conditions with partner communities in priority areas of eco-innovation in Auvergne Rhône-Alpes (energy, sustainable construction and development, management of polluting emissions (solid, liquid, gaseous), environmental measurement and assessment (cross-cutting area). - Support for eco-conception of products and services” with focus on technological improvements or innovations, or even technological breakthroughs that will reduce the environmental impact of a product (product, process, service ...) or a family of products throughout its life cycle. Focus on 3 priority axes: incremental eco-design without modification of the business model, breakthrough eco-design with change of business model, support for procedures for obtaining the European Ecolabel or environmental labelling. - GRAINE: Support sustainable development of the bio-economy sectors in areas that reduce environmental impacts and favoring the services offered by the ecosystems (e.g. 2019 GRAINE call for valorization of biomass : sustainable development of Bioeconomy in response to challenges of ecological transitions (eco-efficient biomass production, transformation and recovery systems to develop technical solutions for a circular biomass economy) + assessment of sustainability and articulation of biomass production in use to develop methods and tools from a systemic and sustainable approach to the management of biomass + support in change and public policy instruments for a sustainable Bioeconomy to identify and analyze levers, support and learning necessary to promote the transition - “Bioeconomy and Environmental protection” aiming to generate growth for the French economy and develop sustainable jobs in ecological and energy transition by reducing the environmental impact; develop a low-carbon and competitive energy mix; change production methods and consumption practices while facilitating societal acceptability. The call aims at aimed at adopting new modes of production, development and consumption of resources, including biomass. - ECEI “Circular Economy - Eco-efficiency in Industry, Agriculture and Water” aims to select demonstrator projects: developing new products, technologies, 	<p>PIA 3: regional</p> <p>INNOV’ R: regional</p> <p>ADEME: regional</p> <p>ADEME: national</p> <p>PIA by ADEME: national</p> <p>PIA by ADEME: national</p>

		business models or services ; making it possible to concretize the transition from a linear economic model " to a circular one ; being able to rely on new digital solutions and in particular on artificial intelligence or metrology. The 4 thematic axes include eco-design of products and services; more efficient production of material resources and energy; the prevention of waste production, the optimization of their collection and the production of secondary material or energy resources, the treatment of ultimate waste ; the collection, treatment and distribution of water, solutions for saving and managing the resource, innovative business and management models in the water sector	
Upper Austria	x (3 regional, 9 national)	<ul style="list-style-type: none"> - Cities of the future (Stadt der Zukunft) - Energy (Vorzeigeregion Energie) - Production of the future (including cooperative R&D on bio-based industry, plant and raw materials, smart textiles environment analysis, biobased industry as a component of recycling management, security for digital transformation) 	FFG: national FGG: national BMVIT: national
Slovenia	x (3)	<ul style="list-style-type: none"> - Supporting the H2020 Teaming InnoRenew CoE - Center of Excellence in sustainable building with renewable materials, wood modifications - Support to RDI in different fields with research related to climate change, research infrastructure for planning and implementing climate related policies 	30 million EUR ESIF by MIZS: regional 6 million EUR Climate fund: national
Trentino	x (3 regional and 3 national)	<ul style="list-style-type: none"> - "Accordo di programma" and Rural development plan with some research topics are related to Bioeconomy - National plan of research (agri-food and green chemistry) 	Regional: 2,7 billion EUR National: 2,5 billion EUR (cumulative)
Fribourg	x	<i>Funding has a general (not explicitly Bioeconomy) focus</i>	
South Tyrol	x	<i>Funding has a general (not explicitly Bioeconomy) focus</i>	
development of technological or non-technological innovation			
Bavaria	x (2)	<i>Funding has a general (not explicitly Bioeconomy) focus, assessment of sustainability/resource efficiency basically included</i>	
Baden-Württemberg	x	Innovative SMEs: development projects for all sectors of modern biotech, with special focus on the National Research Strategy Bioeconomy Strategy 2030.	
Auvergne-Rhône-Alpes	x	Support from projects developing ambitious, innovative, sustainable methodologies, technologies, industrial solutions and services in the energy field with eligible innovation axes renewable energy, buildings , energy storage and conversion uses (mobility, public lighting, digital approaches).	
Upper Austria	x (6)	<ul style="list-style-type: none"> - Agricultural research and development, raw material management (funding provided for measures to significantly reduce the consumption of raw materials while maintaining productivity of existing production processes and the functionality of the products, for investments in innovative service concepts to increase material source efficiency, e.g. chemical leasing, investments to achieve direct environmental effects through the use of products based on renewable raw materials). - Promotion of waste prevention - Patent check 	

Slovenia	x (3)	<ul style="list-style-type: none"> - Incentives for the development of semi-finished wood products (Wooden products 2.0 with a higher level of technological complexity), - Promoting sustainable business strategic transformation and developing new business models in Slovenian companies for easier integration into global value chains 	8.4 million EUR (Slovene enterprise fund) 7,85 million EUR (SPIRIT: Public Agency for Internationalisation, Foreign Investments and Technology)
Trentino	x (2 regional + 1 national)	Rural development plan: Investments in farms, investments for diversification on the use of renewable energy sources	Regional: 41 million EUR
South Tyrol	x	<i>Funding has a general (not explicitly Bioeconomy) focus</i>	
generic access to finance			
Bavaria	x (2)	<i>Funding has a general (not explicitly Bioeconomy) focus</i>	
Baden-Württemberg	x	Agriculture – sustainability: low-interest loans for investments in agriculture, which serve to improve the effectiveness and sustainability of agricultural holdings	
Auvergne-Rhône-Alpes	x (1 regional and 1 national)	<ul style="list-style-type: none"> - Investment fund specializing in renewable energies, supporting the emergence of renewable energy production projects (solar, wind, hydro, anaerobic digestion, biomass) - Fund for innovation capital dedicated to agronomy, (sustainable) agriculture, agribusiness, nutrition, green chemistry and bioenergy. 	OSER ENR: Regional CAPAGRO Innovation fund: national
Slovenia	x (2)	<ul style="list-style-type: none"> - Digitalization support to domestic and foreign greenfield investment into economic activities relevant for the transition into a low-carbon, circular and climate resilient economy - Support to the transition into a circular, low carbon and climate resilient economy 	Climate fund: 21 million EUR national 5 million EUR national
Trentino	x (1 regional and 1 national)	<i>Funding has a general (not explicitly Bioeconomy) focus</i>	
creation of innovative companies			
Bavaria	x (3)	<ul style="list-style-type: none"> - BAYTOU: Future technologies - FLÜGGE: support for spin-offs from academic institutions 	Regional Regional
Baden-Württemberg	x	Organic value chains: Coordination point for further training, advanced training and advice, planning, organization, implementation and follow-up	
Auvergne-Rhône-Alpes	x (2 regional + 4 national)	<ul style="list-style-type: none"> - <i>Funding has a general (not explicitly Bioeconomy) focus</i> - the Start-up & Go funding scheme from the Region - the Bpifrance's Growth Loan to finance the development of VSEs and SMEs in the Region 	Regional Regional
Slovenia	x (5)	<i>Funding has a general (not explicitly Bioeconomy) focus</i>	
Trentino	x (2 regional and 1 national)	<i>Funding has a general (not explicitly Bioeconomy) focus</i>	
knowledge and technology transfer			
Bavaria	x (4)	<ul style="list-style-type: none"> - Hochtechnologien für das 21. Jahrhundert (life science, energy & environment, material sciences, nanotechnology) Patent alliance: patented technology pool for users and patent exploitation for researchers, - Validierung von Forschungsergebnissen: research or development of significantly improved products or production processes or knowledge-based services with high potential in industrial application. 	Regional: Bayerische Forschungstiftung Regional: StMWi
Baden-Württemberg	x	Research and development projects as well as measures for the transfer of technology and knowledge for the sustainable production, processing and marketing of	

		agricultural products to close significant gaps in knowledge and experience for sustainable economic forms	
Auvergne-Rhône-Alpes	x	Agro-Transfert Ressources et Territoires - an innovation transfer center combining skills and resources to offer innovative solutions based on the research and expertise of stakeholders in the territories to respond to new agricultural challenges in terms of economic, environmental and territorial performance in the following areas: soils and agro-systems, innovative production systems, multi-criteria evaluation, bio-economy . Agro-Transfert Ressources et Territoires also coordinates and develops an internet sharing platform dedicated to sustainability assessment	national
Upper Austria	x	Production of the future	
Slovenia	x (2)	<i>Funding has a general (not explicitly Bioeconomy) focus</i>	
Trentino	x (3)	Rural development plan: Activation of training courses aimed at improving the skills of farmers and foresters, of land management with headquarters in rural areas.	regional: 1.2 million EUR
South Tyrol	x	Rural development plan	
support for improving capacities			
Bavaria	x	<i>Funding has a general (not explicitly Bioeconomy) focus</i>	
Baden-Württemberg	x	Environmental protection funding from the German Federal Environmental Foundation: Energy from renewable raw materials	
Auvergne-Rhône-Alpes	x (1 regional and 2 national)	<ul style="list-style-type: none"> - "Investment Solution – Industry of the Future" to support particularly innovative technological development projects around the mastery of the digital chain and related organizational changes (includes new materials and composites, big data, intelligent production lines, etc.) - Support and transformation of supply chains (including services, tools and digital supply chain platforms in circular economy and industrial ecology) - Structuring of agricultural and agrifood chains" – the agricultural component of a major investment plan (GPI) which aims to support the development of agricultural, agrifood, fishing and aquaculture products and accelerate the transformation of these sectors (including ecological transition, climate change, risk management) 	<p>BPIFRANCE for PIA: national</p> <p>GPI: national</p>
Upper Austria	x (2)	<i>Funding has a general (not explicitly Bioeconomy) focus</i>	
Slovenia	x (2)	<i>Funding has a general (not explicitly Bioeconomy) focus</i>	
Trentino	x	<i>Funding has a general (not explicitly Bioeconomy) focus</i>	
Fribourg	x (2)	<i>Funding has a general (not explicitly Bioeconomy) focus</i>	
education and workforce development			
Bavaria	x	<i>Funding has a general (not explicitly Bioeconomy) focus</i>	
Baden-Württemberg	x	<i>Funding has a general (not explicitly Bioeconomy) focus</i>	
Auvergne-Rhône-Alpes	x	- The European Center for Biotechnology and Bioeconomics (CEBB) , and the European Biorefinery Institute (IEB) are dedicated to the development of innovative and collaborative projects and the creation of industries of the future: agromaterials, biomolecules and ingredients with high added value. There are many targeted growth markets: food, construction, fine chemicals, cosmetics, packaging, transport, etc.	<p>National</p> <p>National</p>

		<ul style="list-style-type: none"> - The NEOMA Business School Chair in Bioeconomics is located both on the Reims campus and at the European Center for Biotechnology and Bioeconomic offers research and training in the Bioeconomy, in collaboration with CEBB members (AgroParistech, CentraleSupélec and URCA) and its industrial partners - Biomass Energy and Enterprises support scheme to limit dependence of businesses and communities on cost of fossil fuels, guarantee a long-term energy supply, reduce environmental impact, reduce operating costs - Master on plastics and eco-conception to train future technical executives in the plastics sector, in the field of eco-design of plastics (supported by Plastipolis) - Energy recovery Masters (École Supérieure des Mines de St-Etienne / ISTP) (supported by Plastipolis) - Behavioural skills repository for the chemistry-environment sector with professionals in the chemistry-environment sector, representatives of the Prospective Observatory of the Chemical Industries (developed by Plastipolis) - Employment Training objective contract in the chemistry environment (Axelera cluster is partner) 	<p>National</p> <p>Regional</p> <p>Regional</p> <p>Regional</p> <p>Regional</p>
Upper Austria	x	<i>Funding has a general (not explicitly Bioeconomy) focus</i>	
Slovenia	x (4)	Developing sustainable business strategies and business models in practice (SPIRIT training), Master program in sustainable built environments (University of Primorska)	
Trentino Fribourg	x	<i>Funding has a general (not explicitly Bioeconomy) focus</i>	
support to cluster initiatives and similar focused on circular bioeconomy			
Bavaria	x	Cross clusters projects in Bioeconomy, circular economy (expected in 2020)	
Baden-Württemberg	x	Bioeconomy 2030 – Bioeconomy International: international collaborative projects between German and foreign partners research and development issues in the field of Bioeconomy	
Auvergne-Rhône-Alpes	x	<ul style="list-style-type: none"> - Encouraging investment and business establishment in the following areas: <ul style="list-style-type: none"> - “industry 4.0 and industrial production” including environmental chemistry, industrial processes and eco-efficient factory, - composite and bio-based materials, technical textiles, plastic parts, etc. (clusters Plastipolis, Axelera, Techtera, Minalogic, CIMES, Tenerrdis) - innovative materials (including bio-based) in public buildings / public works” (clusters Tenerrdis, Minalogic, Cluster Eco-nergies, etc) - development of new opportunities for agricultural production and their by-products such as biomaterials, bioenergy (clusters Vegepolys Valley, Terralia, Organics Cluster) - bioenergy, including wood-energy (clusters Tenerrdis, Minalogic, Axelera) - The IAR competitiveness cluster, “the Bioeconomy cluster” is responsible for a series of events and tools aimed at promoting biobased products: bi-annual scientific symposium, communication campaign, 	<p>Regional</p> <p>National</p>

		creation of an online database of bio-based products (Agrobiobase), traveling exhibition, open house in the companies concerned ...	
Slovenia	x	Strategic Research and Innovation Partnerships –SRIPs: SRIP Circular Economy and SRIP Smart buildings and home including the wood value chain	
Trentino	x	Progetto Manifattura offers an environment designed to inspire innovation and creativity and promote sustainable growth in environmental, social and economic terms . The hub intends to perform three different functions: - Pre-incubator for new entrepreneurial initiatives, - Incubator for small and medium enterprises, - Business park for mature enterprises	Regional: 1.5 million EUR / year
Fribourg	x	<i>Funding has a general (not explicitly Bioeconomy) focus</i>	
South Tyrol	x	<i>Funding has a general (not explicitly Bioeconomy) focus</i>	
support to joint infrastructure – available for smes and firms active in circular bioeconomy like technology centers, joint research centers			
Bavaria	x	baybionik, baytp, bayxy...etc. bavarian networks that receive regional funds for common projects and can be joined by companies	
Baden-Württemberg	x (2)	<ul style="list-style-type: none"> - promotion of organic sample regions (vwv organic sample regions): creation of networks for cooperation between various companies in the agricultural sector, in the food chain and other actors in the agricultural sector - kmu-innovativ: bioökonomie/sme-innovative: bioeconomy support to inovative SMEs as well as big enterprises, research centres and universities (the latter ones only if they cooperate with SMEin the funded project) which work in the cutting-edge research and industries related to bioeconomy. this funding is within the framework of the national bioeconomy strategy and the high-tech strategy of the German government 	National
Auvergne-Rhône-Alpes	x (1 regional and 1 national)	- Axel'One: a collaborative innovation platform providing spaces adapted to R&D collaborative projects - offices, laboratories, technological halls and daily support services with the aim to meet market challenges in areas where the Auvergne-Rhône-Alpes region has strengths: energy efficiency, process optimization, lightweight and bio-sourced materials.	Regional
		- Bio-Valo- a service and innovation platform for the development of the biomass recovery sector. it makes it possible to carry out technical studies and develop prototypes dedicated to the recovery and transformation of organic matter for anaerobic digestion and the production of advanced biofuels (methanation, biogmv, hythane, h2 ...) and green chemistry.	National
Slovenia	x (3x)	<i>funding has a general (not explicitly bioeconomy) focus</i>	
Trentino		<i>funding has a general (not explicitly bioeconomy) focus</i>	
Fribourg		<i>funding has a general (not explicitly bioeconomy) focus</i>	
South Tyrol	x	<i>funding has a general (not explicitly bioeconomy) focus</i>	
support to digitalization of bio-based value chains (or value chains in general)			
Bavaria	x	hochtechnologien für das 21. jahrhundert (life science, energy & environment , material sciences, nanotechnology)	
Baden-Württemberg	x	<ul style="list-style-type: none"> - information and promotion measures for agricultural products in the internal market and in third countries: information and promotion measures in favour of agricultural products and of food made from agricultural products - promotion of transnational research projects on digitally supported agri-food systems: era-net cofund ict-agri-food is to initiate excellent, transnational research projects with an 	

		interdisciplinary approach "from the field to the plate" and to develop digital solutions for the creation of sustainable and transparent food systems.	
Auvergne-Rhône-Alpes	x	<ul style="list-style-type: none"> - EU projects on the digitalisation of agro-food companies involving clusters located in Auvergne Rhone alps - s3food https://s3food.eu/ with 2 open calls for proposals in 2020 to provide food processing SMEs and technology providing SMEs with financial support (through vouchers) and training to carry out their innovation activities. - Connsensys s3 (escps3) - https://www.clustercollaboration.eu/node/6479 - other funding has a general (not explicitly bioeconomy) focus, e.g. Digifed https://digifed.org/ 	
Slovenia	x(4)	<i>funding has a general (not explicitly bioeconomy) focus</i>	
Trentino	x (1 regional and 1 national)	<i>funding has a general (not explicitly bioeconomy) focus</i>	
other relevant programs, initiatives			
Auvergne-Rhône-Alpes	x	<ul style="list-style-type: none"> - Supporting the creation of a biomass boiler over 1200 MWh / year without connection to a heating network to promote the expansion of wood as renewable energy through the installation of virtuous wood boilers. - Encouraging the development of projects to produce heat from biomass in industry, agriculture and the tertiary sector. More than 100 installations are funded, 58 of which are in operation. These installations cover different activity sectors (food, paper and cardboard, chemicals, wood industry, etc.). Eligible biomass includes wooden and similar chips, industry by-products from primary processing of wood, end-of life wood and waste wood, pellets, agricultural by-products 	<p>AURA Bios Heat fund: regional</p> <p>BCIAT by ADEME: national</p>
Slovenia	x	<ul style="list-style-type: none"> - Systemic support to a sustainable transition (a horizontal program of decarbonizing Slovenia through circular economy): support to EIT Climate KIC deep demonstration in circular economy (Slovenia as the pilot) - Participation in different ERA-NET CoFund actions including ForestValue (call closed) and ERA CoBioTech (1 call closed, 1 open). 	5 million EUR
<p>Note on funding level: PPs consider to further check if other transnational funding exists (e.g. ERA-NET funding programs, EUREKA, EUROSTARS, ...). Transnational funding is important as it surpasses borders, increases opportunities for internationalisation and building value chains.</p> <p>Note on funding amounts: The regions provided very different information for the "Amount of funding in million EUR" category), mostly the information provided is for the funding rate and/or amount of funding per project, but not the total value of the program. Additionally, a vast majority of programs is general (not related to Bioeconomy) and the PPs were not in the position to identify how much funding goes into supporting the knowledge-based Bioeconomy. Due to the above reasons comparison between regional funding initiatives is not possible.</p>			

4 FUTURE OUTLOOK AND IDENTIFIED OPPORTUNITIES

4.1 Conclusion

There is no doubt that the Alpine Region, incl. the PPs' regions, have a high potential to bring Bioeconomy forward. Key determinants include:

- **Sufficient biomass resources** are in place. Biomass from agriculture, forestry and municipal waste is prevailing and to different extents available in all regions.
- **Critical mass of actors** from private and public sectors are in place, capable to cascade bioeconomic products and processes accordingly.

- A **well-matured landscape of cluster initiatives, networks and other platforms** intended to bring related actors together, to network, to provide information and knowledge exchange is in place.
- **Regional and national support schemes** for bio-economization of industries are available. Many of them may be very broad and rarely focused on core topics related to the Bioeconomy. However, there are funding schemes in place that can support interested actors from industry and academia to innovative in the field of Bioeconomy.
- **Bioeconomy related strategies on national or regional level exist.** Although still an exception on regional level, most PP regions have a related strategy on national level (even if of a broader scope).

The PPs' reports have identified certain opportunities based on their identified strengths and weaknesses and proposed certain actions to promote the opportunities and minimize the potential threats. These are presented in Table 12. As regional opportunities and recommendations are overlapping or complementary, they are summarized below, to be further explored and developed in a cross-regional manner.

Table 12: Regional strengths, opportunities and actions to be taken

Region	Strengths	Opportunities	Actions
Bavaria	<ul style="list-style-type: none"> - Favorable biogenic raw material situation concerning production, use, research and business environment - BUT! <ul style="list-style-type: none"> - only few value chains that cross industries - Only low-cascading usage of raw material - Insufficient network of economic actors - No tracking of origin of used inputs / material flows 	<ul style="list-style-type: none"> - Setting up a political framework resulting in sustainable use of soil and water, appropriate treatment of animals, synthesis of modern tech and traditional farming methods in agriculture and forestry - Advantageous conditions for direct energetic usage (through subventions for biomass plants) impede material use of biomass <p>BUT! Substitution of fossil fuels (for energy and materials) is economically unattractive (higher prices, reduced availability, differences in technical characteristics, loss of image caused by skeptical consumers)</p> <ul style="list-style-type: none"> - Cross-industrial Bavarian strategy on Bioeconomy needs to supplement bottom-up actions of industry - Potential in advanced biofuels, alternative use of biowaste, - Establishment of circular value chains in urban areas / regional centers of competence (material cycles, efficient recovery and full exploitation of existing resources) - Plant breeding for optimized production - Generation of special ingredients and biorefineries aiming towards full circular use of substance - Identification of new value chains and synergies - Intensification of production of raw materials using new technical and digital means – soil sensors, drones, 	<p>Recommendation to:</p> <ul style="list-style-type: none"> - fund RDI in the field of the material use of biogenic resources - Continue efforts to maintain the benefit quote of biofuels or classic fuels on federal level - adapt legal and administrative framework conditions (e.g. to include bio-based materials in regulations on biowaste, add ecological and social criteria to public procurement) - integration of Bioeconomy in the regional strategy on sustainability

		big data for e.g. minimal use of fertilizers and optimized land use	
Auvergne-Rhône-Alpes	<ul style="list-style-type: none"> - First industrial region of France - 14 competitiveness clusters and 18 business clusters - Birthplace of French chemistry - Strong sectors linked to bioeconomy: <ul style="list-style-type: none"> - Biobased plastics - Green chemistry - Pharmacy - Technical textiles - Eco-construction - Agriculture/agrofood and forestry 	<ul style="list-style-type: none"> - Anti-waste and circular economy law with 4 directions: putting an end to waste to preserve natural resources, mobilizing industries to transform production methods, strengthening consumer information, improving waste collection and combating wild deposits - A regional scheme for the mobilization of biomass in the process of being approved - Regional Plan of Prevention and Management of Waste (PRPGD) integrating a Plan on circular economy foreseeing the valorization of biowaste - The regional Bioeconomy Trophies organized by the Regional delegation of the Ministry for Food, Agriculture and Forest to identify projects and stakeholders from different sectors innovating in bioeconomy (http://draaf.auvergne-rhone-alpes.agriculture.gouv.fr/Nouvel-article,3151) - Many national and regional funding schemes available to support the development of bioeconomy in the Region - The potential of forestry is still underexploited 	<ul style="list-style-type: none"> - A biobased product label based on CEN/TC/4111 standard - Focus on energy intermediate crops - Strengthening of LCA methods for products and Bioeconomy sector - Incentives for manufacturers who integrate eco-design into their production methods and penalties for those who don't
Upper Austria	<ul style="list-style-type: none"> - Biobased plastics from wood (cellulose), starchy plants (corn), algae - Textile fibres, composites of cork with polymer-based binders (for shoe insoles, hands for prams), natural fibre-reinforced plastics based on hemp and nettles, wood plastic composites - Paper and pulp products as high tech products (e.g. printed conductors providing information on freshness and transport route of food packaging, pharmaceuticals, blood products, vaccines, forgery proof paper, fibre products with electronic application in the form of wearables), increasing the use of wastepaper for paper and board products - Biorefineries: Fine chemicals (for production of cellulose netting tubes, acetic acid for food industry, 	<ul style="list-style-type: none"> - Establish itself as a superregional hub for bioeconomic products and know-how. - Become a biomass utilization pioneer due to available biogenic resources, chemical and technical businesses and industry related research facilities. - Extensive conversion of power generation to renewable energy sources, importance of combining generation of electricity and heat in small plants - Optimised treatment and use of additional organic residual and waste materials for thermal use of bioenergy - Increased efficiency of biogas plants through membrane filtration - Increased use of biofuels (biodiesel from vegetable or cooking oil and bioethanol produced from the fermentation of grain residues) 	<ul style="list-style-type: none"> - Use of wood in urban areas: multi-story buildings, environmentally friendly impregnations, flame protecting for renewable insulating materials) - Wood concrete metal combination in furniture - Improved recyclability, optimization of cascade use - Production of icatonic acid from wood (basis for rubber, paints, coatings)

	furfural, magnesium lignin sulfonate (production of refractory bricks), omega 3 fatty acids from algae, animal feed)		
Slovenia	- Favorable general conditions	<p>NO BIOECONOMY STRATEGY:</p> <p>Need for Bioeconomy to become a strategic policy objective, involvement of relevant actors in the policy development process, financial support through thematic and generic programs, innovation hubs, clusters as catalysts and cross-border (international and transnational) collaboration as an aim</p> <p>- Clusters need to continue developing bio-cluster excellence and promotion of companies in the bio-based industry, providing better services to members in order to capitalize on the R&D intensive bio-based products and services to make a breakthrough on the market</p>	-
Trentino	<p>- Production of high-level education/research in several Bioeconomy related fields: bioenergy, agro-metrology, bioecology, biopolymers, biomaterials, bio-aromatics, biotechnologies, waste management, forestry, agri-food, green chemistry, biodiversity (CA 3 center of University of Trento and Fondaione Edmund Mach) and agronomics, biology, forestry and Bioeconomy in the alpine area (The Alpine center – CSALP))</p> <p>- International summer school on Bioeconomy</p>	<p>- Trentino as a model for Bioeconomy principles</p> <p>- FRUITOMICS most important Bioeconomy infrastructure in Trentino for agri-zoo technical, food and environmental sectors which will integrate and strengthen existing regional and national infrastructures with international infrastructures and clusters (Elixir, ESFRI EMPHASIS, cluster agri-food), establishing a one site access to specialist skills and advanced high-throughput omics</p>	- Incentives to modernize the agricultural sector and bioenergy production and utilization, improve accessibility for biomass collection, promotion of new wood value chains
Fribourg	<p>- Construction and energy sector linked to wood and forestry sector (as a building or insulation material)</p> <p>- Agricultural biomass (hemp, straw) as insulation material</p> <p>- Need for new applications and developments to add value to biomass in construction also from chemical / plastics industries (new biobased products – biobased paints, biobased plastic derivatives)</p>	<p>- Food and feed including food processing industry through developing new products (related to health and well-being) and valorisation of by-products and waste produced (currently transformed into animal feed and biogas or are burned)</p> <p>- pharmaceuticals,</p> <p>- plastics</p> <p>- chemicals</p> <p>- Need for intersectoral cooperation (create optimized processes, develop new products)</p> <p>- Need for cross-sector cooperation and cross-industrial value chains to valorize waste and create value added</p>	- New value chains for the plastics industry in the medical sector and the food industry (e.g. bioplastics with a high bacterial resistance) – supply (biomass could come from the forestry – lignin, agriculture – starch, sugar or from waste of the food industry – animal proteins).
South Tyrol	- Strong R&D cooperation between research entities	- Abundant presence of by-products and/or waste from highly	- More specific funding programs

	<p>and companies: bio-based sector research (base and applied research in agriculture and food technology) is led by the Free University of Bolzano and the Laimburg Research Centre. Fraunhofer Italia and Eurac Research carry out applied research on different topic. NOI Techpark and IDM Südtirol/Alto Adige are business support organizations that facilitate cooperation</p>	<p>strategic bio-based sectors (agriculture and animal husbandry, food processing, forestry, wood processing) - Good enabling environment for R&D on reuse / development of new products based on by-products or waste from previous supply chains</p>	<p>targeting the bioeconomy with focus on reuse of waste and by-products - Development of the regional industrial sector for the reuse of waste and by-products for the production of new products - Support to develop industrial strategies for rethinking / reconverting value chains and/or production processes for the valorization of waste and by-products from biological origin</p>
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Recommendations given in the PP reports to better support the Bioeconomy in the Alpine region include:

- Setting up a legal and administrative framework to support the development of the Bioeconomy and integration of the Bioeconomy in regional sustainability / circular economy strategies
- Devising common programs to support R&D in promising areas related to the Bioeconomy
- Creating and interlinking high quality education programs related to the Bioeconomy
- Promoting inter- and cross-sectoral cooperation in order to better interlink economic and other actors (e.g. in clusters, which provide state of the art services to members in order to capitalize on the R&D intensive bio-based products and services)
- Promoting cross-industrial value chains in the Bioeconomy to valorize side streams, create value added from waste, and explore opportunities for cascading uses of raw material
- Establishing circular value chains in urban areas / regional centers of competence
- Promote new value chains in the forest-based, bioplastics (medical sector/food industry), residual side-streams and waste
- Tracking the origin of used inputs / material flows
- Intensifying production of raw materials using new technical and digital means
- Implementing a bio-based product label
- Strengthening LCA methods for products and Bioeconomy sector
- Implementing an incentives system for manufacturers who integrate eco-design into their production methods

Thematic opportunities for the Bioeconomy in the Alpine region include:

- Bioenergy (including social acceptance, incentives for increased production and consumption, modernization and improved efficiency of plants, optimized use of waste and other residuals) and biofuels
- Biobased plastics (wood, starchy crops, algae) and plastics composites (wood, cork, hemp)
- Pulp and paper products as high-tech products (printed conductors providing information on freshness and transport route of food packaging, pharmaceuticals, blood products, vaccines, forgery proof paper, fiber products with electronic application in the form of wearables)
- Biorefineries for production of fine chemicals

- Construction (use of wood in multi-story buildings, renewable insulating materials, design for disassembly and cascading uses of materials used, bio-based paints and coatings)
- Food and feed including food processing industry (developing new products related to health and well-being, valorization of by-products and waste)
- Pharmaceuticals

4.2 Recommendations

Taken the findings and individual recommendations of the PP into account, the following key recommendations can be further discussed over the course of the AlpLinkBioEco project, especially as input for the setting-up of a common policy dialogue on circular bio-based economy.

1. **A COMMON FRAMEWORK FOR DATA COLLECTION.** Reports provided very different sets of data, when it comes to the fundamental figures on the state of Bioeconomy in the region. Some PPs significantly struggled in this regard. For relevant and comprehensive comparison, a common framework for data collection based on common indicators should be used. The quality of the data provided in the PP reports shows clear evidence that more efforts need to be made to collect harmonized data.
2. **A COMMON DEFINITION OF THE BIOECONOMY FOR THE ALPINE REGION.** There are many definitions of the Bioeconomy and regions use different ones. A common definition of the Bioeconomy for the Alpine region should be introduced by the Alpine Regions as it is important to gain a common understanding of the Bioeconomy as a basis for the future masterplan on Bioeconomy.
3. **A COMMON STRATEGIC FRAMEWORK FOR THE ALPINE REGION.** Connected to the issue of a lack of a common definition and approach to the development of the Bioeconomy, there is little alignment also on strategic level. Some regions have dedicated Bioeconomy strategies, others incorporate them in wider sustainability, circular economy or development strategies. Most (but not all) regions also directly/ indirectly include Bioeconomy in their S3. A common Alpine Space regional Bioeconomy strategy considering the specificities of the region should be drawn up. Thus, defining a joint strategic framework would help to find a common ground from which future actions can start from.
4. **CONNECTION BETWEEN BIOECONOMY AND CIRCULARITY.** Bioeconomy in the 21st century should be not only knowledge-based but also circular. A general lack of the circularity principle and cascading use of biomass examples can be observed. The lack of support for reverse logistics goes hand in hand with an evident focus on the use of raw biomass (not just production side streams and waste) for bioenergy.
5. **CROSSREGIONAL COOPERATION.** As in many other fields, there is a lack of commitment of most regions to align regional strategies with EUSALP. Furthermore, hardly any regional-driven cross-border initiative can be identified, which is not funded by external funding sources (e. g. INTERREG). Pilot-actions, driven by 2 or 3 regional actors, but focusing on cross-border cooperation, might be the first step to demonstrate how cross-border cooperation works. These pilots could be initiated by cluster initiatives, which often aim to support internationalization. Such pilots do not require substantial resources and effort.
6. **INNOVATION VOUCHERS TO BRIDGE THE GAP FOR CROSS-REGIONAL COOPERATION.** In the frame of the AlpGov I project¹⁵, the “Cluster & Bioeconomy” sub-group received some funds (around € 10.000) to undertake actions to match different Bioeconomy actors from the Alpine Region. The Sub-Group identified and selected such initiatives. It is recommended to use additional budgets from AlpGov II in a similar way, but to focus more on supporting cross-regional pilots (see Recommendation 5). For such “Vouchers”, B2B cross-regional cooperation shall be at the core.

¹⁵ AlpGov is the flagship project under EUSALP to improve overall governance of the macroregional approach AlpGov I and II do have certain flexible budgets.

AlpLinkBioEco Partners



AlpLinkBioEco develops

1. Database to map existing resources, actors and relevant policies in the Alpine Space
2. Methodology to match actors for new value chains
3. New (cross)-regional value chains
4. Policy recommendations for the development of bioeconomy in the Alpine Space



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38