

PA #5 The Slovenian Bioeconomy and supporting knowledge on the transition to a local circular bioeconomy

Agriculture, food production and wood processing are the main sectors in the Slovenian bioeconomy.

The Slovenian bioeconomy, worth €3 billion in 2020 and employing 115.8 thousand people, is based on 16 sectors, including traditional biomass production, processing of raw biomass, and transformation of processed biomass and bio-based materials. Agriculture, food production and wood processing are the main sectors, with bio-based chemicals and pharmaceuticals, agriculture, and food and beverage production each contributing around 20% of the total value added.

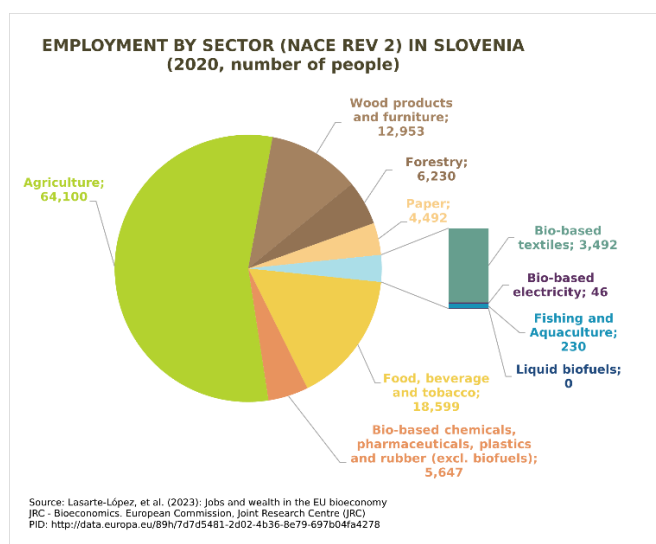


Figure 1: Employment by Sector | Slovenia

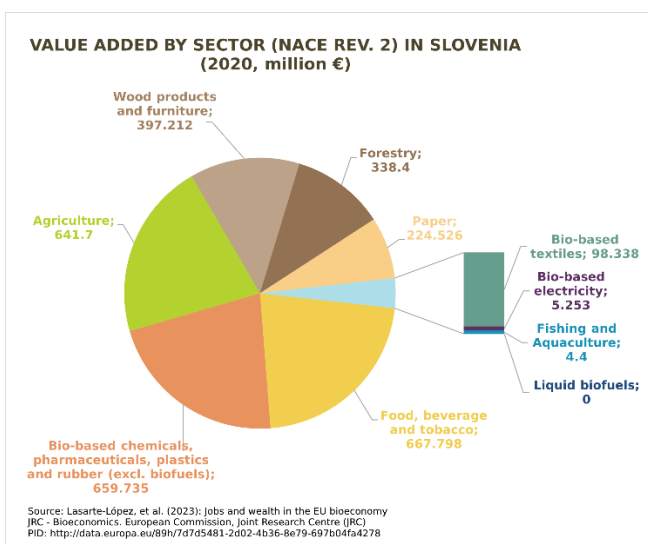


Figure 2: Value Added by Sector | Slovenia

Exceptional forest potential, but structural obstacles hinder optimal wood utilization

Slovenia's forests cover 58% of the country's area and have a timber stock of 338 million cubic meters. The fragmentation of the forests and the ownership structure hinder the optimal use of wood. Logging accounts for 60-70% of the permitted timber harvest. Low-grade wood has the greatest untapped potential for biorefinery processes. Other potential sources of biomass are residues generated after extraction, processing and consumption in the forest-wood-paper chain, as well as logging residues such as bark. The biomass from recovered wood residues, used wood and wood waste can be processed into bio-based products (e.g. biocomposites, biochar, biofuel) or used in agriculture and environmental protection (e.g. litter, mulch, greening of degraded land) before conventional energy use.

Crop residues as feedstock for bioeconomy, as long as the balance of soil organic matter is not jeopardized

In 2023, the total utilized agricultural area in Slovenia amounted to 447,158 ha, of which 56% was permanent grassland and pastures, 38% arable land and 6% permanent orchards. Harvest residues and secondary crops make up the largest share of raw materials from crop production, followed by residues from vegetables, oilseeds and root crops, and horticultural residues. Only after balancing the soil organic matter can these biomass streams be used by: (i) extracting bioactive ingredients (e.g. for functional food and cosmetics) and using them in the production of packaging, (ii) converting fibers into composite materials (e.g. for building insulation) or (iii) small-scale biorefining of complex raw materials into biochemicals and biomaterials with higher added value.

Livestock manure as a source of heat and electricity

Since two thirds of farms in Slovenia raise livestock (for meat and dairy products), it is not surprising that livestock manure is one of the priority side streams in agriculture. Its current use as organic fertiliser can be upgraded

through the establishment of small biogas plants (up to 250 kW) at larger farms and improved soil fertilization techniques to create added value and reduce environmental impact.

The bioeconomic potential of residues and waste from food production is diverse

The dairy industry, animal by-products, the brewing industry and wine production are perspective sectors that provide homogeneous biomass streams and enable scaling. Given the chemical composition and technological characteristics of by-products from food processing, there is untapped potential in the recovery of bioactive compounds and the application of various biotechnological processes.

Towards integrated, sustainable, and robust bioeconomy in Slovenia

Recently established [Slovenian Bioeconomy Hub](#) will serve as dynamic platform for collaboration, innovation, and knowledge transfer. It will support the development of national bioeconomy and create opportunities for more complex (cross-sector) value chains and business models that enhance biomass flows along the value chain. Despite currently lacking dedicated national Bioeconomy strategy and Action Plan, Slovenia has many policies addressing the bioeconomy. Among national strategic documents, the following can be pointed out: Slovenian Sustainable Smart Specialisation Strategy 2021–27 ([MGRT, 2022](#)), Slovenian Development Strategy 2030 ([Šooš, 2017](#)), Slovenian Industrial Strategy 2030 ([MGRT, 2021](#)), Comprehensive National Energy and Climate Plan 2030 ([Celoviti nacionalni energetski in podnebni načrt Republike Slovenije, 2020](#)), and National Development Strategy of Agriculture and Food System ([MKGP, 2021](#)). Bioeconomy is also strongly represented in the major inter-ministerial initiative, called Comprehensive Strategic Project for Decarbonising Slovenia.

SLOVENIA

FROM A PATCHWORK OF GOOD PRACTICES TO AN INTEGRATED, SUSTAINABLE AND ROBUST BIOECONOMY SYSTEM

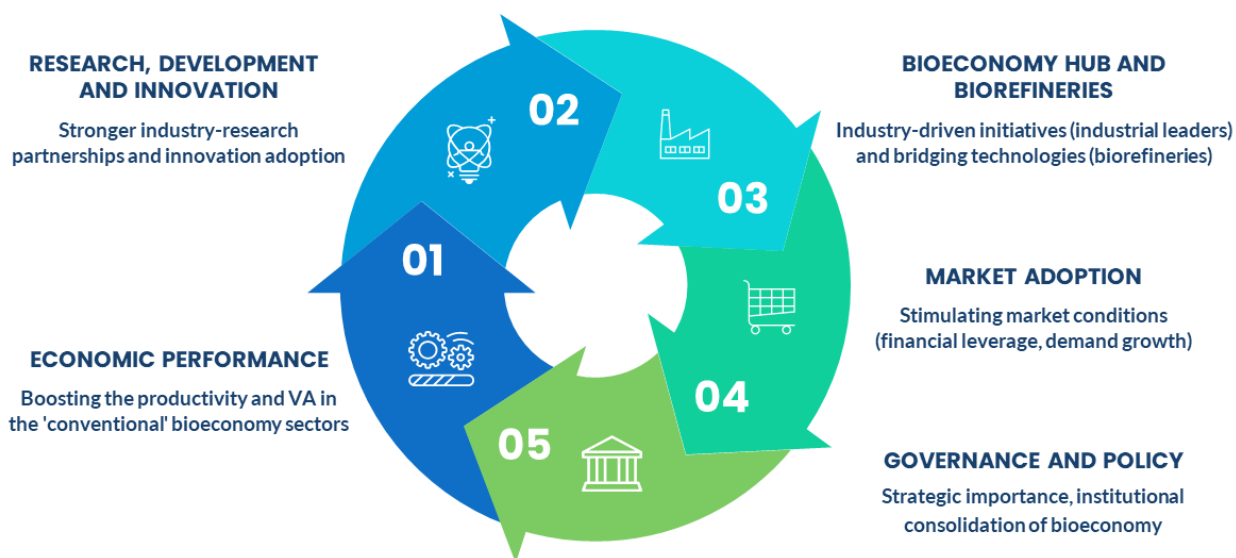


Figure 3: Slovenian Bioeconomy System

