Priorities in Bioeconomy Strategies

Subjects: Agricultural Economics & Policy

Contributor: Christina-Ioanna Papadopoulou , Efstratios Loizou , Fotios Chatzitheodoridis

Bioeconomy is an emerging concept and no commonly accepted definition has been given. Bioeconomy strategies attempt to cover every aspect of this emerging concept from a different perspective, depending on the country, region, or organisation issuing them. For these reasons, each strategy has its own priority fields depending on the economic, geomorphological, social, ecological, and technological conditions of each country. There are trends in the priority fields of bioeconomy strategies in the years 2013–2022. Moreover, the economic and technological development of the respective countries foreshadows their priorities. A successful transition to a bioeconomic model requires the participation of society as a whole, because a sustainable society as a whole requires sustainable and environmentally friendly solutions.

bioeconomy strategies bioeconomy priorities network visualization

1. Introduction

The term bioeconomy seems to have been used already in the early 2000s [1], while policy discussions on the bioeconomy started in the middle of the decade on the agenda of the European Commission (EC). However, the foundations for the bioeconomy come from previous strategic agendas of the EC, including the 1993 white paper that emphasised the need for knowledge-based investment and the role of biotechnology in innovation and growth, and the Lisbon agenda in 2000, which called for global leadership to focus on the knowledge economy to ensure competitiveness and economic growth. In addition, in 2002, the EC stated that life sciences and biotechnology are probably the most promising cutting-edge technologies, with a high potential to contribute to the achievement of the Lisbon agenda objectives. In 2005, at the international conference of the European Union, the knowledge-based bio economy (KBBE) framework was presented, followed by another conference in 2007, which outlined the prospects for the European bioeconomy over the next 20 years. These two events contributed to the emergence of the knowledge-based bioeconomy in European policy circles [2].

Bioeconomy is of high attractiveness as a potential solution for green growth and competitiveness [3]. The European bioeconomy strategy supports the production of renewable biological resources and their conversion into vital products and bioenergy in order to meet the 2030 agenda and its sustainable development goals [4]. Biomass resources represent an opportunity for sustainable development in bio-based industries [5], covering sectors as diverse as agriculture, food, biochemicals, bioenergy, biocides, and forests [6][7]. Moreover, the development of bioeconomy sectors represents an opportunity to promote innovation and job creation in rural and industrial areas [8]. It is also an opportunity to revitalise productivity and growth by improving the competitiveness of domestic

industries through new technologies [9], and reducing dependence on imported raw materials by rehabilitating marginalised areas [10].

In the context of climate change, there is a need to make the production process and consumption patterns more sustainable, due to the increasing pressure on non-renewable resources. A shift towards more sustainable production and more efficient use and management of bio-resources can help reduce waste, pollution, climate change, and the use of fossil resources. This shift implies a series of changes in both primary production and industry processes that are characterised as bioeconomy [11].

Bioeconomy describes a concept that recognises the full potential of biotechnological research and innovation for the economy and society as a whole. It has been promoted over the last twenty years, particularly by the pioneering biotechnology countries such as the Netherlands, Germany, and Finland [12]. In 2006, the OECD had already presented a major report “The Bioeconomy 2030: Designing a policy agenda” [13]. In 2012, the European Commission presented the first bioeconomy strategy [14]. In this framework, the bioeconomy was defined as follows: “The bioeconomy involves the production of renewable resources and their transformation into food, feed, bio-products and bio-energy. It includes agriculture, forestry, fisheries, food and paper production as well as chemical and energy parts. The bioeconomy sectors are innovative as they use a wide range of sciences (life sciences, earth sciences, ecology, food science, social sciences) and technologies (biotechnology, nanotechnology, ICT), engineering and local traditional knowledge”.

As expressed in the 2018 updated strategy, the EU’s bioeconomy objectives are: (a) to ensure food and nutrition security, (b) to ensure the sustainability of the natural resources, (c) to reduce dependence on non-renewable, unsustainable resources whether sourced domestically or from abroad, (d) to mitigate and adapt to climate change, and (e) to strength European competitiveness and create jobs [4]. These objectives were revised to recognise the contribution of the bioeconomy strategy to both the circular economy and the Energy Union. The scope had to be adjusted and harmonised with European priorities [4].

Based on the above, it can be concluded that a strategy for the bioeconomy is a set of expectations. All bioeconomy strategies aim to contribute to the economic growth and international competitiveness of the respective economic system [15]. Moreover, job creation is explicitly expected in some strategies as a consequence of economic growth. Furthermore, strategies that define the bioeconomy in the broadest sense extend the promise of economic growth to traditional bioeconomy sectors [16]. Economic expectations are closely linked to the goal of the bioeconomy playing a leading role in technological development. Common to all strategy documents is the fact that new scientific findings and technological developments are shaping the bioeconomy and should be supported [17].

Almost all strategies expect the bioeconomy to make a significant contribution to society or global challenges. Food security, resource conservation, climate and environmental protection, and health problems are mentioned as examples. The scarcity of fossil resources and climate change are the business case for the intended transition from a fossil-fuel-based economy to a bio-based economy [17]. Strategies differ in the extent to which they envision

the replacement of fossil resources with bio-based resources. This implies a transition from a bio-based economy with reduced dependence on fossil resources to an economy based on renewable resources [14]. At the same time, the disorganised nature of the bioeconomy is indicated as far-reaching, and the integrated process of social transformation must be supported by social, economic, political, and ecological research. From a transformation approach, some of the strategies face conflicts in objectives, side effects, and governance issues [18].

About half of the strategies predict that the bioeconomy will acquire a global character, with two different lines of argumentation: first, the bioeconomy is seen as part of a global strategy for sustainable resource management and focuses on solving global challenges. The second argument sees the bioeconomy as a global phenomenon. Here, emphasis is placed on the global interconnection of biomass resources, value chains, and technologies, with an international division of labour in research, production, and markets [19]. Both arguments foresee crucial progress in health in the context of the bioeconomy. The purpose of developing bioeconomy strategies at the national level or internationally is common, as it revolves around sustainability and viability. Despite existing barriers and conflicts of interest [20], it is a one-way street to implement a bioeconomy strategy by all.

2. Bioeconomy Strategies

The global economy, due to its heavy dependence on fossil resources, including oil, as an energy source, is vulnerable to the declining supply and volatile market for these resources [21]. Therefore, in order to secure the economy, countries need to become low-carbon and resource-efficient societies based on bio-based products. The development of the bioeconomy affects many sectors and branches of the economy, so countries are adopting strategies and taking measures. The bioeconomy contributes to food security, sustainable management of natural resources, improved waste management, reduced dependence on non-renewable resources, mitigation of climate change, job creation, and maintaining competitiveness [22]. Bioeconomy strategies address the changes, inter alia, by developing knowledge in the areas of primary production and food production [23]. By implementing bioeconomy strategies and related initiatives, it is more manageable to reduce waste and increase the efficiency of the food chain with changes, particularly in developed countries [24].

Sustainable production includes the use of biotechnology and other modern technologies that allow for increasing productivity and efficiency, reducing environmental impacts, the development of sectors such as biofuels, and the production of biomaterials from agriculture, forestry, and the domestic sector [25]. In the context of climate change, agriculture can be seen as an ally. The development of the bioeconomy in the sector can help reduce CO_2 emissions by reducing energy consumption [4]. The implementation of bioeconomy strategies also contributes to the sustainable management of natural resources. The development of agriculture, forestry, and livestock is linked to the resources needed for biomass production [26]. These resources are finite and depleting, so it is necessary to adopt an approach to production that can be described as ‘more biomass from fewer resources’. In this context, the development of the bioeconomy should lead to a better use of nature’s self-regulating functions that allow a better understanding of the functioning of ecosystems. Significant growth is also coming from sustainable primary production and the development of biotechnology, leading to the transformation of existing, and the opening of

new, markets for bioproducts [27]. These developments are increasing the demand for labour in the primary sector and industry.

At the same time, mitigating the effects climate change, while ensuring energy security and economic growth and prosperity is a huge challenge. Turning vision into reality requires knowledge-based innovation and research [28]. Supporting innovation is a driving force and this conviction stems from the challenges facing the world today, such as sustainable management of natural resources, sustainable production, improving public health, mitigating climate change, inclusive social development, and global sustainability.

Despite the dominant focus on sustainability, the primary sector, technology development, and biomass production, this shows that bioeconomy strategies are influenced by government policy, existing regulations, and human resources, as well as social acceptance and market structure. If there is no governance coordination, no strategy can be implemented [29][30]. These factors interact with each other, modifying the influence of each separately. A successful transition to a bioeconomic model requires the participation of society as a whole, because a sustainable society as a whole requires sustainable and environmentally friendly solutions. The search for opportunities to accelerate the development of regions and countries requires linking the concept of sustainable development to a more flexible use of resources through better application of knowledge and innovation, and the development of more efficient technologies. The implementation of bioeconomy strategies in a region's development policy must be the result of a conscious decision by state and local authorities, and their ability to coordinate and create an effective network of cooperation between scientific, economic, business, and local stakeholders [31][32].

- There is no mention in any paper of bioeconomy education for stakeholders (farmers, entrepreneurs, etc.). Knowledge generated from research needs to be channelled to society to facilitate acceptance and adoption;
- The bioeconomy business models and clusters already successfully developed in China [33] contribute to the exclusion and marginalisation of small and regionally isolated producers;
- The current energy crisis demonstrates the dependence of countries on carbon and the weakness of bioeconomy strategies in solving the major problem.

As the priority fields of bioeconomy strategies "lose" their ecological focus and acquire a social, and at the same time capitalist, vision, priorities now focus on economic growth, gross value added, entrepreneurship, competitiveness, employment, and technology development, and future research is suggested to avoid some of the previous trends such as the focus on biodiversity, the development of remote regions, and agro-ecological systems. It is also important to carry out future research on the training of bioeconomy participants, and to include education as a priority in strategies.

References

1. Kamm, B.; Kamm, M.J. Principles of biorefineries. Appl. Microbiol. Biotechnol. 2004, 64, 137–145.
2. McCormick, K.; Kautto, N. The Bioeconomy in Europe: An Overview. Sustainability 2013, 5, 2589–2608.
3. DeBoer, J.; Panwar, R.; Kozak, R.; Cashore, B. Squaring the circle: Refining the competitiveness logic for the circular bioeconomy. For. Policy Econ. 2020, 110, 101858.
4. European Commission. A Sustainable Bioeconomy for Europe: Strengthening the Connection between Economy, Society and the eNVIRONMENT. Updated Bioeconomy Strategy; The European Commission: Brussels, Belgium, 2018; p. 5.
5. Morone, P.; D'amato, D. The role of sustainability standards in the uptake of bio-based chemicals. Curr. Opin. Green Sustain. Chem. 2019, 19, 45–49.
6. Morone, P.; Falcone, P.M.; Tartiu, V.E. Food waste valorisation: Assessing the effectiveness of collaborative research networks through the lenses of a COST action. J. Clean. Prod. 2019, 238, 117868.
7. Scarlat, N.; Dallemand, J.F.; Monforti-Ferrario, F.; Nita, V. The role of biomass and bioenergy in a future bioeconomy: Policies and facts. Environ. Dev. 2015, 15, 3–34.
8. Vivien, F.D.; Nieddu, M.; Befort, N.; Debref, R.; Giampietro, M. The hijacking of the bioeconomy. Ecol. Econ. 2019, 159, 189–197.
9. Purkus, A.; Hagemann, N.; Bedtke, N.; Gawel, E. Towards a sustainable innovation system for the German wood-based bioeconomy: Implications for policy design. J. Clean. Prod. 2018, 172, 3955–3968.
10. Hurmekoski, E.; Lovrić, M.; Lovrić, N.; Hetemäki, L.; Winkel, G. Frontiers of the forest-based bioeconomy–A European Delphi study. For. Policy Econ. 2019, 102, 86–99.
11. Haarich, S. Bioeconomy Development in EU Regions: Mapping of EU Member States'/Regions' Research and Innovation Plans & Strategies for Smart Specialisation (RIS3) on Bioeconomy; Publications Office of the European Union: Luxembourg, 2017.
12. Kircher, M.; Maurer, K.H.; Herzberg, D. KBBE: The Knowledge-based Bioeconomy: Concept, Status and Future Prospects. EFB Bioeconomy J. 2022, 2, 100034.
13. OECD. The Bioeconomy to 2030: Designing a Policy Agenda; OECD Publications: Paris, France, 2006.
14. European Commission. Innovating for Sustainable Growth: A Bioeconomy for Europe; The European Commission: Brussels, Belgium, 2012.
15. Bracco, S.; Calicioglu, O.; Gomez San Juan, M.; Flammini, A. Assessing the contribution of bioeconomy to the total economy: A review of national frameworks. Sustainability 2018, 10, 1698.

16. Ronzon, T.; Piotrowski, S.; M'Barek, R.; Carus, M. A systematic approach to understanding and quantifying the EU's bioeconomy. Bio-Based Appl. Econ. J. 2017, 6, 1–17.
17. Skydan, O.V.; Yaremova, M.I.; Tarasovych, L.V.; Dankevych, V.Y.; Kutsmus, N.M. Possibilities of Developing Sustainable World by Introducing Bioeconomy: Global Perspective. Probl. Ekorozw. 2022, 17, 162–170.
18. Temmes, A.; Peck, P. Do forest biorefineries fit with working principles of a circular bioeconomy? A case of Finnish and Swedish initiatives. For. Policy Econ. 2020, 110, 101896.
19. Meyer, R. Bioeconomy strategies: Contexts, visions, guiding implementation principles and resulting debates. Sustainability 2017, 9, 1031.
20. Bigliardi, B.; Filippelli, S. Investigating circular business model innovation through keywords analysis. Sustainability 2020, 13, 5036.
21. Wicaksana, K.S.; Ramadhan, R.F. The Effect of the Russia-Ukraine Crisis on Price Fluctuations and Trade in Energy Sector in Indonesia. J. Nas. Pengelolaan Energi MigasZoom 2022, 4, 6–18.
22. Gottinger, A.; Ladu, L.; Quitzow, R. Studying the transition towards a circular bioeconomy—A systematic literature review on transition studies and existing barriers. Sustainability 2020, 12, 8990.
23. Alviar, M.; García-Suaza, A.; Ramírez-Gómez, L.; Villegas-Velásquez, S. Measuring the contribution of the bioeconomy: The case of Colombia and Antioquia. Sustainability 2021, 13, 2353.
24. Logakanthi, S.; Kannah, R.Y.; Banu, J.R. Analysis and regulation policies of food waste based on circular bioeconomies. In Food Waste to Valuable Resources; Academic Press: Cambridge, MA, USA, 2020; pp. 389–400.
25. Vogelpohl, T.; Beer, K.; Ewert, B.; Perbandt, D.; Töller, A.E.; Böcher, M. Patterns of European bioeconomy policy. Insights from a cross-case study of three policy areas. Environ. Politics 2022, 31, 386–406.
26. Kumeh, E.M.; Kyereh, B.; Birkenberg, A.; Birner, R. Customary power, farmer strategies and the dynamics of access to protected forestlands for farming: Implications for Ghana's forest bioeconomy. For. Policy Econ. 2021, 133, 102597.
27. Hoff, H.; Johnson, F.X.; Allen, B.; Biber-Freudenberger, L.; Förster, J.J. Sustainable bio-resource pathways towards a fossil-free world: The European bioeconomy in a global development context. In Proceedings of the IEEP Think2030 Conference, Brussels, Belgium, 17–18 October 2018.
28. Pyka, A.; Cardellini, G.; van Meijl, H.; Verkerk, P.J. Modelling the bioeconomy: Emerging approaches to address policy needs. J. Clean. Prod. 2022, 330, 129801.

29. Maksymiv, Y.; Yakubiv, V.; Pylypiv, N.; Hryhoruk, I.; Piatnychuk, I.; Popadynets, N. Strategic challenges for sustainable governance of the bioeconomy: Preventing conflict between SDGs. Sustainability 2021, 13, 8308.
30. Dinica, V. New Zealand's transition attempts to a more sustainable economy: Political statements and governance realities. Political Sci. 2021, 73, 181–214.
31. Sotarauta, M.; Suvinen, N. Place leadership and the challenge of transformation: Policy platforms and innovation ecosystems in promotion of green growth. Eur. Plan. Stud. 2019, 27, 1748–1767.
32. Jurga, P.; Loizou, E.; Rozakis, S. Comparing bioeconomy potential at national vs. regional level employing input-output modeling. Energies 2021, 14, 1714.
33. Puglisi, A.; Chou, D. China's Industrial Clusters: Building AI-Driven Bio-Discovery Capacity; Center for Security and Emerging Technology: Washington, DC, USA, 2022.

Retrieved from https://encyclopedia.pub/entry/history/show/72246