



The BioBased Status in the Danube Region

June 2017

A report under the DanuBioValNet project.
WP3.1: Analysis of Status quo in the partner regions



Framework Conditions for Cluster Development
in bio-based industry in Baden-Württemberg (BW),
Upper Austria (AT), Czech Republic (CZ), Slovakia (SK),
Slovenia (SI), Croatia (HR), Serbia (RS), Romania (RO),
Bulgaria (BG) and Montenegro (ME)

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I. Summary

The DanuBioValNet partners have provided an important initial overview of the state of the bioeconomy for their affiliated regions in the multi-country Danube macro region. A key initial advancement in the DanuBioValNet effort is reflected in the ability of the partners from diverse country settings to agree on the basic goals of the project and the general methodology to be pursued. The development and sharing of the respective country reports has set the stage for more detailed examination of specific selected bio-based sectors in the region along with the associated value chains.

The report prepared for the ten selected Danube countries offers concrete observations on the current regional situation regarding the strengths and weaknesses associated with bio-based products, suppliers and markets as well as innovation opportunities and R&D competences. The reports provides preliminary information on the regional bio-based strategies and government policies

already in place and identifies certain policy gaps that can be addressed through the DanuBioValNet project. It became obvious that only a few regions/countries have a dedicated strategy or policy in place. However, several regions identified Bioeconomy as one of several Priority Areas under their Smart Specialisation Strategies (S3).

The participating partners benefited from group presentations and discussions at the DanuBioValNet partners meeting in Prague on March 31, 2017. The topics covered at this meeting included dimensions and characteristics of value chains as applied to bio-based sectors of industry and manufacturing. Emphasis was placed on the need to identify and analyse cluster initiatives and associated value chains based on their relevance, competence and potential for sustaining bio-based industries in the region.

II. Introduction

The synthesis of the Status quo among the DanuBioValNet partners (PP): Upper Austria, Baden Württemberg, Bulgaria, Czech Republic, Slovakia, Slovenia, Croatia, Serbia, Romania and Montenegro, is the first deliverable in WP3 A-3.1. It includes Country Reports from 10 PP. The present Synthesis Report provides information about the current state of the art, where the current and future regional hot spots of innovation in bioeconomy are located as well as policies and programmes in place. Based on the 10 PP reports, the Synthesis Report provides input for policy learning and input for suggested next steps in bio-based value chain (VC) and cluster development within DanuBioValNet.

Bioeconomy comprises those parts of the economy that use renewable biological resources from land

and sea – such as crops, forests, fish, animals and micro-organisms – to produce food, materials and energy. Current EU development strategies, such as the Europe 2020 Strategy (European Commission 2010), the Bioeconomy Strategy for Europe (European Commission 2012) and the Research and Innovation Strategies for Smart Specialisation (RIS3) (European Commission 2014) are the main guiding principles to bring bioeconomy in Europe forward. As the Synthesis report reveals, there is an increasing number of clusters and cluster initiatives dealing with certain parts of the bioeconomic value chains. Consequently, the cluster topic is a key consideration in this Synthesis Report. General observations are listed on the next page.

DanuBioValNet Bio-based Profile (status June 2017)

Production of Biomass. DanuBioValNet regions have good opportunities for production of biomass due to the large amount of available forest and agricultural land. The agricultural land and forest area remained relative constant in all regions/countries. Additionally, in the reporting period, Austria, Croatia and Romania have the highest percentage of electricity from biomass sources in Danube region.

Three types of biomass: Wood, agricultural biomass and biowaste, but their use in the industry varies from region to region. Mostly, the biomass that is not used for food and feed is used as primary energy for power and heating plants, for domestic use as the combustion, and for the production of biofuels and biogas.

Lack of Supportive Policies. Major shortcomings in most of the regions include the lack of supportive policies, programs and measures, sources of funding and lack of regional bio-based industry strategies. In all PP regions/countries the Strategies for Smart Specialisation (S3) are implemented (except in IPA Project Partner), but only a few cover bioeconomy in a dedicated way (Croatia, Slovakia and Slovenia).

Key Assets. The key assets of the bio-based industry include enterprises, biomass supply, cluster organisations, knowledge institutions and R&D and some already existing competitive bio-based products. But their key value varies from region to region. For example: for BW and Upper Austria, all listed key assets are of highest importance whereas, for Croatia and Romania, the SMEs are the most important key asset.

Clusters in initial stages. Bioeconomy clusters, if existing, are in all regions in initial stage but there are traditional industry clusters (potentially) dealing with the bio-based industries which are in drive to maturity stage and also in the age of mature production and can be driving force in the development of bioeconomy clusters.

Lack of statistics. There is a lack of empirically derived statistics for the bioeconomy sector in this region, as well as lack of understanding and agreement on what sectors are considered to be part of the bio-based industry.



III. Framework and current regional situation

Description of the Danube Region

From the source headwaters to the fluvial mouth, the Danube River passes 10 countries, 4 capitals and draws water from 19 nation states. This makes the

Danube River Basin the most international one in the World. It is no wonder that Napoleon referred to the Danube as the “Queen of Europe’s River”.



Forests and other wooded areas occupy 38.2 % of the total area of 10 Danube countries/regions that participate in the DanuBioValNet Project. This is slightly more than EU 27,¹ where the forest

area, on average, covers 37.1 % of the territory. The total surface area of the 10 participating countries/regions is 775,956 km², and the forest area is close to 300,000 km².

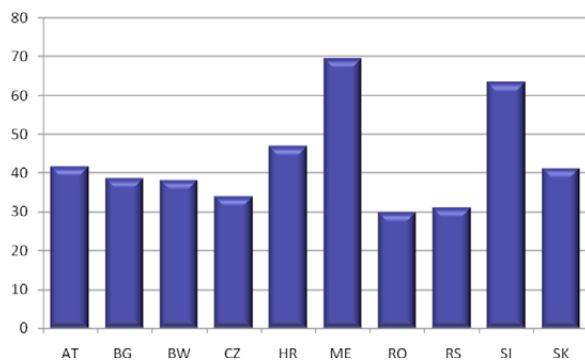


Figure 1: DanuBioValNet countries -x axis²; Area of forested land as a percentage of total surface area -y axis

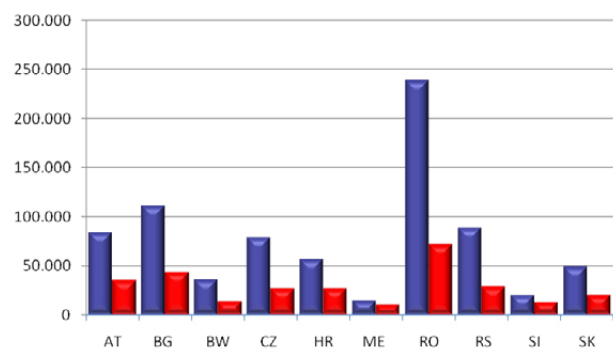


Figure 2: DanuBioValNet countries -x axis; (■ Total surface area in km² ■ Forested land in km²)- y axis

¹⁾ Source: Eurostat, latest public data, June 2016 - Croatia is not included
Countries are listed in the Figures in the alphabetical order unless otherwise indicated

The forests prevail in the most of the landscape of the Danube countries like Montenegro 70%, Slovenia 63,3%, Croatia 47%, Austria and Slovakia 42%. It is worth mentioning that Romania has the largest surface of virgin forests in Europe. Woodland and forests in the DanuBioValNet countries have traditionally been very important ecologically, economically and socio-culturally. There is a great diversity of species from broad-leaved trees (the most widely present ones are oak and beech) to conifer trees (mostly spruce and pine trees).

According to latest data provided from Country Reports, almost half of the territory of the

participating countries/regions (49,4%) consists of agricultural land. This includes arable land, permanent crops and also agricultural grasslands as well as horticultural land. This is well above EU-27 which is, on average, 40% of the total area in 2014 was agricultural land².

The area is cultivated by great variety of plants. Most of the land is used for cereal crop production (wheat, barley, rye, oats, maize, millet, sorghum). Romania and Serbia rank among first 5 maize producers in Europe, oilseeds (particularly rape, soy and sunflower), vineyards and orchards, wild and cultivated medicinal plants, grass, clover, alfalfa.

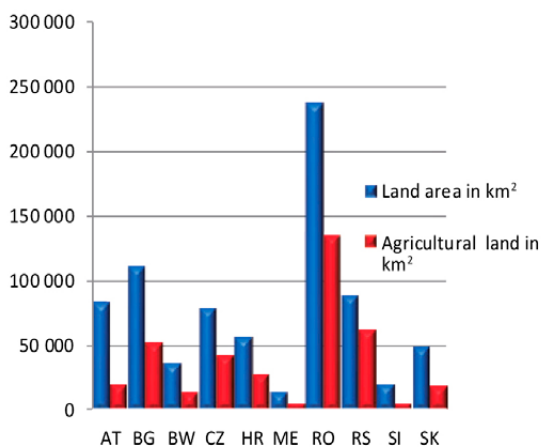


Figure 3: ■ Total surface area in km²
■ Agricultural land in km² - x axis
DanuBioValNet countries - y axis

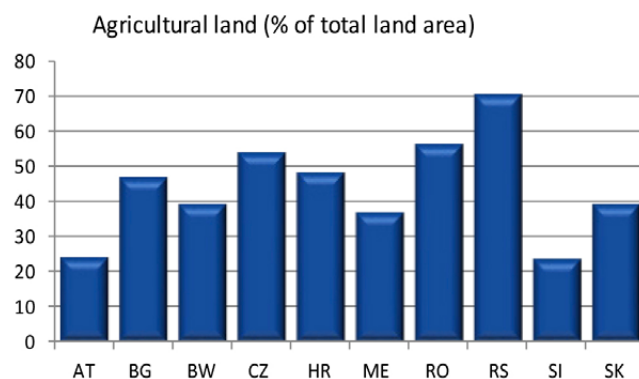


Figure 4: DanuBioValNet countries - x axis
Area of agricultural land as a percentage of total surface area - y axis

IV. Economic Activities of the region related to the bio-based economy

Biomass production

Biomass production encompasses all aspects of the generation of natural biological resources that are used in the bioeconomy. The biomass can be a direct product from the agriculture, forest, or fishing industries or it can be waste originating from different steps of the production cycle. Other sources, such as algae or insects, are also considered as suitable biomass for a bioeconomy. The list of biomass sector industries is included in the so called Nomenclature Générale des Activités Économiques dans les Communautés Européennes (NACE) section³ A: Agriculture, Forestry and Fishing. These sectors

are the most direct and largest suppliers of biomass for the bioeconomy.

The information about biomass availability on an annual basis for 2010 and 2015 are presented in the DanuBioValNet Country Reports. In addition to the biomass originated from direct production of agricultural and forestry products, the data for other biogenic resources such as straw or animal waste and other waste from sources like restaurants, shops or communal waste has been taken into consideration. Other sources, such as algae or insects, were

²⁾ Source: Eurostat, latest public data, June 2016 - Croatia is not included

³⁾ NACE Code is a pan-European classification system which groups organisations according to their business activities.

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not identified across the region in significant quantities according to the Country reports. (There are certain efforts in cultivation of algae – e.g. *Chlorella sp.* in CZ, South Bohemia Region). Also, there is not enough data of the waste from Fishery.

Country reports contain a very detailed description on biomass production in every single country. Data are available but difficult to compare because the national statistics do not process data in a unified way. The experts/participants in the project estimated the biomass production per capita in their countries based on databases they have had access to their countries.

The agricultural biomass production is reported in all countries and also the forestry biomass production, although in smaller quantities. Waste streams represent a significant source in a few countries (CZ, BG).

The waste that is most used in the countries where it is available is the one that comes from forestry and wood processing industry. It is used mostly for firewood (from 95% in Romania to 40% in Austria).

Transformation of biomass

The bio-based value chain transforms the biomass or extracts components from it to make them usable for the bio-based product industries. The industries transforming the biomass can also be the direct manufacturers of a final product. This means that the boundary between the transformer industry and the bio-based product industry can be somewhat blurry. Using the NACE classification³, the main industries that may eventually transform the biomass and manufacture or may potentially manufacture bio-based products encompass industries that are grouped in Section C Manufacturing and Divisions. Data on that level of categorization presents a very rough classification of the activities,

Wood based economic sectors

The data including wood based economic sectors and sectors with potential for biorefinery (herein after Wood based economic sectors) are grouped in Section C Manufacturing: Divisions 16 -Manufacture of wood and of products of wood and cork, except

Types of waste could be in various forms:

- Forest residues (branches and shrubs), wood from forestry, industrial wood waste (wood, sawdust, bark, scraps, black lye, etc.), building wood waste;
- Solid agricultural waste (straw, corn and sunflower stems, vine leaves, fruit tree pruning branches, tobacco stems);
- Fertilizer from livestock farms;
- Animal faeces, urine and manure compost and others biodegradable waste;
- Energy crops non-perennial and perennial energy crops (fast growing tree species);
- Oil crops (sunflower, rape, etc.);
- Industrial waste: solid (paper, shavings, sawdust - woodworking, furniture industry, production of window frames, etc.), liquid (from the food industry, etc.);
- Urban waste: solid (organic solid fractions from households and the commercial sector - over 70% of untreated waste is subject to biological decomposition), liquid (waste water), sludge from sewage treatment plants;
- Phyto-pharmaceutical: wild and cultivated herbs.

but given that the statistical data were only publicly available on the level of Sections and Divisions, it is a way to incorporate official statistics and, more importantly, provide reliable and comparable data that gives us a picture of the economic activity taking place in the region.

Finer partition of categories would make it possible to collect and present the information at more specific levels of activities. However, with this level of data that is publically available, an outline of the economic activities in the region is presented. We categorized two main fields, wood and agricultural based products.

furniture, manufacture of articles of straw and plaiting materials; Division 17 - Manufacture of paper and paper products and Divisions 20 - Manufacture of chemicals and chemical products.

³) NACE Code is a pan-European classification system which groups organisations according to their business activities.

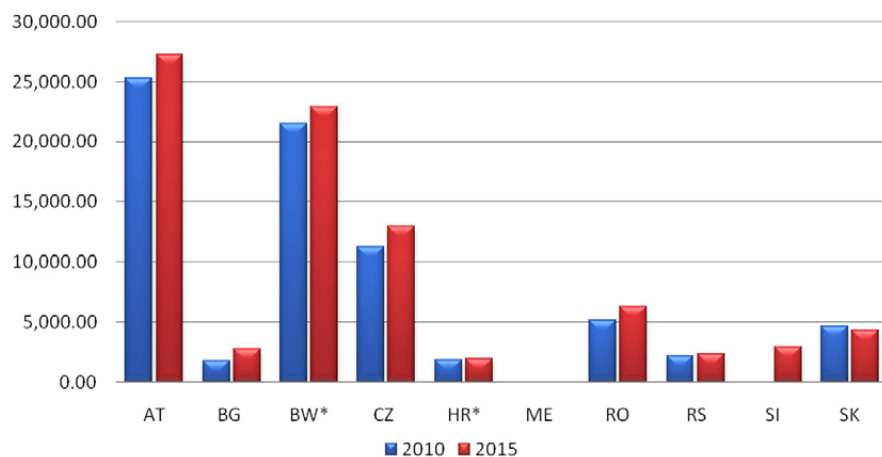


Figure 5: DanuBioValNet countries - x axis; Turnover of wood based economic sectors (C 16+17+20) in million Euros in 2010 and 2015 (*2014) - y axis

The preceding figure shows that, in the period observed, the turnover of wood based products and industry sectors that might become interesting for a biorefinery in the future rises in Upper Danube countries and in the Lower Danube countries is at the same level or even slightly decreases. It is noticeable that the values of turnover for the above

mentioned industry in the Upper Danube countries are substantially higher than in the Lower Danube. The data about the productivity and the profitability of the business, that are shown in the charts below, indicate that the differences between Upper and Lower Danube countries are even more pronounced:

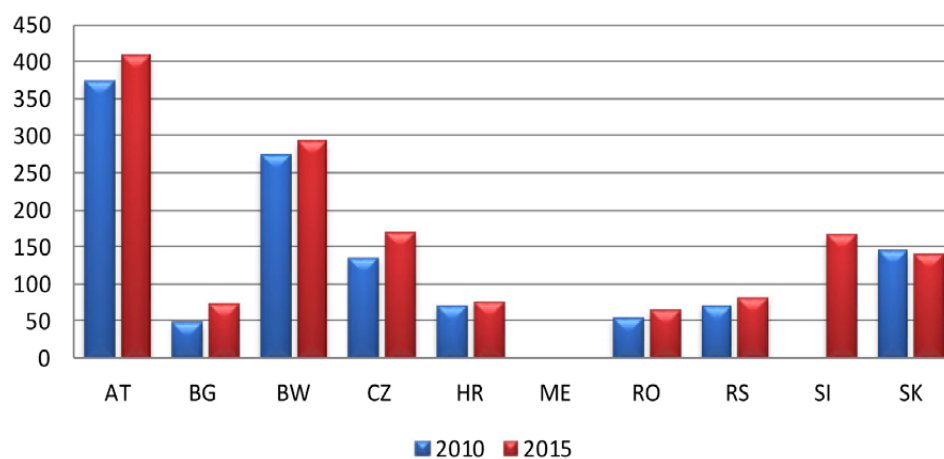


Figure 6: DanuBioValNet countries - x axis; Turnover of wood based economic sectors (C16+17+20) in thousand Euros in relation to the number of employees (*2014)-y axis

In the Figure 6 and the Figure 7, the countries are placed according to their geographical position along Danube. It could be seen directly from the charts how the productivity declines from Upper to Lower Danube.

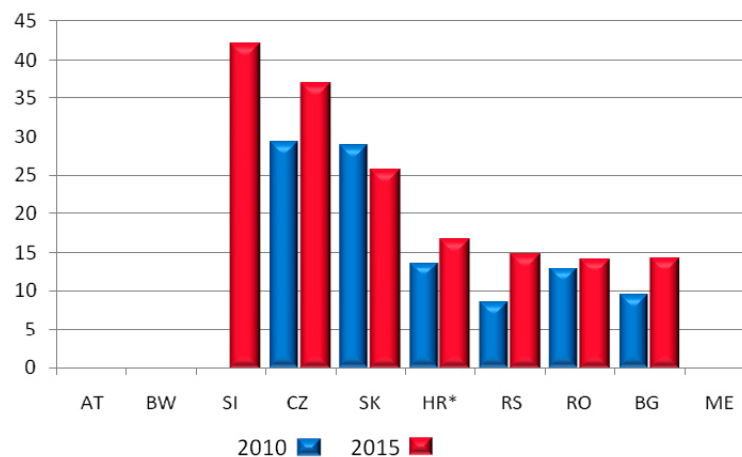


Figure 7: DanuBioValNet countries – x axis; Value added at factor cost in million Euros in relation to the number of employees of wood based economic sectors (C16+17+20 (*2014)-y axis. Data were not available for AT, BW, ME.

Agricultural based economic sectors

The agricultural based economic sectors and sectors with potential for bioplastic and phyto-pharmaceutical (hereinafter Agricultural based economic sectors) are: Division 10 - Manufacture of food products, Division 11 - Manufacture of beverages, Division 12 - Manufacture of tobacco products, Division 13 - Manufacture of textiles, Division 14 - Manufacture of wearing apparel, Division 15 - Manufacture of leather and related products, Division 21 - Manufacture of basic pharmaceutical products and pharmaceutical preparations, Division 22 - Manufacture of rubber and plastic products. The same remark that was made

earlier about the reliability of data for wood based product industries applies here as well.

A finer disaggregation of categories would make it possible to present the information with greater precision. However, with this level of data, we have a picture of the economic activity taking place in the region.

Turnover (Figure 8) and productivity (Figure 9 and Figure 10) of the industry that might potentially fall in the grouping for agricultural based products is presented below and on the next page:

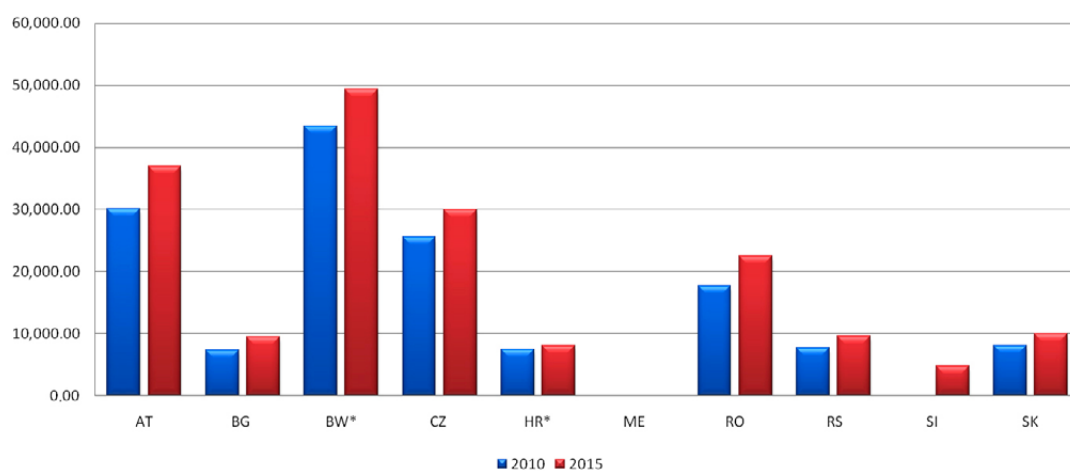


Figure 8: DanuBioValNet countries – x axis; Turnover in million Euros of agricultural based economic sectors (C 10+11+12+13+4+15+21+22) - in 2010 and 2015 (*2014)

Countries are listed in the Figures in the alphabetical order unless otherwise indicated

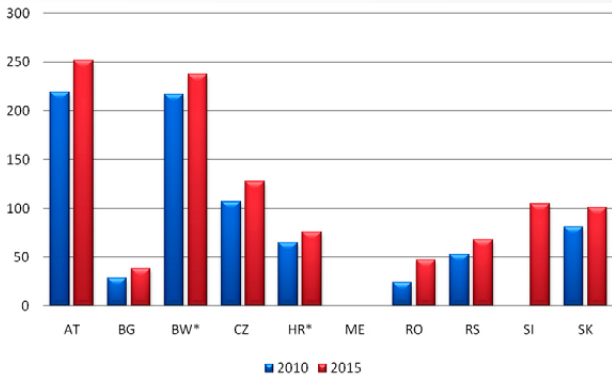


Figure 9: DanuBioValNet countries - x axis; Turnover in million Euros in relation to number of employees of agricultural based economic sectors (*2014) - y axis

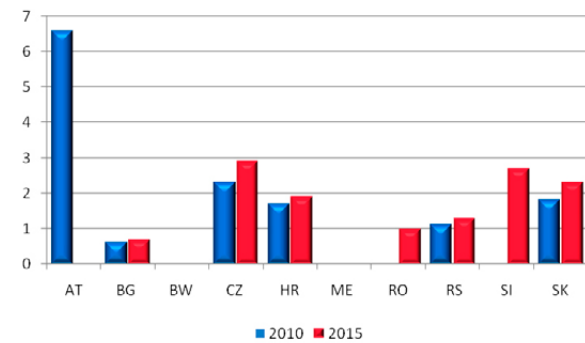


Figure 10: DanuBioValNet countries - x axis; Value added at factor cost in million Euros in relation to number of employees of agricultural based economic sectors (*2014) - y axis

The profitability of business in agricultural based products is growing in all DanuBioValNet countries in the period 2010-2015, as the Figures above demonstrate.

Industrial structure

Comparing the indicators related to the wood based industries and agricultural based product industries, it can be observed that the agricultural product industries are more developed in all

DanuBioValNet countries in terms of turnover and value added, as demonstrated in the Figures 11 and 13 for the year 2010 and Figures 12 and 14 for 2015.

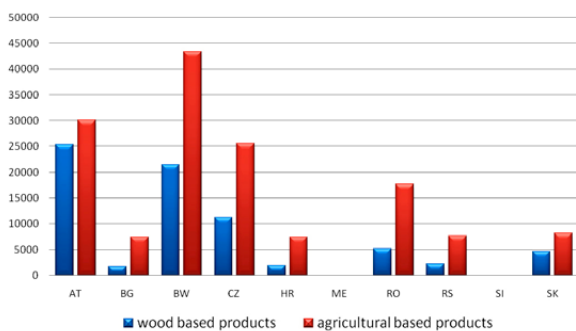


Figure 11: The comparison of wood based product and agricultural based product industries - DanuBioValNet countries - x axis; Turnover in million Euros in 2010 - y axis

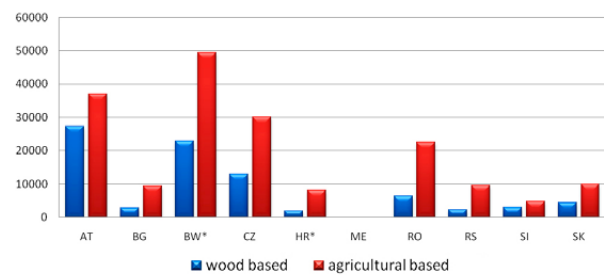


Figure 12: The comparison of wood based product and agricultural based product industries - DanuBioValNet countries - x axis; Turnover in million Euros in 2015 (*2014) - y axis

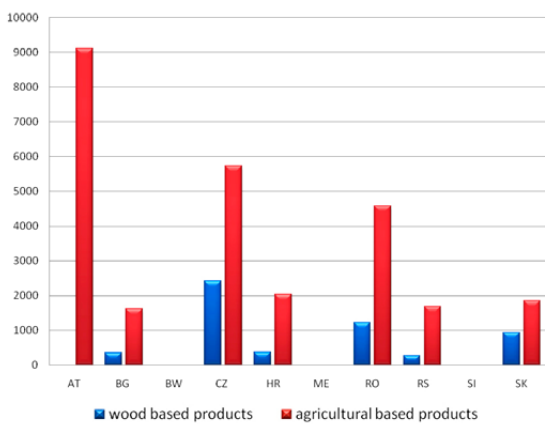


Figure 13: The comparison of wood based product and agricultural based product industries - DanuBioValNet countries - x axis; Value added at factor costs in million Euros in 2010 - y axis

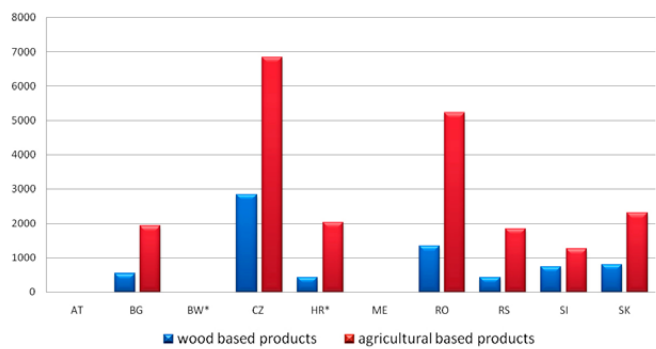


Figure 14: The comparison of wood based product and agricultural based product industries - DanuBioValNet countries - x axis; Value added at factor costs in million Euros in 2015 (*2014) - y axis

Countries are listed in the Figures in the alphabetical order unless otherwise indicated

The industrial structure of the participating countries shows the presence of all industries related to bioeconomy. However, considering all the countries of the region, certain industries are revealed as their regional strength. The highest values of turnover in thousands of Euros in 2015 show the manufacturing

of food (74,476,128), rubber and plastic products (47,674,081), chemicals and chemical products (38,506,031), wood (23,091,585), and pharmaceutical products and pharmaceutical preparations (16,896,796).

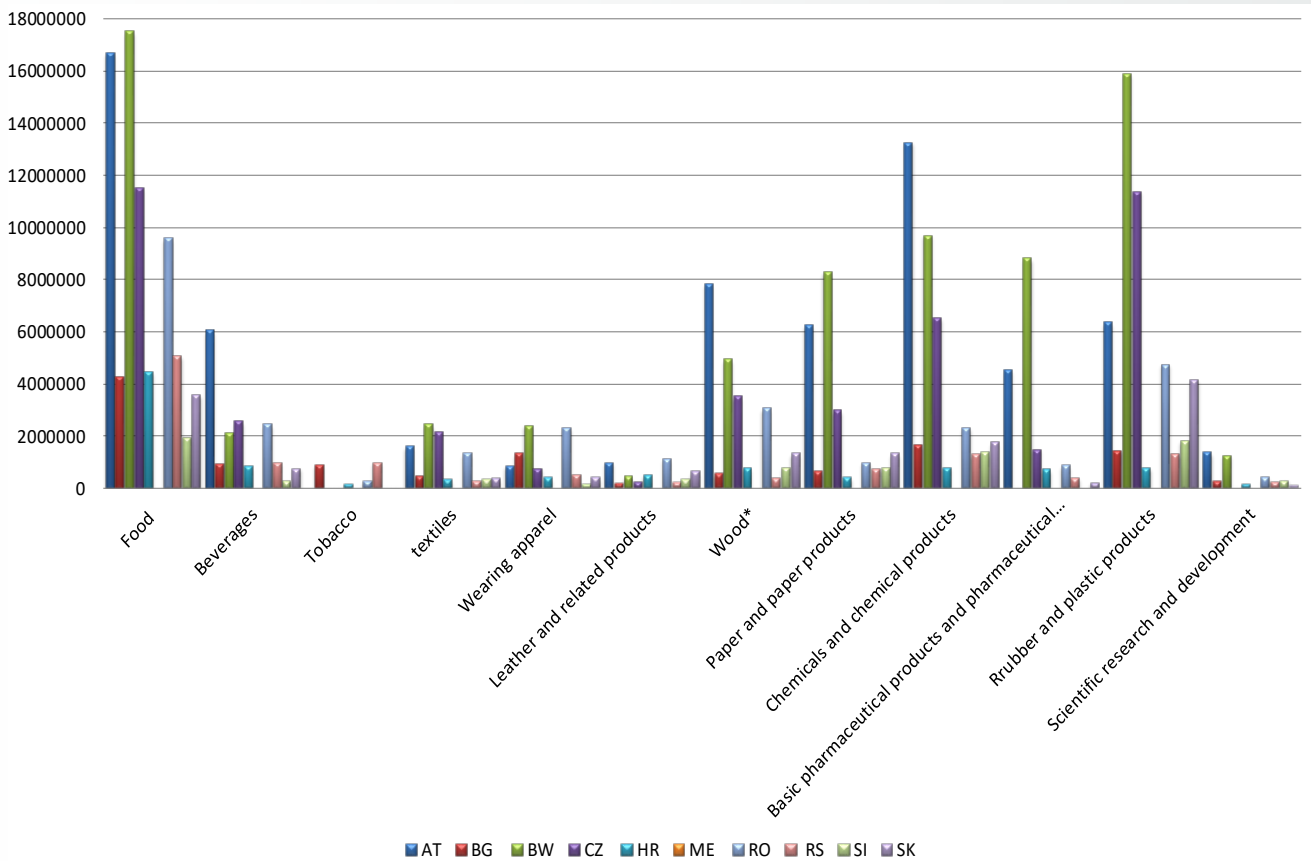


Figure 15: Turnover in 1000 Euros of the Industries related to bioeconomy in DanuBioValNet countries in 2015 (BW and HR data for 2014)

Regarding the levels of employment, in the first place is food industry, and then comes apparel industry, followed by rubber and plastic products, wood and chemicals and chemical products industry.

	AT	BG	BW	CZ	HR	RO	RS	SI	SK
Food	74187	77.732	80592	86.124	52.483	146.696	60472	13407	31.617
Beverages	9155	12.974	6291	13.772	7.019	18.111	8339	1460	4.740
Tobacco	N/A	3.140	N/A	N/A	789	1.609	1240	N/A	N/A
textiles	9125	11.710	13324	23.817	4.231	30.860	9422	2770	5.771
Wearing apparel	6237	100.607	9848	16.032	16.140	159.244	26210	3116	14.813
Leather and related products	4213	15.839	1724	5.071	11.208	60.886	11049	3611	10.349
Wood	32547	15.652	20521	30.845	15.429	55.910	9887	6957	15.246
Paper and paper products	16802	8.929	28215	18.288	4.209	12.571	6728	4217	6.983
Chemicals and chemical	17515	13.376	29641	28.130	6.018	25.569	12318	6297	8.877
Basic pharmaceutical	14140	N/A	26874	9.294	4.850	9.266	5030	7739	2.165
Rubber and plastic products	29793	25.357	69492	81.026	9.704	54.469	19832	13419	29.632

Table 1: Number of employees in the industries related to bioeconomy in DanuBioValNet countries in 2015 (BW and HR data for 2014)

Countries are listed in the Figures in the alphabetical order unless otherwise indicated

V. Bio-based Industry, Academia and R&D competences

Knowledge and R&D

Indicators for scientific research and development activities are monitored in Section M, Division 72 of the NACE classification of the activities. There is an

observable intensity of these activities in the region, indicating a great potential.

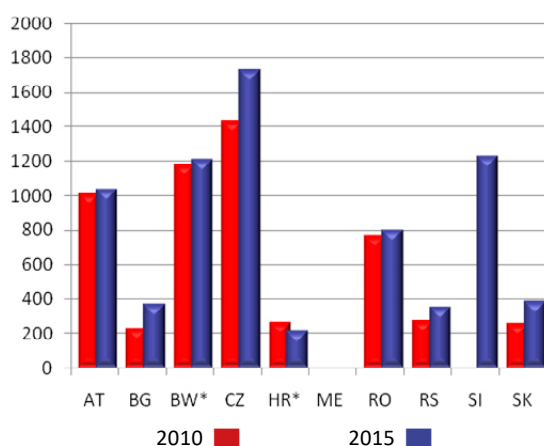


Figure 16: DanuBioValNet countries – x axis; Number of enterprises in R&D Sector in 2010 and 2015 (*2014)-y axis

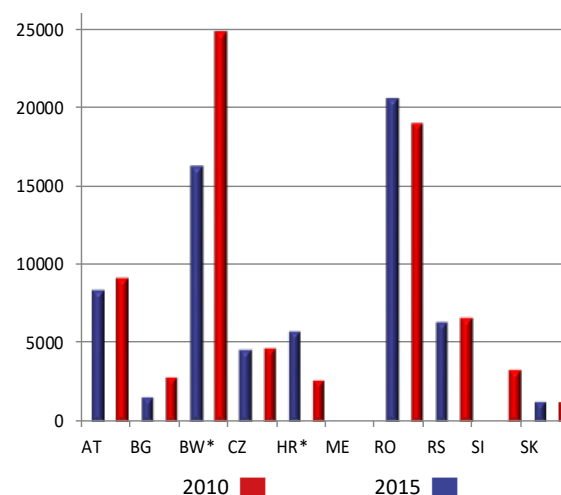


Figure 17: Number of employees in R&D Sector in 2010 and 2015 (*2014) – x axis; DanuBioValNet countries – y axis;

Not all R&D activities in the region are related to bio-based economy. However, the Country Reports provide valuable information about scientific activities. The reports include information on the present opportunities and the share of Secondary & Tertiary education in bio-based industry as a percentage of total population in region. Said conditions can contribute to the future possibilities for development of the bioeconomy. The experience to date shows that a strengthening of the bioeconomy is strongly knowledge-based and its development depends to a large extent on sustained research efforts.

Almost all participating regions have a wide range of university institutions and universities of applied sciences. Building upon their know-how, these institutions can make a significant contribution to the bio-based industry and related value chains through interdisciplinary cooperation and associated initiatives. For example, the bioeconomy is a leading topic and a research focus in Baden-Württemberg. It combines agricultural sciences, natural sciences and economic and social sciences in an interdisciplinary way. The aim of bioeconomy proponents is to secure global nutrition, to make

agricultural production sustainable, to produce healthy and safe food, to use sustainable raw materials industrially and to expand productive use of available biomass.

Although the bio-sector is fairly new to Croatia, biotechnology is one of the most important and most widespread key technologies in public research organisations as well as in the business sector. Further examples of successfully translated R&D into manufactured goods and products in biochemical and bioplastic production and in development of environmentally friendly new materials and substances can be found in relatively large pharmaceutical companies in Croatia, Slovenia, Serbia and Slovakia. Several SMEs are also emerging in the biopharmaceutical sector through the technology transfer process from universities and R&D institutes.

Investments in RDI are made in order to address and support the next phases of technological readiness. This is particularly the case in the field of biotechnology. In Croatia, for example, biotechnology and pharmaceuticals (together with ICT) represent financially the strongest R&D sectors (S3).

Countries are listed in the Figures in the alphabetical order unless otherwise indicated

VI. Strengths and Opportunities

An analysis of strengths and opportunities of bioeconomy of DanuBioValNet countries shows that the area of all ten Danube countries/regions has good preconditions for converting to a bio-based economy in terms of their natural geographic conditions and resources, their traditional industry, R&D infrastructure and quality human resources. This capacity also provides new opportunities to complement traditional products with new

products and services to maintain and improve region's competitiveness. In addition to the potential within the industrial sector that has long been based on agriculture and forestry, the development of bioeconomy also offers inherent opportunities for increased use of biomass raw materials within other commercial sectors. This applies, for example, to the plastics and biopolymers, the construction, phyto-pharmaceuticals and packaging.

Strengths	Opportunities
Technologically and economically successful companies in many areas of bio-based industry	Great potential in the field of plastics and biopolymers
Potential for technology leadership, e.g. In wood processing	Development of microalgae technology
Sophisticated technologies	Material use of grassland biomass in green bio refineries
Well-developed plant construction	Significant application fields in bio-based textiles
High potential for innovation	Mixtures of bio-ethanol with fossil fuels
Continuous increase in efficiency of the processes	Tax exemptions
Well positioned R & D area	Decarbonisation
Scientific potential available	Innovations in use of waste in packaging industry
Good research infrastructure (open)	Forward looking industries like paper and pulp
Good cooperation between companies and universities	HR development
High technological knowledge in the companies	Phyto-pharmaceuticals
Well connected industry	Solid biomass sources (wood waste, wood chips, pellets)
Applications of life sciences and biotechnology	Water integrated transport
Investment in bio production facilities	Connections of domestic and global suppliers chains
Value added wood products	Linkages between domestic and global R&D organisations
Bio-based paints and eco surface treatments	Use of natural resources in innovation economy
Eco-construction	Support for the conversion to green technologies, materials and products due to legislation and undesirable ecological changes
Phyto-pharmaceuticals cultivation	High possibility to improve production by establishing sophisticated agriculture and water resource management
Renewable Energy	Potential in terms of biodegradable materials
Food and Feed	Advanced bio-composites

Key Drivers/Cluster organizations

There are a number of key drivers and opportunities that can be capitalised upon to facilitate the development of the bioeconomy in the Danube region.

Cluster initiatives currently exist in the following sectors:

	AT	BG	BW	CZ	HR	ME	RO	RS	SI	SK
Primary biomass sector										
Food & Feed										
Pulp & Paper										
Bio-Chemicals										
Bio-Polymers										
Phytopharma										
Textile & Clothing										
Renewable Energy										
Eco-Construction										

VII. Policies conducive to support Bioeconomy

Bioeconomy is high on the agenda at the European level. The DanuBioValNet project findings reveal that in the Danube Region there is still a gap between theory and practice with regard to the bioeconomy potential. As far as a dedicated regional or national strategy is concerned, only Germany (Baden-Württemberg), Croatia and Slovakia have drafted and implemented such a strategy.

- **Baden-Württemberg** has a dedicated research strategy focusing on bio-based industry lasting from 2014 – 2019 with a budget of 12 million Euros. At the core of the strategy are circular value chains and a holistic systematic approach. The strategy is based on three pillars: biogas, ligno-cellulose and microalgae for an energetic and material use. The Smart Specialisations Strategy for BW is only partially regarding the bio-based industry. It covers the fields of biotechnology; environmental technologies, renewable energies & resource efficiency. In addition, actors from Baden-Württemberg strongly benefit from the national Bioeconomy Strategy and have attracted around 100 Mio EUR in public funding from 2011 – 2015 for this purpose. Key drivers are the industry; mainly those from the application areas. Although there is a significant interest on BW's part to become more active in bio-based industry, appropriate incentives are missing. Thus, cluster initiatives

play a crucial role in facilitating bio-based innovation and in lowering the reluctance on the part of the industry. Cluster managements are often not aware of the benefits of bio-based products arising for their industrial members.

- There is no specific national strategy for the bioeconomy in **Croatia** but some governmental action plans do provide guidance for the development of this sector, especially in agriculture, forestry, timber and the paper industry. The Republic of Croatia has a Smart Specialization Strategy 2016-2020 (S3) which identifies five thematic priority areas (TPAs) and 13 sub-thematic priority areas. Food and Bioeconomy have been selected as an important TPA based on significant natural resources. (Resources include plenty of good quality arable land and sea, natural forests and water resources that enable their conversion into food, feed, wood and bio-based products). Croatia also has successful companies, including large companies with their own R&D institutes or departments. The country also has a number of progressive SMEs combined with proven research excellence in the public sector. Food and Bioeconomy as a priority area has logical and functional links with other TPAs such as Health and Quality of Life, Energy and Sustainable Environment.

- In **Bulgaria**, clean technologies and biotechnologies are part of the Innovation strategy for smart specialization 2014-2020. These sectors are framed within the priority area "Industry for healthy life-style and bio-technologies". However, there is no dedicated Regional Bio-based Strategy developed for the country and there is no specific ministry or agency appointed to develop or be responsible for the Bio-based industry. The potential of the biomass in Bulgaria is revealed in the National long-term program for promotion of the usage of biomass 2008-2020.
- The bio-based industries in the **Czech Republic** are diversified in different industries and/or sectors (agriculture, energy, plastics, textile, construction etc.). Notwithstanding, their application and occurrence is still very random. There is no common national or regional strategy on bioeconomy and bio-based industries development. The cluster organisations are mainly focused on the traditional manufacturing and processing industries/technologies and high-tech/key enabling technologies. There is a National Research and Innovation Strategy for Smart Specialisation of the Czech Republic. For the purpose of Smart Specialisation under the conditions existing in the Czech Republic, these domains have been defined in relation to certain bio-based industries. These include: advanced materials, nanotechnology and industrial biotechnology. There are also the key application sectors and application themes such as natural resources, sustainable agriculture, food safety and sufficiency, drugs and medical products. However, the bio-based industries are involved in large-scale sectors (e.g. agriculture, energy and others), which are supported within the national/sectoral funding programmes.
- The structure of the industry in **Montenegro** and the very high contribution of agriculture in that country's GDP indicate that the bioeconomy could be seen as a niche industry that Montenegro should be able to benefit from. The bioeconomy has not been promoted sufficiently on policy level in Montenegro. Thus, there is no strategic framework that can serve to nurture and promote bio-based industries. From Montenegro's perspective, it is important to build opportunities for cross-sectoral collaboration between following industries: agriculture and forestry, food industry, chemical industry, plastics and plastic processing industry, wood processing industry, construction industry, energy industry and machinery and plant engineering. In Montenegro, there is no special bio-based strategy or policy. The Montenegro Development Directions 2015- 2018, the Strategy for Development of Agriculture and Rural Areas 2015-2020 and the Agricultural Development Strategy 2015-2020 constitute the elements of the tacit strategic framework for bio-based industry or value chains in Montenegro.
- The intensive development of **Romanian** industries was based on natural resources' exploitation, without mitigating the negative consequences on the environment. After joining the EU, the Romanian government approved the National Renewable Energy Action Plan and the Energy Strategy (NREAP, 2010). Those strategies take into account renewable energy sources. There is no Bio-based national or regional strategy in Romania, but some seeds can be found in the following instruments: The National Strategy for Competitiveness 2014-2020; the analysis of Industrial Policies, the proposal for an Energy Strategy 2016-2030, the 2010 Master Plan for Biomass, and the biomass law proposal which is presently being discussed in Romania's Parliament.
- There are no specifically defined strategies relating to bio-based industry in **Serbia**. Bio-based industry is mentioned in several documents: "National strategy for sustainable development" 2008-2017, National Strategy on Economic Development of the Republic of Serbia 2006-2012, where the strategic sectors related to bioeconomy are defined (including the bio part of the chemical industry, pharmaceuticals, food industry). Another relevant document is "Strategy for Research for Innovation, Scientific and technological development 2016 - 2020" which is mainly focused on framework and infrastructure development, including clusters.
- There is no specific Bio-based industry strategy in **Slovakia**. On the other hand, Slovakia has a good quality document "Strategy of Research and Innovation for Intelligent Specialisation" (RIS3). This is related to the role of clusters, which are

strongly emphasized in the RIS3. However, no call has yet been published to support clusters. The bio-based industry in Slovakia is supported through various policies, such as Operational Programme for Research and Innovation, Programme of Rural Development, Enviro-fund, Operational Programme Quality of environment, Programme of waste management in Slovakia for years 2016-202, and the Recycling Fund. Furthermore, there is a significant amount of other strategies and concepts related to the issue of bio-based industry. These include the Action Plan of the biomass exploitation, the Biowaste strategy, The Green report 2016, the Agricultural and Food Report in Slovakia, the Innovation Strategy of Agrobiotech and the Priority Areas of Biomedicine and Biotechnology.

- Public support towards bioeconomy strengthened in the period between 2014-2016, and adaptation of **Slovenia's** Strategy for Smart Specialisation (S4) helped to prioritize aspects of bioeconomy in its Strategic priority 4 ("smart use of resources"). It also borrows results and key findings from the EU clustering project initiatives BERST and Poly4EmI which addressed the challenge of Slovenia's innovation policy model. Slovenia is yet to adopt a regional Bio-based industry strategy and needs to improve public support to be in line

with smart use of resources that was set in the Strategy S4 by the Government office for development and European cohesion policy. Even though there is no bioeconomy goals set out, it should be noted that the Strategy S4 promotes networks for the transition to the circular economy. Proposed value chains should be at the core of the yet to be established strategy to engage the Slovenian bioeconomy.

- Currently, Upper **Austria** has neither a bio-based industry strategy nor a bio-based industry cluster. Since 2013, the bioeconomy has been positioned as an educational and research campaign in the field of the use of biogenic resources in the work program 2013-2018 of the Austrian federal government. An inter-ministerial working group was set up to develop an action plan and a national strategy on the bioeconomy. The Research, Technology and Innovation strategy has been developed in order to set the appropriate framework for future research priorities in the field of bio-based industries and to support promising developments. This RTI strategy is focused on important economic sectors for Austria: the food industry, the chemical and pharmaceutical industries and the wood processing industry. The information about the status of the bioeconomy as priority area within S3 is not applicable.

The following graph provides a survey to what extent the partner regions/countries have dedicated strategies or policies in place.

Country/Region	National/Regional bioeconomy Strategy in place	National/Regional Programme in place	Bioeconomy mentioned as Priority Areas within S3
Baden-Württemberg	✓	✓	
Bulgaria			
Croatia	✓		✓
Czech Republic		✓	
Montenegro			
Romania			
Serbia			
Slovakia			✓
Slovenia			✓
Upper Austria		✓	

ANNEXES

Annex 1: Definitions/Glossary

- **Clusters:** Clusters are generally described as groups of specialised enterprises, often SMEs, and other supporting actors in a particular location that cooperate closely together.
- **Cluster initiatives:** A cluster initiative is an organised effort aiming at fostering the development of the cluster either by strengthening the potential of cluster actors or shaping relationships between them. They often have a character like a regional network. Cluster initiatives usually managed by a cluster organisations.
- **Cluster organisations:** Cluster organisations are entities that support the strengthening of collaboration, networking and learning in innovation clusters and act as innovation support providers by providing or channelling specialised and customised business support services to stimulate innovation activities, especially in SMEs. They are usually the actors that facilitate strategic partnering across clusters. Cluster organisations are also called cluster managements.
- **Cluster participants:** Cluster participants are representatives industry, academia or other intermediaries, which are commonly engaged in a cluster initiative. Given the case a cluster initiative has a certain legal form, like associations, cluster participants are often called cluster members.
- **Cluster policy:** Cluster policy is an expression of political commitment, composed of a set of specific government policy interventions that aim to strengthen existing clusters and/or facilitate the emergence of new ones. Cluster policy is to be seen as a framework policy that opens the way for the bottom-up dynamics seen in clusters and cluster initiatives. This differs from the approach taken by traditional industrial policies which try (and most often fail) to create or back winners.

Annex 2: List of cluster initiatives for bio-based industry in DanuBioValNet regions

- **Upper Austria**

- Plastics Cluster (part of the Business Upper Austria GmbH)
- Furniture and timber construction cluster (MHC) in Upper Austria (part of the Business Upper Austria GmbH)
- Food Cluster (part of the Business Upper Austria GmbH)
- Oekoenergie-Cluster (OEC)
- Cleantech Cluster

- **Baden Württemberg**

- AFBW
- Automotive-Initiative RheinMainNeckar
- Automotive-Initiative Ostwürttemberg
- Automotive. Engineering. Network Das Mobilitätscluster e.V. (AEN)
- AutomotiveDIALOG Wirtschaftsraum Heilbronn
- Automotive_NETZ
- Bioenergie-Region Hohenlohe-Odenwald-Tauber GmbH
- Biomastec: neueBiomasseEffizienz
- Be-engineers GbR
- 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
- ENERGETIKOM – Energiekompetenz und Ökodesign e. V.
- EnergieForum Karlsruhe
- Engineering – Life Sciences – Automation (ELSA)
- Focus.energiee.V.
- Fotec – NetzwerkFunktionaleOberflächen
- HolzketteSchwarzwald e. V.
- IHK-Chef Arbeitskreis “Druck, Verpackung, Medien”
- IHK-Netzwerk Automotive
- INNONET Kunststoff
- Innovations- und Effizienzcluster Klimapartner Oberrhein, INNOeff“ KPO
- KITE hyLITE: KarlsruherInnovationscluster
- KompetenznetzMedtech& Biotech
- Kompetenzzentrum Umwelttechnik – KURS e. V.
- KunststoffDIALOGWirtschaftsraum Heilbronn
- Modell Hohenlohe – Netzwerk für betrieblichen Umweltschutz und nachhaltiges Wirtschaften e.V.

- NetzwerkUmwelttechnik&Ressourceneffizienz
- Packaging Excellence Region Stuttgart e.V.
- Packaging Valley Germany e.V.
- proHolzSchwarzwald
- RegioholzNordschwarzwald
- TechnologyMountainse.V.
- Umweltkompetenzzentrum Rhein-Neckar e. V. (UKOM)

- **Bulgaria**

- Automotive Cluster Bulgaria
- Black Sea Energy Cluster
- Bulgarian Association Polymers
- Bulgarian Furniture Cluster
- Cleantech Bulgaria
- Cluster Bio
- Cluster Green Sinergy
- Cluster Mechatronics and Automation
- Cluster Renewable Energy and Sources
- Electric Vehicles Industrial Cluster
- Green Energy Cluster
- Textile Cluster and Institute Dunav
- TKK Bulclust – textile cluster

- **Czech Republic**

- Agrocluster Vysočina
- Czech Pellets Cluster
- South Bohemian Forestry - Wood Cluster
- Moravian Forestry Cluster
- ORLICKO Agricultural Cluster
- Cluster of Applied Biotechnology and Nanotechnology
- Regional Food Cluster - Tastes Great, South-Bohemian
- OMNIPACK Cluster - Cluster of packaging manufacturers
- Plastics Cluster
- Moravian Silesian Automotive Cluster
- MoPharmaC - Moravian Pharma Cluster
- CLUTEX - Cluster of Technical Textiles
- BIOKLASTR
- ENVICRACK - Cluster of Alternative Energy Sources
- Hi-Tech innovation cluster
- EKOGEN
- Cluster of Czech Furniture Manufacturers
- South-Moravian Building Cluster
- National Wood -processing Cluster
- NiPaS - Cluster of Low-energy & Passive Civil Engineering

- **Romania**

- PROWOOD (primary biomass sector)
- Green Energy (renewable energies)
- IndAgro Pol (food & feed)

- ETREC (automotive)
 - ASTRICO NE (textile)
 - ELINCLUS (automotive)
 - ROSENC (Renewable energies)
 - Traditions Manufacture Future (textile)
 - REGIOFA (primary biomass sector)
 - Romanian Textile Concept (textile)
 - Transylvanian Furniture Cluster (primary biomass sector)
 - AgroFood Regional Cluster (food & feed)
 - Agro Transylvania (food & feed)
 - MECHATREC (automotive)
 - Transylvanian Textile and Fashion (textile)
 - Builders Guild Iasi (eco construction) - Initial stage
 - Construct Cluster Oltenia (eco construction)
 - Advertise Printing Packaging (pulp & paper)
 - BIOGAS INNO (renewable energies)
 - Green Solutions Lower Danube (renewable energies)
 - TREC (renewable energies)
 - ACAROM (automotive)
 - START Innovation (renewable energies)
 - BIODANUBIUS (renewable energies)
 - ECOIND (renewable energies)
 - INOMAR (renewable energies)
 - Transylvanian Mechanical Engineering (automotive)
- **Serbia**
 - HERBAL PHARMANET", Producers of herbal raw materials and herbal products association, Obrenovac
 - AC SERBIA", Automotive cluster, Belgrade
 - FACT" - Fashion Apparel Cluster Serbia, Belgrade
 - "Dundjer" - Construction cluster, Nis
 - BIO-NAUČNI KLASTER-bio-science cluster, Subotica
 - "Timber cluster", wood-processing cluster, Belgrade
 - "KLASTER AGROINDUSTRIJA", Agro- industry cluster, Subotica
 - UDRUŽENJE "AGRO KLASTER HOMOLJE" , Agro-industry cluster East Serbia
 - KLASTER "VOGANJ", RUMA Agro- industry cluster
 - FRUŠKOGORSKI KLASTER VINOGRADARA I VINARA "ALMA MONS", Cluster of wine growers and wine-makers of Fruška Gora
 - Pannonia fruit and vegetable producers Cluster, KUCURA
 - Vojvodina Organic agriculture cluster, Novi Sad
 - "ECOPANONIA", Cluster for Ecological Energy and Ecological Culture Novi Sad
 - ENEF KLASTER, NOVI SAD "Cluster for Energy Efficiency" Novi Sad.
 - KLASTER VOJPLAST, Packaging cluster SUBOTICA
 - SRBIJE "POLUKS", Association of food manufacturers, KIKINDA
 - ALKO KLASTER - Cluster of grapes, fruit, wine and brandy producers, South Serbia
 - KLASTER PANONSKA PČELA, Honey and honey based products clusters, Novi Sad
- **Slovakia**
 - Slovak Plastic Cluster
 - Energy Cluster of Presov Region
 - Energy Cluster - West Slovakia
 - National Energy Cluster NEK
 - Cluster for Support to Innovative and Green Technologies
 - Bioeconomy Cluster
 - **Slovenia**
 - Initiative Poly4EmI with following value chains
 - Advanced Packaging
 - Advanced Packaging for Food
 - Advanced Packaging for Food (selective barrier materials)
 - Advanced Packaging for Pharmaceuticals/Cosmetics
 - Coatings and Adhesives Applications
 - Thermal Insulation Applications
 - Automotive
 - Bio-polymer based automotive components
 - Wood-Polymer Composites
 - Wood hybrid composites for construction
 - **Montenegro**
 - Wine Cluster
- Annex 3: Country Reports**
<http://www.interreg-danube.eu/approved-projects/danubiovalnet/outputs>

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