POSITION PAPER:
BIOECONOMY FOR THE DANUBE REGION

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A joint effort by the University of Natural Resources and Life Sciences (Vienna), the Centre for Social Innovation and BIOS Science Austria. The Position Paper was elaborated in a Pilot Activity implemented in the framework of the project Danube-INCO.NET.

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Aim of the Position paper

This position paper aims at mapping bioeconomy related policies in the Danube Region and at supporting the initiation of national RTI bioeconomy strategies. It builds on a document analysis and three expert workshops that have been organised within the EU project Danube-INCO.net, as well as on an online consultation. In the project, experts from the Danube Region came together to: (i) share experiences on bioeconomy-related, national policy initiatives and strategies; (ii) discuss further needs and requirements for developing a bioeconomy RTI strategy; and (iii) identify relevant stakeholders to implement a bioeconomy RTI agenda in a multi-actor approach. Research, technology and innovation are central for the bioeconomy development. At the same time, national and macro-regional bioeconomy strategies are important to build capacities for the progress towards a sustainable bioeconomy by structuring research, innovation, market conditions and education. Furthermore, bioeconomy research and innovations can contribute to achieving many of the goals identified in the Action Plan of the EU Strategy for the Danube Region (EUSDR).

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The Danube Region Strategy

The Danube Region stretches from the Black Forest (Germany) to the Black Sea (Romania-Ukraine-Moldova) covering 14 countries with a total population of about 115 million people. In June 2011, the European Council endorsed the Strategy for the Danube Region (EUSDR), which aims at providing a sustainable framework for policy integration and coherent development of the Danube Region (European Commission, 2010). In order to address common challenges within a homogenous geographic area, the Strategy sets out priority actions divided into 4 pillars and 11 priority areas.

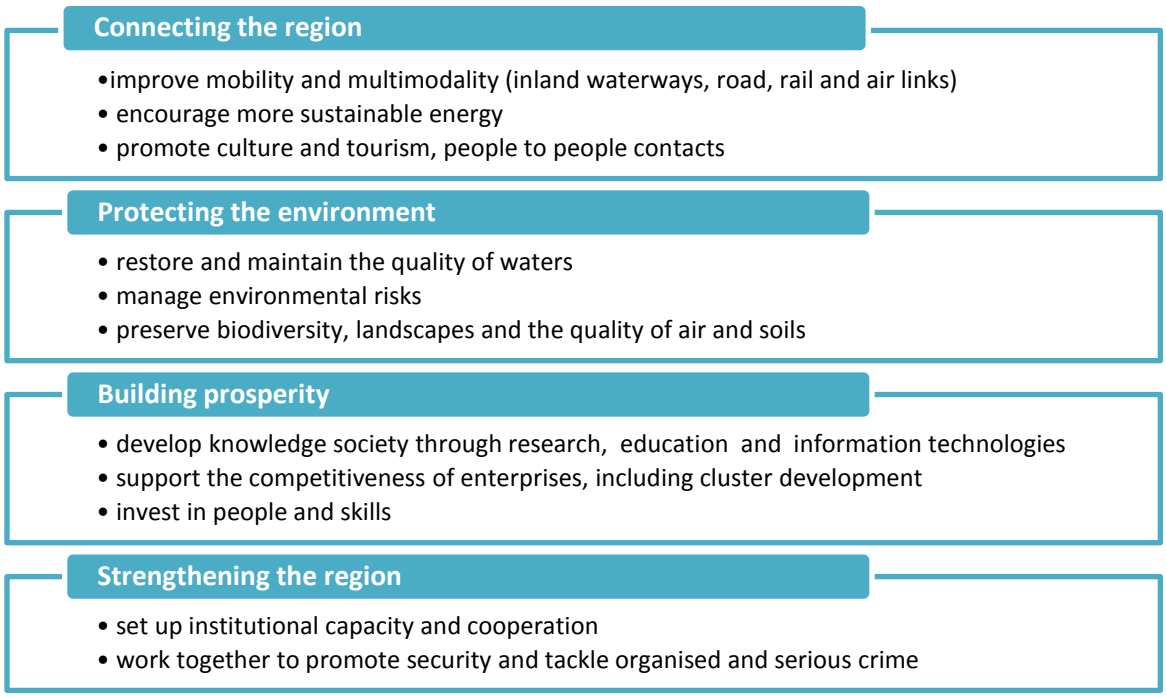

FIGURE 1: MAIN PILLARS AND PRIORITY AREAS OF THE DANUBE REGION STRATEGY (EUROPEAN COMMISSION, 2014)

International Development of Bioeconomy Policies

The bioeconomy has been rapidly rising up the political agenda in recent years. Up to now, more than 45 countries have presented bioeconomy strategies or related policies that aim at promoting the use of renewable resources for bioproducts and bioenergy (Dieckhoff et al., 2015; Fund et al., 2015). Experts and stakeholders at the Global Bioeconomy Summit identified three main priorities of bioeconomy strategies: (i) strengthen linkages between bioeconomy and health (e.g. biopharmaceuticals; healthy nutrition), (ii) sustainable biomass production and utilisation and (iii) bioeconomy innovations with information technology, (e.g. ecosystem-monitoring, precision agriculture and consumer information) (Global Bioeconomy Summit, 2015).

The Global Bioeconomy Summit has not provided a single definition for the bioeconomy, but stated that there is a common understanding of "*bioeconomy as the knowledge-based production and utilisation of biological resources, innovative biological processes and principles to sustainably provide goods and services across all economic sectors*" (Global Bioeconomy Summit, 2015). Experts and stakeholders from more than 50 countries emphasised that the bioeconomy has to fulfil the criteria of ecological and social sustainability to make essential contributions to achieving Sustainable Development Goals (SDGs). The following three areas of action have been identified to be crucial for creating a sustainable bioeconomy: (i) promoting innovative as well as proven technologies and

measures for a sustainable bioeconomy, (ii) establishing good governance for a sustainable bioeconomy, (iii) initiating and strengthening international dialogue and cooperation.

In 2012, the EU presented its Bioeconomy Strategy to achieve a resource-efficient and sustainable economy. It aims at promoting an innovative, resource efficient and competitive society, while ensuring food security, managing natural resources sustainably, mitigating climate change and reducing the dependence on non-renewable resources (European Commission, 2012). According to this strategy, the bioeconomy encompasses "*the production of renewable biological resources and the conversion of these resources and waste streams into value-added products such as food, feed, bio-based products and bioenergy*" (European Commission, 2012). The key sectors include agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries. The sectors promise high innovative potential as they integrate a wide range of sciences (e.g. life sciences, agronomy, ecology, food science and social sciences), industrial technologies (e.g. biotechnology, nanotechnology, information and communication technologies (ICT), and engineering) and local and tacit knowledge. One priority of the Bioeconomy Strategy is to seek synergies with other policy areas, instruments and funding sources, which share and address the same objectives. It highlights the Common Agricultural and Fisheries Policies (CAP and CFP), the Integrated Maritime Policy (IMP), environmental, industrial, employment, energy and health policies.

An Action Plan describes the main measures for implementing the objectives of the Bioeconomy Strategy (European Commission, 2012). These measures include: (i) investments in research, innovation and skills, (ii) reinforced policy interaction and stakeholder engagement, and (iii) enhancement of markets and competitiveness in bioeconomy. To strengthen synergies and coherence between policies and sectors, the EU established a bioeconomy panel. It brings together 30 experts from different areas to foster participation of business and producers, policy-makers and public administrations, scientists and researchers, and civil society organisations (European Commission, 2013).

The impact of the EU Bioeconomy Strategy and the progress towards the goals of the Action Plan are regularly reviewed by the Bioeconomy Observatory, which has been established in collaboration with the Joint Research Centre (JRC). It maps bioeconomy policies in the EU and gathers research statistics and market data, to provide a solid basis for policy development and decision-making. Beyond that, existing research and innovation activities, competence centres and infrastructures in the EU strengthen and support the development of regional and national bioeconomy strategies.

Bioeconomy Strategies and Related Policies in the Danube Region

In the Danube Region, Germany has taken a leading role in developing the bioeconomy. It established a bioeconomy council and presented a "National Research strategy on bioeconomy 2030" and a "National Policy Strategy on bioeconomy". The "National Research Strategy on bioeconomy 2030" calls for stronger research efforts on the efficient use of biogenic resources to realise the vision of a sustainable bio-based economy by 2030, able to produce a wide range of healthy food and to make a sustainable contribution to energy from renewable resources.

The two German federal states that are part of the Danube Region, Bavaria and Baden Württemberg, have presented their own bioeconomy strategies. The bioeconomy research agenda of Baden Württemberg maps bioeconomy relevant research activities and identifies the following three

research areas with large innovative potential: biogas, lignocellulose and algae (Hirth et al., 2013). The concrete measures for implementation include: (i) building a competence centre for modelling and simulation of bioeconomic systems, (ii) initiating a joint graduate programme and (iii) developing a concept for stimulating the common utilisation of large technical infrastructure. Bavaria has set up an expert panel on bioeconomy to stimulate bioeconomy deployment. The fields of action with special relevance for Bavaria are the sustainable utilisation of food and biomass, the development and improvement of bio-based products, the creation of political framework conditions, international networking and the communication of socio economic advantages (StMELF, 2015).

In Austria, BIOS Science Austria and the Austrian Association for Agricultural Research (AAER) initiated the bioeconomy discourse in 2013, by presenting a bioeconomy position paper that motivated the Austrian government to acknowledge the importance of bioeconomy in its working programme. Several national strategies and policies cover bioeconomy relevant topics, such as the Eco-electricity act (2011), the Action plan for increasing the efficiency of resources (2012), the Austrian strategy on climate change mitigation (2012), the action plan for the material use of renewable resources (2015) and the Energy efficiency act (2015).

In 2014, the Austrian Ministry for Transport, Innovation and Technology (BMVIT) presented its RTI-Strategy for Bio-based Industries (Ganglberger and Sturm, 2014), which assessed development paths for feedstocks, processes and products. Key recommendations include the development of integrated concepts, economic and ecological assessments to evaluate the sustainability of different pathways, the promotion of networking and cooperation and the introduction of targeted research support measures. Currently, an interministerial working group is preparing an overview of bioeconomy relevant RTI activities in Austria, which shall contribute to develop a bioeconomy strategy for Austria.

In Hungary, the National Rural Development Strategy and the National Environmental Technology Innovation Strategy (NETIS) 2011–2020 (Ministry of Rural Development, 2012) cover many aspects of the bioeconomy. The latter is a framework for eco-innovation within the Hungarian National Reform Programme, that focuses on environmental innovation, reducing primary material use, encouraging reuse and recycling, and preventing environmental problems (Burns et al., 2015). Furthermore, NETIS aims at providing a framework for implementing the EU 2020 Strategy at a national level.

Finally, the Czech Republic and Slovenia referred to their Rural Development Strategies, which address several bioeconomy related issues (Langeveld, 2015).

Other countries in the Danube Region have not yet presented dedicated bioeconomy strategies.

Additional policy strategies closely related to the bioeconomy, research and innovation programmes and projects are covered in the bioeconomy survey by the Joint Research Center (JRC) and the Standing Committee for Agricultural Research (SCAR) (Langeveld, 2015). However, the survey covers only three countries of the Danube Region (Czech Republic, Hungary and Slovenia). This position paper gives a more comprehensive overview by including information provided by bioeconomy experts from the Danube Region, gathered in the context of the above-mentioned workshops and online consultation.

Table 1: Overview of bioeconomy related policies, strategies and action plans in Danube Region countries

Sector	Policies, strategies and action plans
Primary production (agriculture, forestry, fisheries and aquaculture)	Strategies explicitly addressing the bioeconomy • Raw Materials Strategy 2010 (Germany) • Action Plan on renewable raw materials 2015 (Austria) • Biomass Action Plan in the Czech Republic 2012-2020 Other strategies • Agricultural strategies (Bosnia and Herzegovina, Croatia, Moldova, Romania, Serbia, Slovenia, Ukraine) • National Forest Programme (Hungary, Slovenia)
Conversion technologies (bioenergy, biofuels, biotechnology, biorefineries, …)	Strategies explicitly addressing the bioeconomy • Biorefinery Roadmap 2012 (Germany) • RTI Strategy for biobased industries 2014 (Austria) Priority areas that have been identified • Biobased industries (Croatia) • Biorefineries (Romania, Bulgaria) • Biotechnology (Bosnia and Herzegovina, Moldova, Serbia, Ukraine) • Biogas (Bulgaria, Serbia, Romania, Ukraine) • Renewable energies (Bosnia and Herzegovina, Croatia, Czech Republic, Serbia)
Research and Innovation,	Strategies explicitly addressing the bioeconomy • National Research strategy on bioeconomy 2030 (Germany, 2010) • Destination Bioeconomy - Research for a Biobased and Sustainable Economic Growth (Germany, 2014) • Concept for a bioeconomy research strategy in Baden-Württemberg • Bioeconomy RTI Strategy Austria Other strategies • Science Strategies (Croatia, Serbia) • Research, development and innovation strategies (Czech Republic, Hungary, Romania) • Engagement of Universities in the ICA CASEE network
Environment (resource efficiency, sustainability, water use)	Strategies explicitly addressing the bioeconomy: • Resource efficiency programme 2012 (Germany) • Resource Efficiency Action Plan 2012 (Austria) Other strategies • Strategies for Sustainable Development (Austria, Czech Republic) • Strategies on Climate Change Adaptation 2012 (Austria, Czech Republic) • National Biodiversity Strategy and Action Plan 2015-2020 (Bosnia and Herzegovina) • Environment Protection Strategy 2015-2020 (Croatia and Czech Republic)
Cross-sectional	Strategies explicitly addressing the bioeconomy: • National Policy Strategy on bioeconomy 2013 (Germany) • Bioeconomy for Bavaria Other strategies • National Environmental Technology Innovation Strategy (NETIS) 2012 (Hungary) • Albanian Sustainable Transport Plan (STP) 2016-2020 • National Energy Efficiency Plan (Bosnia and Herzegovina) • Rural Development Strategies (Bosnia and Herzegovina, Croatia, Czech

Republic, Hungary)
- Educational Strategy (Croatia)

Recommendations

The Danube Region, the world´s most international river basin, deserves to enhance its attractiveness through an integrated and coherent development. Currently, large parts of the Danube Region face considerable challenges, for instance difficult demographic developments where rural infrastructure is on the downgrade due to rural depopulation and ageing. The transformation into a circular bioeconomy is imperative for a sustainable future and a key to cope with diverging demands and problems of the Danube Region. The bioeconomy follows a more efficient and integrated pathway along the value chain to promote interlinkages across sectors and territories. Therefore, the aim of the Pilot Activity, in which context this Position Paper was elaborated, was to strengthen international cooperation in scientific fields relevant for the bioeconomy between universities and ministries across the Danube Region. Indeed, against the background of individual sectors becoming ever more interlinked and dependent on each other for raw materials and renewable energy, it becomes more and more important to promote the concerted development across all sectors and the cooperation of science, industry, governments and civil society.

Experts that participated in the workshops and the online consultation highlighted several drivers for promoting the bioeconomy in the Danube Region. The transition from an economy that relies on fossil resources to a circular bioeconomy is seen as an opportunity to stimulate economic growth, create employment opportunities and provide new products and processes that are competitive with those based on fossil fuel, in terms of both price and quality. Furthermore, it should secure a sustainable resource base for feed, fibre and fuel and contribute to environmental goals such as the mitigation of climate change, the reduction of air pollution and the reduction of environmental degradation. Very similar drivers have been identified in the JRC/ SCAR survey, which found that bioeconomy could enhance economic development in classic and new bioeconomy sectors, while securing food security and mitigating climate change (Langeveld, 2015).

The governance needs of bioeconomy and RTI-activities in the Danube Region

Governance needs
1. **Political support and commitment is essential** 2. **Important role of regional and local actors** 3. **Open multi-stakeholder dialogue and knowledge exchange** 4. **Education, awareness raising and public outreach**

In order to achieve and strengthen a bio-based economy in the Danube Region the following recommendations should be considered:

- **Political support and commitment** is essential for a transition towards a bioeconomy. Policy-makers and representatives of the administrations in the Danube Region should be aware of the importance and opportunities that bioeconomy offers to develop regions. Danube Region countries need to elaborate strategies on bioeconomy, both on the political

level and for supporting research, technology and innovation. On the EU-level, a necessary framework and some preconditions are already shaped and prepared to be implemented in support of a transition towards a bioeconomy in the Danube Region, including the EU Bioeconomy Strategy and respective supporting activities and processes. The regional innovation strategies of smart specialisation (S3) for example often indicate bioeconomy as a driver of regional development (see also RIS3 Platform);

- Participants in the Pilot Action emphasised the importance of **involving regional and local actors**. In order to create a sustainable and circular bioeconomy, activities have to be anchored firmly at regional and local level, within regions where people are familiar with available value chains. Regions are investing in basic services and facilities: therefore, a local and regional approach promises a firm connection to regional specifics and specialisations;
- An **open dialogue** is considered essential for: i) developing successful bioeconomy RTI-strategies in the Danube Region countries; ii) developing a common understanding of the bioeconomy; iii) enabling behavioural change; iv) creating the political framework conditions for the transition to a sustainable bioeconomy.

  The dialogue should include policy-makers, representatives from ministries dealing with research, environment, primal production, economics and business, technical development and traffic, research funding agencies, environmental protection agencies, scientists from all sectors, but also civil society, NGOs, production (farmers and business) and industry.

  It is essential to foster **knowledge, exchange, learning, and connections** between all those actor groups to engage in structured and coherent communication on the bioeconomy research and innovation results and activities, while also fostering cross-border collaboration and communication in the Danube Region as a whole. Experiences with regulatory frameworks should be exchanged in order to harmonise regulations and provide the opportunity to develop harmonised, new standards, certificates and labels. In order to achieve that, participants of the consultation proposed to initiate new communication tools and projects, and also to use existing networks and programmes:
  - Knowledge transfer centres
  - Specific (EU) programmes (i.e. R&D projects) involving participants from science, industry/business and government
  - New tools for knowledge sharing at regional level (i.e. e-conferences[1])
  - Brokerage events on bio-economy with a special focus on rural areas

  An example for an existing network is the BioEast initiative, the Central Eastern European Initiative for Knowledge-based Agriculture, Aquaculture and Forestry in Bioeconomy.
- Circular Bioeconomy is not well-known among Danube Region citizens due to a general lack of information tailored to the general public. There is little knowledge on the tangible benefits and opportunities that the use of biological resources promises to bring to everyday life, and there is little knowledge about the efforts to reach a holistic sustainable approach towards a bio-based economy within the EU. **Educational programmes** are only in an initial phase and citizens are not aware of the subject. Raising **awareness** and **public outreach** would foster a common understanding of the concept. Furthermore, as consumers the public could create demand that would help establish a bioeconomy market. It is important to develop science-based approaches to inform consumers about product properties (e.g.

[1] see e.g. http://www.fao.org/food-loss-reduction/events/detail/en/c/327915/

nutritional benefits, production methods and environment sustainability) and to promote a healthy and sustainable lifestyle.

Recommendations for RTI activities

Bioeconomy is a knowledge-based, research and innovation driven concept. In order to support RTI-bioeconomy activities in the Danube Region the **participation in European and international research programmes** should be deepened. Therefore, institutional framework conditions and international clusters on specific priorities should be developed. Cooperation with industry and the focus on tangible and business oriented outputs has to be strengthened to move the bioeconomy out from labs.

To foster RTI activities, Danube countries need to work on their **national research and innovation agendas**, putting a focus on bioeconomy. They need to increase their investment in RTI strategies and projects and make optimal use of research funding opportunities to **develop curricula and strengthen the profile of universities in the priority fields of the bioeconomy** (e.g. funding for young scientists to get qualified specialists with a proper bio-economy background).

Stakeholders within the Danube-INCO.net project highlighted the Danube Region's unique economic, cultural and natural situation, which calls for inter- and transdisciplinary approaches to foster the transition to a bio-based economy. Individual research teams in the Danube Region have outstanding scientific expertise. However, it is necessary to promote synergies and facilitate contacts between these teams. Technical, financial and political barriers between different disciplines must be overcome to fully exploit this potential. The experts that participated in the project presented several examples of how research could contribute to bridging the gap between knowledge and innovation and identified several priority areas for developing RTI strategies.

Priority fields of action
5. Strengthen participation in European and international research programmes 6. Elaborate coherent, national RTI-bioeconomy strategies in the Danube countries, 7. Develop curricula and strengthen bioeconomy profiles of universities 8. Map the sustainable regional biomass potentials in the Danube Region 9. Sustainable intensification, smart breeding and precision farming in agricultural production 10. Developing smart logistical concepts 11. Assessing the techno-economic and ecological efficiency 12. Integrative research approaches on the acceptance of novel technologies, consumer preferences and behavioural changes 13. Developing higher education and research competences

Biomass plays a key role for developing the bioeconomy and providing the resource base for bio-based materials and energy. However, the pressure on limited agricultural and forest resources will increase significantly in the coming decades, as the global population is expected to exceed 9 billion in 2050 and growing wealth in many countries could additionally alter meat consumption. The **mapping of sustainable regional biomass potentials** for the sectors of the bioeconomy is key to minimise potential adverse effects on other sectors that rely on biomass resources (i.e. food production). Together with projections on the biomass demand from those sectors, it is possible to identify the most promising biomass resources and value chains for their utilisation.

Sustainable intensification, smart breeding and precision farming methods in agricultural production have been indicated as essential for resolving the conflict between providing additional biomass resources for various purposes and meeting various environmental targets (i.e. preserving soil fertility and biodiversity and reducing GHG emissions) at the same time. Specific fields of action range from developing new crops and cropping systems as well as new harvest and storage technologies. Modern breeding techniques can increase the nutrient uptake efficiency of crops and thus reduce the nitrogen and phosphorus inputs, while alternative cropping systems, as agroforestry, intercropping or organic agriculture promise more stable yields and lower fertiliser and pesticide inputs. The ongoing digitalisation in agriculture provides ever more spatially and temporally explicit data on soil properties, water flows, nutrient needs of crops and yields. This data contributes to the reduction of fertiliser and pesticide inputs by allowing site-specific application rates. The development of new machineries could increase the sustainable off-take of crop residues and preserves soil fertility.

In order to unlock the full sustainable biomass potential, it is necessary to develop **smart logistical concepts** that facilitate the utilisation of various biomass feedstock (i.e. agricultural and forest residues as well as organic wastes). Spatially explicit optimisation models can help to identify promising regions for future bioeconomy clusters. Within the Danube Region, the ports along the Danube could become important hubs for biomass transport and handling.

In the past, subsidies for biofuels have raised concerns about its impact on food security and climate change. To avoid similar conflicts in the context of the bioeconomy, it needs appropriate monitoring tools and integrative assessments that cover economic, ecological and social aspects. Those assessments could identify promising options by comparing and assessing the **techno-economic and ecological efficiency** of different technologies (i.e. comparing bioenergy and novel biorefinery systems) and analyse their **impact on the climate, soil fertility, biodiversity and water use.**

The importance of recycling biomaterials and the valorisation of waste streams was highlighted by the workshop participants. The cascading use of resources in a bioeconomy is an important option for reducing the pressure on scarce biomass resources and increasing the overall efficiency. It prioritises higher value uses that allow the reuse and recycling of products and fosters the energetic use as last step of the cascade. Considerable amounts of feedstock could be sourced from waste wood, electronic wastes or sewage sludge.

One main barrier to achieve the transition to a bioeconomy in the Danube Region that was mentioned is the lack of public and political awareness on bioeconomy values and the lack of social acceptance of novel products and processes. These issues require integrative approaches that involve social sciences to address the acceptance of novel technologies, consumer preferences and behavioural changes for developing a sustainable low carbon economy.

Developing higher education and research competences as well as **institutional frameworks** and **market regulations** are essential for continued progress towards a more resource efficient, circular bioeconomy. Initiating an ongoing transdisciplinary dialogue forum between universities, industry, government and the civil society could play an important role to increase mutual understanding and identify new ways of long-term development of the bio-economy that will deliver essential societal benefits.

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