

Catalonia Bioeconomy Ecosystem Report

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Circular
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Executive summary

This report offers a comprehensive overview of the bioeconomy sector within Catalonia, Spain, providing a thorough examination of its current landscape and potential for growth. Catalonia, with its rich biodiversity and diverse climates, stands as a fertile ground for bioeconomy endeavours. The region benefits from a plethora of natural resources, including forests, grasslands, and marine ecosystems, which serve as the foundation for bio-based innovation.

Moreover, Catalonia boasts a strong tradition in research and development, supported by a network of universities and research institutes. This, coupled with a robust industrial sector, creates a conducive environment for the advancement of bioeconomy initiatives. The region's commitment to fostering sustainable growth is evident in its Bioeconomy Strategy of Catalonia 2012-2030 (EBC2030), which lays out strategic objectives aimed at catalysing economic activity, strengthening knowledge networks, and preparing society for the transition towards a circular bioeconomy.

The EBC2030 outlines a roadmap for leveraging Catalonia's biological resources to drive economic development while minimizing environmental impact. With quantifiable contributions to the economy, the bioeconomy sector in Catalonia is poised for continued growth. Collaboration across various industries and sectors is essential to realize the full potential of the bioeconomy in Catalonia.

This report serves as a valuable resource for policymakers, investors, businesses, and researchers interested in understanding and engaging with Catalonia's bioeconomy sector. Identifying potential areas for investment and collaboration contributes to the collective effort towards building a sustainable and resilient future.



Characterization of Bioeconomy in Catalonia

The territory of Catalonia is an autonomous region of Spain, located in the north-east of the country. The current population is 7,758,615 inhabitants, with an unemployment rate of 9.31%. The current Gross Domestic Product (GDP) growth is +4,0% and the estimated annual inflation of the Consumer Price Index (CPI) growth is +8,5%¹.

Table 1 Comparison of key societal and economical parameters between Catalonia, Spain, and Europe (2022)²

	Catalonia	Spain	Europe
Population	7,758,615	47,432,805	746.4M
Unemployment rate	9,31%	12,5%	6%
GDP growth	+4%	+7,9%	+5.4%
CPI growth	+8,5%	+7,3%	+9%

Spanish Autonomous regions are divided into lower administrative levels known as provinces. A province in Spain is a territorial division defined as a collection of municipalities. In addition to their political function, provinces are commonly used today as geographical references. The autonomous community of Catalonia is divided into 4 provinces: Barcelona, Tarragona, Girona and Lleida (see Figure 1):

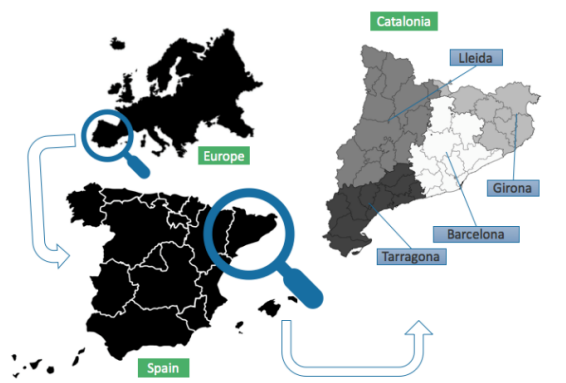


Figure 1. Geographical location of Catalonia and its provinces³

Catalonia has a great potential for bioeconomy for several reasons:

- **Biodiversity:** Catalonia is a region with a rich biodiversity that provides a wide variety of natural resources for the development of a bioeconomy, such as forests, grasslands, wetlands, and marine and freshwater ecosystems.

¹ Idescat, 2022.

² Idescat, INE, Eurostat, 2022

³ Elaborated by the authors.

- **Climate:** climate in Catalonia is diverse, ranging from Mediterranean to semi-arid, allowing the cultivation of a variety of crops, including fruit trees, olive trees, vineyards, and cereals, all of which can provide raw materials for the bioeconomy.
- **Research and development:** Catalonia has a strong tradition of research and development in the field of agriculture and biotechnology, with several universities and research institutes working on projects related to the bioeconomy.
- **Strong industrial tradition,** especially in the chemical and food industries, which provides the necessary infrastructure and expertise to develop a bioeconomy.
- **Government support:** the Catalan government has shown its commitment on promoting the bioeconomy by providing financial and regulatory support for research and development projects, as well as by establishing a favourable legal and administrative framework for the development of the bioeconomy.

Overall, Catalonia's unique combination of natural resources, research and development capabilities, industrial tradition, and government support makes it an ideal location for the development of a thriving bioeconomy.

In 2017, the Government of Catalonia initiated the [Plan for the Implementation of the 2030 Agenda](#), recognizing the importance of a circular bioeconomy model to achieve the [Sustainable Development Goals](#) and address climate change. As a result, the Government Agreement [GOV/23/2020, of February 11, 2020](#), was established, which approved the objectives and content of the [Bioeconomy Strategy of Catalonia 2012-2030](#) (hereinafter, EBC2030). This strategy was assigned to the Department of Agriculture, Livestock, Fisheries and Food⁴, along with other relevant departments, for deployment.

Following the guidelines of the European Strategy, the EBC2030 serves as a roadmap for the transition to a decarbonisation of the economy and the implementation of productive systems with a lower ecological footprint, presenting strategies designed to maximise the use of circular bioeconomy sector's potential to generate economic activity⁵:

“The goal of EBC2030 is:
To promote the sustainable growth and development of the Catalan economy by fostering the production of biological resources and local renewable processes.”

To achieve the objective, the following criteria has been considered in the EBC2030:

Table 2 Criteria considered in the elaboration of the EBC2030⁶

WHAT	HOW
Dynamize and enhance the territory and their resources: agroforestry, fishery and aquaculture biomass and natural capital.	Implementation of competitive value chains in the territory that promote resilient landscapes, adapted to climate change.
Become a development opportunity for the primary sector in collaboration with other sectors.	Reinforce rural and coastal areas in Catalonia through the creation of regional value through circular bioeconomy.

⁴Since 26th May 2021, Ministry of Climate Action, Food and Rural Agenda.

⁵[Catalan Bioeconomy Strategy 2030 Executive Summary](#) – Estratègia Catalana de Bioeconomia 2030 (EBC2030)

⁶EBC2030



Promote the technological transformation of biomass resources biomass in bioproducts, biomaterials and bioenergy.	Use of renewable and local biomass, reduction of waste generation in the supply chain and change in consumption patterns (demand and use of bioproducts).
Search for innovative solutions in the field of bioeconomy.	Biotechnology and digitization.
Reduce emissions (greenhouse gasses, unmanaged surplus nutrients, phytosanitary products, among others) and resource consumption.	Implement productive systems with less environmental impact in terms of emissions and resource consumption.
Decarbonization of the economy and achievement of the Sustainable Development Goals and the Paris Agreement.	Moving towards a healthy and sustainable food and nutrition system and competitive value chains.
Economic, social, and environmental transformation.	Spread and consolidate knowledge and awareness towards the circular bioeconomy.

To achieve the goals of the EBC2030 initiative and adhere to the guiding principles of the strategy, the plan aims to implement a range of actions that can transform and advance the circular bioeconomy in Catalonia. These actions will be incorporated into three-year action plans and will be supported by various groups promoting the bioeconomy in the region. The first action plan, [EBC2030 Action Plan \(2022-24\)](#), establishes seven strategic objectives to promote the use of biological renewable and local resources in all Catalan economic sectors before 2030.

Table 3 Strategic objectives proposed by EBC2030⁷

OBJECTIVES LINKED TO THE GENERATION OF ECONOMIC ACTIVITY

1. Improve the use of Catalonia's biomass by characterising it, quantifying it, and optimising its management and distribution.
2. Develop a business community based on the bioeconomy throughout the territory, with special attention paid to the primary sector.
3. Encourage the use and consumption of bioproducts, bioenergy and biomaterials in the market
4. Promote resilient landscapes and the sustainable provision of ecosystem services in the context of the Catalan circular bioeconomy

FACILITATING OBJECTIVES WITH A TRANSVERSAL CHARACTER

5. Situate knowledge as a motor of the circular bioeconomy
6. Strengthen the role of the Administration and adapt the legal and regulatory framework to favour the circular bioeconomy in Catalonia
7. Prepare Catalan society for the change towards the circular bioeconomy

These objectives are backed by numerous research and development initiatives aimed at creating bioeconomy solutions across various industries. These projects aid in the implementation and growth of an economically sustainable transition towards a bioeconomy model (see *Analysis of the Positioning of Bioeconomy R+D in the Catalan region within the EU framework*).

⁷[EBC2030 Action Plan \(2022-24\)](#)



Quantifying the Bioeconomy sector in Catalonia

The circular bioeconomy is a rapidly growing sector that aims to create a sustainable economic model based on the use of renewable biological resources. Catalonia has been at the forefront of this movement, promoting the development of a circular bioeconomy through various initiatives and projects. In this context, it is important to understand the current state of the circular bioeconomy sector in Catalonia.

Quantifying the value of the circular bioeconomy requires a definition that includes all the sectors producing natural raw materials and those transforming them into bioproducts, biomaterials and bioenergy. Overall, the bioeconomy sector in Catalonia is substantial, generating revenues of €43,476 million, accounting for 9.8% of the overall value of domestic production and 4.5% of the GDP of added value (2018). It also provides employment for 5.2% of the workforce in the region.



Figure 2 Economic value scorings in the Catalan economy (2018) of all the activity sectors belonging to the circular bioeconomy.⁸

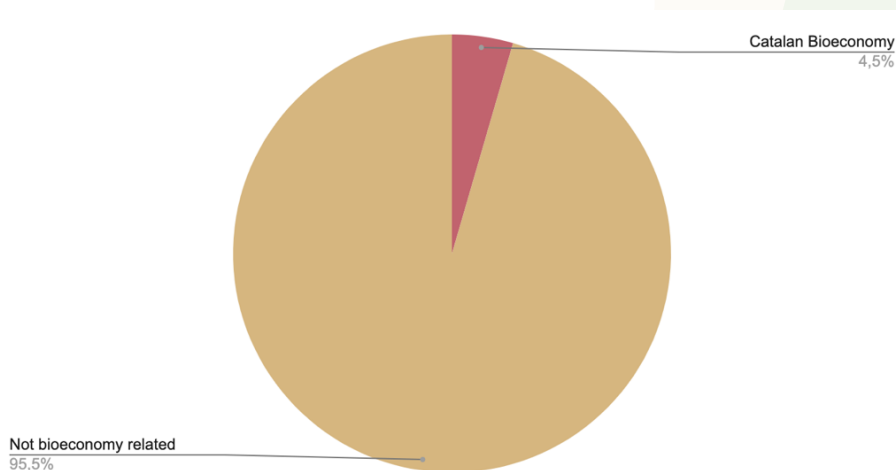


Figure 3 Catalan Bioeconomy GDP contribution to Catalan economy (2018)⁹

In the context of the bioeconomy in Catalonia, the **primary sector** refers to the traditional agricultural sector, including activities such as agriculture, livestock, forestry, and fishing, which involves the

⁸ Idescat, 2018

⁹ Idescat, 2018

production of raw materials from renewable biological resources. This sector is focused on the production of food and other agricultural products and the management of natural resources.

The **industrial sector**, on the other hand, encompasses the processing, storage, and distribution of these products from the primary sector. It also includes the development of new technologies to produce bio-based products, such as bioplastics, biofuels, and biochemicals. It includes bio-packaging and paper, bioenergy and fuels, bioproducts (chemistry and pharmacy, cosmetics, fertilizers and bioplastics), construction, forestry linked to first and second transformation of wood and cork, textile and agri-food (by-products). This sector is focused on the transformation of raw materials into finished products and the commercialization of these products in the market.

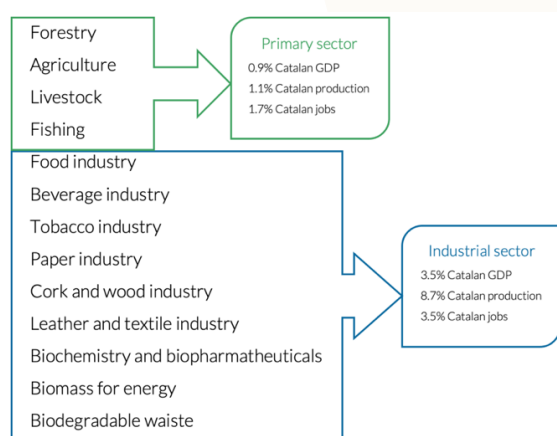


Figure 4 Catalan bioeconomy sectors, grouped in primary and industrial sectors, 2018¹⁰

In 2019, the primary sector in Catalonia contributed to 0,9% of the Catalan GDP and represented 1,7% of the employed population; however, the primary sector has a huge territorial presence, with a 25% of its territory dedicated to crops and a forest area of 64%¹¹. The forestry sector is an important part of the chain of supply of food and industrial products and the supply of biomass to produce bioenergy. The transition towards a bioeconomy model will depend upon a strong, independent, and sustainable primary sector for the provision of food and other essential goods and services. The forest sector is an important part in the food and industrial product supply chain and the supply of biomass to produce bioenergy. On the other hand, on 2018, the industrial sector in Catalonia contributed to 3.5% of the Catalan GDP and represented 8,6% of the regional production and 3.3% of the employed population.

In the bioeconomy, the primary sector and industrial sector are closely linked, as the production of raw materials from the primary sector provides the input for the processing and manufacturing activities of the industrial sector. However, the two sectors have different focuses and objectives, with the primary sector focused on the production of raw materials, and the industrial sector focused on the processing and commercialization of these materials.

As seen, bioeconomy in Catalonia is characterized by a diverse array of economic sectors, stakeholders, and interests. The contribution of the different bioeconomy economic sectors is uneven and diversified, aligning to the industrial diversity and sectorial specialization of the Catalan industrial network. Of these,

¹⁰ Idescat, 2018

¹¹ Idescat, 2019

the agri-food sector stands out as the largest contributor to GDP, accounting for 2.4%. The other economic sectors combined make up 2% of the total GDP¹².

Table 4 Contribution of economic sectors associated with circular bioeconomy to the Catalan economy (2018)¹³

Economic sectors associated with circular bioeconomy	% of Catalan GDP	% of Catalan production	% of Catalan jobs
Agriculture, livestock, forestry, and fishing	0,9%	1,1%	1,7%
Food, beverage, and tobacco industries	2,4%	6.4%	2.6%
Textile industry (natural fibres) and leather	0,1%	1.2%	0.4%
Wood and cork industries	0,2%	0.3%	0.2%
Paper industries	0,5%	0.4%	0.0%
Biochemical and pharmaceutical industries	0,2%	0.2%	0.1%
Biomass for energy	0,1%	0.1%	0.0%
Biodegradable waste	0,1%	0.2%	0.2%

This table shows the contribution of various economic sectors associated with the circular bioeconomy to the Catalan economy in 2018 and provides a useful snapshot of the current state of the circular bioeconomy in the region, highlighting the sectors that are making the most significant contributions to this important economic and environmental paradigm.

The food industries and primary sector, including agriculture, livestock, forestry, and fishing, are the two most significant spheres of activity, offering great potential for the recovery and utilization of biomass in the region.

The food, beverage, and tobacco industries are the largest contributors to the circular bioeconomy in Catalonia, accounting for 2.4% of the region's GDP, 6.4% of its production, and 2.6% of its jobs. This is not surprising given that the food and beverage sector is a significant part of most economies and is often a major contributor to the circular bioeconomy due to its reliance on natural resources.

The paper industry is another important contributor to the circular bioeconomy in Catalonia, accounting for 0.5% of the region's GDP, 1.2% of its production, and 0.4% of its jobs. The use of recycled paper and sustainable forestry practices are important aspects of the circular bioeconomy, and it's good to see the paper industry contributing to these efforts.

The wood and cork industries, as well as the textile industry and leather, are smaller contributors to the circular bioeconomy in Catalonia, accounting for 0.2% and 0.1% of the region's GDP, respectively. However, these industries are also making efforts to reduce waste and promote sustainable practices.

Finally, the biochemical and pharmaceutical industries, biomass for energy, and biodegradable waste sectors are relatively small contributors to the circular bioeconomy in Catalonia, each accounting for less than 0.2% of the region's GDP. However, these sectors have significant potential to contribute to the circular bioeconomy in the future, particularly as technology and sustainability practices continue to advance.

¹² Idescat, 2018

¹³ Idescat, 2018



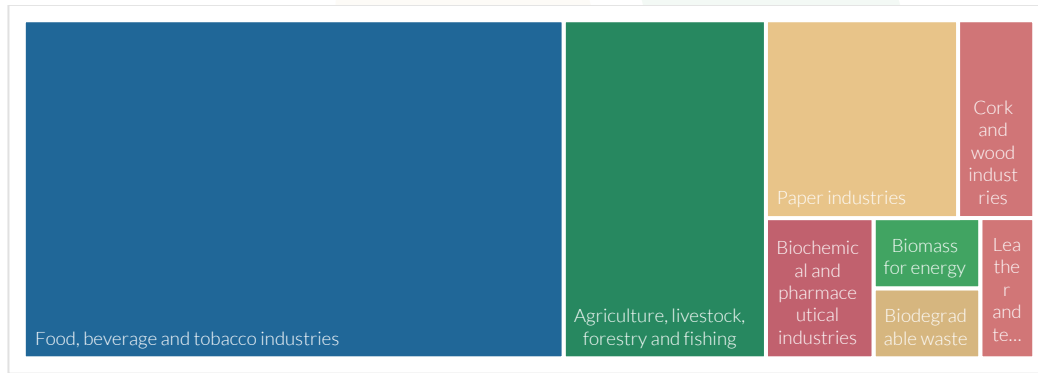


Figure 5 Contribution of the economic sectors associated with circular bioeconomy to the Catalan economy (GVA¹⁴ 2018)¹⁵

¹⁴ The gross value added (GVA) is the sum of all additional values acquired by goods and services when transformed in the production process. The GVA is calculated by subtracting the value of the goods and services used during the process of production from the total production value.

¹⁵ Idescat, 2018

Use and recovery potential of biomass resources in Catalonia

Characterisation of biomass resources

In the EBC2030, biomass is understood as the set of all organic matter of plant or animal origin, including materials resulting from natural or artificial transformation processes. This can include anything from wood and crop residues to manure and food waste (see Figure 6). The biomass resources that fall within this scope are:

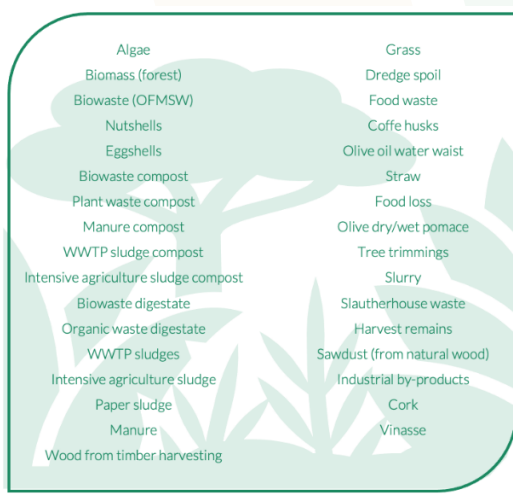














































































Figure 6 Resources for the biomass potential¹⁶

The potential use of different biomass resources in specific sectors in Catalonia, as presented in Figure 7, is likely a result of a combination of availability, characteristics and properties, and technological readiness of the organic resources.



¹⁶ Waste Agency of Catalonia – [Agència de Residus de Catalunya](#) (ARC)

¹⁷ organic fraction from municipal waste

	Food and beverage industries	Agriculture, forestry and fishing	Manufacture of paper and paper products	Manufacture of textiles and garments	Manufacture of wood and products from wood and cork. Manufacture of articles of straw	Manufacture of biobased pharmaceutical products	Manufacture of biobased chemical products	Bioenergy
Nutshell								
Eggshells								
Biowaste compost								
Plant waste compost								
Manure compost								
WWTP sludge compost								
Intensive agriculture sludge compost								
Biowaste digestate								
Organic waste digestate								
WWTP sludges								
Intensive agriculture sludge								
Paper sludge								
Manure								
Wood from timber harvesting								
Grass								
Dredge spoil								
Food waste								
Coffee husks								

	Food and beverage industries	Agriculture, forestry and fishing	Manufacture of paper and paper products	Manufacture of textiles and garments	Manufacture of wood and products from wood and cork. Manufacture of articles of straw	Manufacture of biobased pharmaceutical products	Manufacture of biobased chemical products	Bioenergy
Olive oil water waist								
Straw								
Food loss								
Olive dry/wet pomace								
Tree trimmings								
Slurry								
Slaughterhouse waste								
Harvest remains								
Sawdust (from natural wood)								
Industrial by-products								
Cork								
Vinasse								

Figure 7 List of potential uses by sectors of the identified biomass resources in Catalonia¹⁸

Evidently, most potential uses involve agriculture, silviculture, and fishing; manufacture of biobased pharmaceutical products; manufacture of biobased chemical products; and production of bioenergy. These resources and potential uses can be recovered in different ways using diverse technologies and processes.

It is important to note that biomass data in Catalonia is highly dispersed, sometimes missing and/or inconsistent, hampering precise and territorialized quantitative assessments of the different flows of organic resources and biowaste. For this reason, there is a need to characterize better the current amount of biowaste and organic materials available and produced in the territory, to be able to calculate a more precise biomass potential in Catalonia.

¹⁸Waste Agency of Catalonia – Agència de Residus de Catalunya (ARC)

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