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Towards a Systematic Bio-based Industry Approach for the Danube Region

Working paper: Synthesis Report on Bio-based Value Chains
Roadmapping in the Danube Region with Action Lines
for The Danube Bio-Based Strategy

WP4 Strategy and Policy actions

**Activity 4.1 Development of Joint Bio-based Industry
Cluster Policy Strategy (JBCS) incl. StressTest Tool**

***Cross-clustering partnership for boosting eco-innovation by developing
a joint bio-based value-added network for the Danube Region***

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OVERVIEW

The present Synthesis Report on Bio-based Value Chains Roadmapping in the Danube Region serves as the first input for the development of a Joint Bio-based Industry Cluster Policy Strategy. The report highlights the results of the value chain mapping outputs and deliverables. Particular characteristics, gaps, and needs along selected value chains are described along with associated policy considerations and actions needed to sustain bio-based industry growth in the Danube Region.

The Policy Forum on Bioeconomy Masterplan for the Danube Region, organized by the Ministry of Education, Science and Sport of the Republic of Slovenia and Ministry of Economic Affairs, Labour, Housing Baden-Württemberg Germany met on 25 September 2018 in Ljubljana. Participants discussed and proactively set forward concrete activities that need to be implemented on all different levels: macro or regional level, national and local or business level. The Policy Forum came at a critical point, as the Danube Region needs to make a joint effort in designing the pathway and taking actions as well as influencing and

engaging all the relevant policymakers. The Policy Forum pointed out that Danube bio-based approach has a triple impact on cohesion, environmental and social-economic sustainability. It points in the direction that Danube countries can play a critical role in cohesion and in achieving European sustainability and Bioeconomy Goals 2030. Responsible actions are needed that convey a deeper understanding of the concept of bioeconomy, integration of various actors, and promotion of the bioeconomic as an opportunity and not as a threat to industry and in conjunction with zero waste and Circular Economy models. The innovative aspects of the actions proposed lie in the ability to create critical mass and de-risking investments by delivery of support to industries along bio-based value chains in a cost-effective manner. To this end, follow up calls for taking all conclusions to the local and national political level as well as to the cluster level are imperative. Moreover, it is of critical importance to present and discuss the macro regional aspect of bioeconomy and bio-based value chains with the most relevant institutions on a EU level such Bio-Based consortium / BBI JU, DG Growth, DG Regio, and DG Research.

DANUBIOVALNET PROJECT

The DanuBioValNet project is designed to provide a region-wide roadmap for contributing to the transition from a fossil-based to a bio-based economy in selected industries. The project addresses some of the main challenges identified for the Danube macro-region and highlights specific ways in which the current dependency on fossil resources can be reduced through value-added activities in specific productive sectors. The project furthermore identifies ways in which the eco-innovations will support the regional development by diversifying the local economy and by creating new employment opportunities. In this project, bio-based value chains and related clusters are put into focus. The development of new bio-based value chains from primary production to consumer markets needs to be done by connecting biomass producers, processors, enterprises from different regions, different industries and end-markets. External market forces in selected sectors of the Danube region's bioeconomy serve to provide ongoing and evolving opportunities for competitive expansion of the various transformational value-added activities. The DanuBioValNet project is designed to develop new methods and tools to connect enterprises transnationally, cross-regionally and across sectors through clusters along selected high-end value chains. The principal sectors of interest to the project are: bioplastics and bio-based packaging, eco-construction, phytopharma and hemp, all of which build on the available regional biomass and

the identified pockets of excellence along the respective value chains. The partners for the DanuBioValNet project include Upper Austria, Baden-Württemberg, Bulgaria, Czech Republic, Slovakia, Slovenia, Croatia, Serbia, Romania and Montenegro (as an associated partner).

Two of the fundamental strengths of this project stem from the empirical nature of its information gathering process and the direct involvement of the stakeholders themselves in framing the issues to be addressed. Through a process of interviews, focus groups and workshops, the data generation relating to the existing value chains serves to highlight market opportunities as well as areas where improved and enhanced cooperation among the various actors can benefit the entire sector. With a view toward the larger regional and international picture, new methods and tools to support clusters for transnational cooperation are being developed and will be tested in three pilot actions where the plan is to create new bio-based value chains in the Danube Region with development and testing of new bio-based cluster services. DanuBioValNet solutions are generated by the actors who are most familiar with the needs and demands of the respective sectors and who will benefit most from the improved value-chains and updated public policies. This includes direct involvement of policy makers and nine cluster organisations along with their constituent SMEs.

ACTION LINES PROPOSED IN THE DANUBE BIO-BASED STRATEGY

Vision for the Danube

The Danube macro-region countries are home of extensive forests and agricultural land. They are rich in aquatic resources and produce a central value in traditional sectors such as agriculture, forestry, fishery, food processing, and pulp and paper manufacturing. The Danube countries can become Bioeconomy Leaders (Raw Material Production, Conversion, Products) by making use of long lasting interaction scenarios (phytopharma, bio-based packaging, eco-constructions), current logistics infrastructure (waterways,...) and by integration and/or combination of bioeconomy with other policies.

Target Bio-Based business intelligence

The current findings reveal a gap in empirically derived statistics for the bioeconomy sector, as well as a lack of understanding and agreement on what sectors are considered to be part of the bio-based industry and what bio-based industry is about. To help identify activities that would push the knowledge frontier and empower emerging bio-based networks it is critically important to stay informed about the market tendencies and opportunities as well as to gain better understanding of the socio-economic and environmental impacts. A Danube brain trust / network / task force would be able to continue the dialogue with industry, scholars, and policy makers in the region and EU.

Development and implementation of Systematic Bioeconomy Strategy

Despite their biomass potential, Danube countries are lagging behind in industrial bio-based activities and their potential remains largely untapped. The findings reveal that most partner regions do not have a dedicated strategy in place about how to develop bio-based industry. A holistic approach is missing with a mismatch between Smart Specialization Strategies and support measures in practice. Moreover, lack of coordination causes existing biomass providers, processors and end markets to operate in a disjointed manner. This contradicts the impression and communication of policy that bioeconomy is high on the agenda. Given the case that a bioeconomy focus is really important, this should be backed by systematic and serious policy making. It is important to understand which strategies are in place to develop the bioeconomy policy with a clear definition that does not overlap with other policies. The policy should allow that synergies will be created. The Bio-based Industry Cluster Policy Strategy provides a sound platform to develop demand-oriented and well-aligned policy approaches among the partners.

Funding Gap prevent development of cross-regional bio-based value chains

The regional bioeconomy is still emerging despite the fact that some industry value chains in the Danube region have developed well in the past. Often, a critical mass is missing, leading to fewer numbers of actors ready to invest in innovation or resulting in disconnected value chains. The findings reveal that there is a funding gap for implementation of macro-regional bio-based strategy. There are many funding opportunities offered within the EU, but there is a lack of coordination hampering effective transnational cooperation. There is a critical need to streamline funding and synchronize funding schemes at macroregional, regional as well as EU level. This will motivate and engage actors to take more risks and to further develop policy instruments according to the real demands of the bio-based industry. This is especially important along the cross-regional value chains since they are cross sectorial by nature. In addition, there is a critical underrepresentation of actors from the Danube Region in the Bio-based consortium / BBI JU that disconnects Danube actors from the cutting-edge research, innovation and high-end value chains on the European level. To this end, a dialog needs to be established among the key drivers and leaders of the Danube Strategy, regional policy makers, as well as with Bio-Based Industries Joint Undertaking (BBI JU), DG Growth and DG Regio.

Bio-economisation of Clusters and Distributed Manufacturing Environments

Cluster mapping and value chains mapping show that existing activities are not interlinked with industrial production value chains. Farmers, cultivators, and biomass feedstock providers are in general not part of any clusters. Bio-based value chains might be further promoted by the integration of biomass feedstock producers in traditional clusters rather than by establishment of bioeconomy / bio-based clusters. Promotion of bioeconomy as an opportunity and not as a threat to industry can be supported by targeting networking and cooperation (cross sectorial, cross regional) with biomass producers, bio-based solution providers and traditional clusters such as ICT, automotive, packaging, and construction. New distributed manufacturing environments that use the amounts of locally available renewable raw and residual materials for conversion to deliver locally demanded materials can be connected via clusters and cross border value chains. Raising awareness among clusters will reveal benefits from bio-based activities/business that impact cohesion and improve social-economics and the environment.

Focus on regional strengths and macro-regional assets

Although Bio-based industry covers a very broad field, the findings reveal that there are some value chains with very high potential for this industry in the Danube Region. Phytopharma, Eco-Construction and Bio-Packaging in the Danube Region are comparably well developed. Some of the Danube regions belong to European front-runner regions. The Strategy should not only focus on the three afore-mentioned value chains, but should be broader while focusing on local commodities. Very important regional advantages are start-ups and SMEs and they must be more involved in local systems of production, because SMEs can often be more flexible and responsive to customer needs. The start-ups and SMEs must be grouped into the local/regional networks/clusters and support systems so that they could meet the challenges of internationalisation and globalisation. The Bio-based Industry Cluster Policy Strategy must aim to focus on these value chains in order to assure long-term competitive advantages for the related industries.

Better inter-ministerial cooperation within the Danube Regions to better capture the interdisciplinary nature of Bioeconomy

The findings reveal that policy responsibilities related to the bioeconomy are covered by several ministries in given Danube countries. This leads to increased friction, lack of coordination and partly unclear responsibilities. The Bio-based Industry Cluster Policy Strategy encourages the partner regions to clarify and streamline responsibilities related to the development of Bio-based industry in the given partner regions.

Make more serious use of cluster initiatives and related intermediaries for value chain and supply chain development

The findings reveal that, in general, there is no lack in terms of numbers of cluster initiatives and other intermediaries to serve as platforms or other tools designed to further develop the Bio-based industry cluster. However, these entities are often not well embedded within the regional innovation system nor in policy development and implementation approaches. Neither are they actively supported by current policy making. Furthermore, role, tasks or coordination activities among different intermediaries within a given Danube Region are not clear. This leads to the existence of critically under-staffed cluster organisations and similar entities shifting their focus towards new funding resources rather than operating according to the regional demand. The Bio-based Industry Cluster Policy Strategy invites the partner regions to streamline their portfolio of cluster initiatives and entities dedicated to support the Bio-based economy in the Danube Region and to make more active use of cluster initiatives and related intermediaries.

The report is organized as follows. The next section presents a review of findings on trends, gaps, constraints and recommendations relating to the reviewed value chains. Chapter One provides results of the mapping reports and findings on trends, gaps, constraints, and recommendations relating to the reviewed value chains be presented in summary fashion. Chapter Three presents a set of policy considerations and options. The last part of the report provides the annexes that include more information about the Policy Forum.

I. REVIEW OF FINDINGS

BIOMASS POTENTIAL

Biomass resources. DanuBioValNet regions/countries have good opportunities for production of biomass due to the large amount of available forest and agricultural land. The agricultural land and forest area remain relatively constant in all regions/countries. Wood and agricultural biomass, bio-waste, landfill gas and biogas, and alcohol fuels (like Ethanol or Biodiesel) are the main types of biomass, but their uses in industry vary from region to region. Mostly, the biomass is used as primary energy for power and heating plants, for domestic use as a combustion source, and for the production of biofuels and biogas.

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. 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 land¹.

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.

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

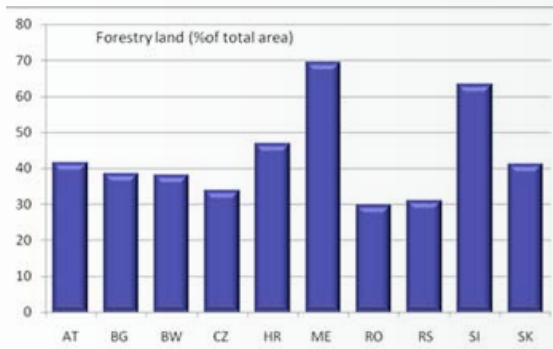


Figure 1: DanuBioValNet countries - Area of forested land as percentage of total area

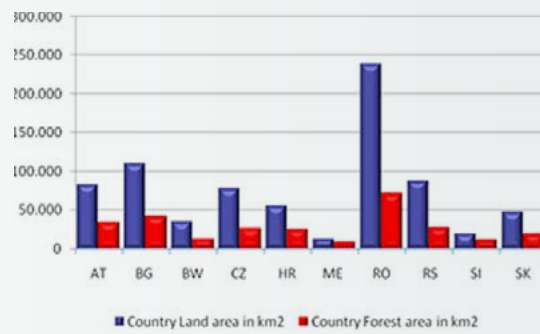


Figure 2: DanuBioValNet countries - Total surface area in km² Forested land in km²

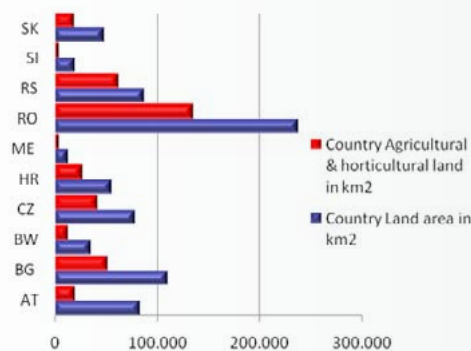


Figure 3: DanuBioValNet countries - Total surface area in km² Agricultural land in km²

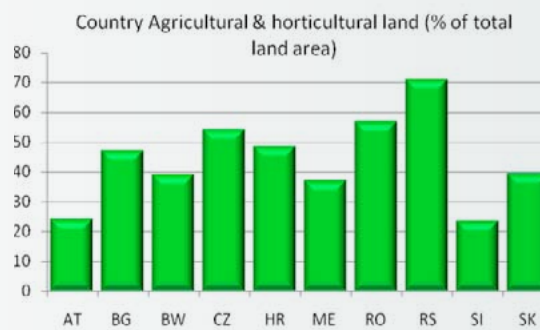


Figure 4: DanuBioValNet countries - Area of agricultural land as a percentage of total surface area

POLICIES AND CLUSTERS

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). Only Baden Wurttemberg has national / regional bioeconomy strategy and programmes.

The key assets of the bio-based industry are enterprises, biomass supply, cluster organisations, knowledge institutions, R&D activities and competitive bio-based products. However, their key value varies from region to region. For example, for BW and Upper Austria, all that is listed as key assets are of highest importance. For Croatia and Romania, the SMEs are considered to be the most important key asset.

Table 1: Bio-based cluster profile

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

*Mainly Wood clusters and farmers associations/cooperatives

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.

COMPETENCIES AND POTENTIALS FOR SELECTED VALUE CHAINS IN THE DANUBE REGION

The potential of the **Phytopharmaceutical sector** in Danube is huge. The Danube Region has excellent natural resources, with research capacities and companies, several of them global leaders in the field of the production of herbal medicinal products. Natural conditions of the Danube enable the cultivation of high-quality medicinal plants for a use in several Phytopharmaceutical Value Chains (rosemary, lime, willow, velvet, chamomile, and many others).

Eco-construction is an emerging market in the construction industry. According to the survey, the respondents think that people will be more interested in eco-construction products in the future. Regarding the future perspectives, all respondents see a huge potential within the eco-construction sector. The demand for environmentally-friendly products increases from year to year due to a relatively wide variety of possible products. In some regions of Austria, construction with wood is quite well established (like in Vorarlberg) and there are some best practice examples for community buildings as well as private houses. Furthermore, the country is well-endowed with ample forest-covered regions. The companies from the wood processing

industry that participated in the survey cover the entire value chain of the eco-construction sector, from processing of round logs to end-market products. The same could be applied to bio-based insulation material, although this industry is only emerging. There is a strong local / regional orientation on the part of the companies.

The Bio-based Packaging industry in the Danube Region is one of the main markets for bio-based polymers. To further develop the bio-based packaging sector, the great majority of the companies within the Danube Region are interested in cooperating. There is a huge and unexploited potential in the area of biodegradable compostable materials. Also, products that can be used in the agricultural sector have high market development opportunities. There are many national and multi-national initiatives that further fuel the demand for new bio-based packaging material. Among others, compostability is a very appealing property when the packaging meets the end of its useful life. This is a key functional property for purposes of successfully reaching the goal of the Circular Economy. Further end-of-life solutions need to be developed for recycling of bio-based packaging materials.

MARKET DEMANDS AND NEW APPLICATION FIELDS RELATED TO THE SELECTED VALUE CHAIN

Phytopharma. Markets in phytopharmaceutical and natural cosmetics are constantly evolving and expanding. The demand for natural products increases from year to year. Due to the wide variety of possible products, the actual trends and the changing pattern of needs, companies are willing to expand their production operations. The Global Market for Botanical and Plant-Derived Drugs will grow from \$29.4 Billion in 2017 to around \$39.6 Billion by 2022 with a CAGR of 6.1%. Europe is the largest herbal product market worth USD 7.5 billion. Germany and France are the region's market leaders. In 2015, the German market alone had an annual volume of 4 billion EUR. In the European market, Germany's share is 50%. The supplier companies of herbal material stated that their main challenge is how to keep up with high demands from pharmaceutical industry. They are challenged to grow a wider variety of species as the options for wild harvesting decrease. They are

also called upon to apply EU standards for physical chemical analyses to meet all required parameters and to engage more in organic production. New markets on the local and global level will likely be developed as the overall market increases on the global and local level.

Most of the interviewed companies from the **eco-construction** sector are looking into the development of new technologies and innovation in wooden construction, with multi-story wooden buildings, eco-friendly insulation (straw, paper, hemp, cellulose, and wool), composite beam design and "smart eco-houses". With the increase of new breakthrough technologies and production capabilities, costs of the eco-based composite materials and prefabricated structures will be reduced, thus making them more affordable to a wider range of customers. One company mentioned that the transparency and cost accuracy to include disposal

costs of building materials will lead to better prospects of the eco-construction industry. Multiple options are now available to design and to build an eco-friendly dwelling. Architects, civil engineers and builders worldwide are now using construction techniques that have been developed throughout history, in response to local environmental concerns and to the physical resource opportunities available. Furthermore, 21st century technological refinements have essentially boosted construction techniques. Buildings that integrate passive energy systems (bioclimatic buildings) are operated using non-mechanical methods, thereby optimising the use of natural resources. This involves the positioning and location of a building to allow and make use of sunlight throughout the whole year. By using sun rays, thermal mass is stored into the building materials such as concrete, which allows the generation of enough heat for a room. Eco-friendly building often uses eco-materials, which are certified green building materials, such as wood from sustainably managed forest plantations with accreditations from respective certification bodies.

For the Danube Region, the **potential markets for bio-based products** include the packaging sector,

disposables and consumables and, in general, articles with a short lifespan. Food packaging is among the sectors with the highest potential markets for such materials. Due to various environmental concerns, the use of biodegradable materials may contribute to the sustainability and the reduction of environmental impacts as well as to the greenhouse gas balances. Future perspectives of the **bioplastic packaging** also depend on solving the recycling issues dedicated to bioplastics in general. The biodegradable bioplastics cannot be recycled together with oil-based plastics because it would debase the quality of recycled material. So, the product cycle of the biodegradable bioplastic packaging (liquidation, recycling) is still significant issue. Improvement of the current recycling system of oil-based plastic products is still more eco-friendly than the current production of bioplastics. At the moment, the industries of greatest relevance to this sector are the food and pharmaceutical sectors. Stronger cooperation with food processing and manufacturing companies is a key to further development of advanced bio-based packaging materials. However, the pharmaceutical and phytopharma sectors are also interested in new packaging solutions.

MISSING LINKS AND EXISTING GAPS OF SELECTED VALUE CHAIN

In the Phytopharma VC, added value services are the key missing link in several regions. This is partly due to the cost optimization but mainly due to absence of service in the region (i.e., absence of standards, equipment, and knowledge). Establishment of specialized services depends on the demand as well as on other economies of scale thresholds. However, value added is unevenly distributed across the Danube Value Chain. Regions with a significant production of Medical Aromatic Plants (MAPs) in general do not equal the production of countries with extraction companies and with big manufacturing companies. Most cultivators and producers see the potential in organic production and in broader cooperation with the pharmaceutical industry and other sectors. They see the opportunities in the development of new business models (sharing economy) and in new technologies (weather forecasting, virtual technologies, analytics, logistics). They also see huge potentials in bio-based (herbal) pharmacy. Value chain mapping exercises reveal the same pattern. Baden-Württemberg has a majority of firms positioned in the end-market side, with well-established global players. While several other regions covered whole value chain, their market penetration and access to Europe and global markets such as US and China are limited. Currently, the value chain has several non-contributing intermediaries. Minimizing the dependency on these intermediaries by developing new databases, networks and payment methods

will help to ensure increased profits for both cultivators/collectors and sales. The development of new databases and knowledge networks is of critical importance for staying informed about the market tendencies and opportunities in phytopharmaceutical sector.

In the eco-construction sector, one of reported problems is that the clients do not focus on eco-construction products, but are only interested in the certification and price. The „eco“-impact is not as important to them as the awareness campaigns are. Legislation unification throughout EU for eco-construction products is a priority interest. The technical standards for wood construction and the certificates are too demanding and are not valid across Europe. One of the identified gaps is also a poor implementation of the “green” strategies. A lack of a skilled workforce in the sector of eco-construction is mentioned as an obstacle. Intellectual property protection related to innovative idea is an issue for pioneering companies. For the companies that plan to expand internationally, the main gap seems to be the difficulties in access to the market.

The biggest challenge **in bio-based packaging** remains the development of new markets as well as the costs and performance of bio-based packaging materials.

CROSS-SECTORAL BUSINESS OPPORTUNITIES FOR SMES WITHIN DANUBE REGION

For Phytopharma, the main competitors for the respondents dealing with the herbal essences and extracts are producers in three following areas: food industry, pharmacy and cosmetics (since there is a wide range of possible products). Since the synthetic essences are the substitutes for natural essences, respondents face a tough competition in both domestic and foreign markets. The Danube region has an opportunity to further enable its “branding” for Phytopharma cluster excellence and products in line with the above-mentioned qualities and standardization of value-added activities and related conditions. Forming strong alliances will help the whole value chain in attracting investors and cooperation-building to achieve common goals, and to strengthen the sector. Stronger cooperation across national borders and across different value chains is necessary in order to build up the missing know-how in bio-based packaging sector.

In Eco-construction most of the interviewed companies see opportunities in the development of new technologies and innovation in wooden construction, with multi-storey wooden buildings, eco-friendly insulation (straw, paper, hemp, cellulose, and wool), composite beam design, smart eco-houses, 3D printing, etc. However, this requires cooperation with other economic sectors.

For the Bio-based packaging the most relating industries at the moment, and probably also in the future, are the food and pharmaceutical sector. Especially stronger cooperation with food processing and manufacturing companies is the key to further develop advanced/bio-based packaging materials. But also, the producers and retailers of consumer goods are interested in new packaging solutions.

POLICY FRAMEWORK CONDITIONS

According to the respondents and participants in this project, there is much work to be done on the regional and EU policy level to push the bio-based plastics/packaging market forward. At the EU and national level, it is necessary to create better legal frameworks for the use and application of bioplastics. The public must be better informed about the use of bio-based plastic packaging material. Consumers must be made aware of the fact that the right waste separation is essential for the successful biodegradability of the materials. Significant efforts must be

made to raise awareness of the public regarding benefits of bio-based materials against raw materials considering public health and environmental impacts. This is why better recycling strategies in general and a better “End-Of-Life” infrastructure must be developed on a national and EU level. In addition, on the EU level, there should be a progressive ban on plastic packaging and better mechanisms in place for promotion of biodegradability and environmentally-friendly plastics.

II. STRUCTURE OF VALUE CHAIN

PHYTOPHARMA VALUE CHAIN

DanuBioValNet project defines Phytopharma as “health-related products derived from plant sources”² and comprised of value-added activities associated with producing pharmaceutical and cosmeceutical agents of plant origin. These include bio-active ingredients for pharmaceutical grade medicines, natural herbal medicines, cosmetics, cosmeceuticals, nutraceuticals, nutritional supplements and similar

health-related natural products. Phytopharmaceutical products offer a wide variety of value chains, as they are part of at least three industries – pharmacy (dietary supplements, drugs), cosmetics (natural cosmetics, perfumes) and food industry (seeds, oils, herbal essences and extracts, etc.). The figure below illustrates the structure of phytopharmaceutical Value Chain in the frame of DanuBioValNet project³.

2) Memo Phytopharma Day, Stuttgart 4, December, 2017

3) The value chain map was not designed to shed detailed insights on dynamics within and between nodes (e.g. separate nodes and channels for large commercial operators vs. SMEs and informal enterprises), but simply to identify the nodes themselves as clearly as possible.

Figure 5: DanuBioValNet Phytopharma value chain

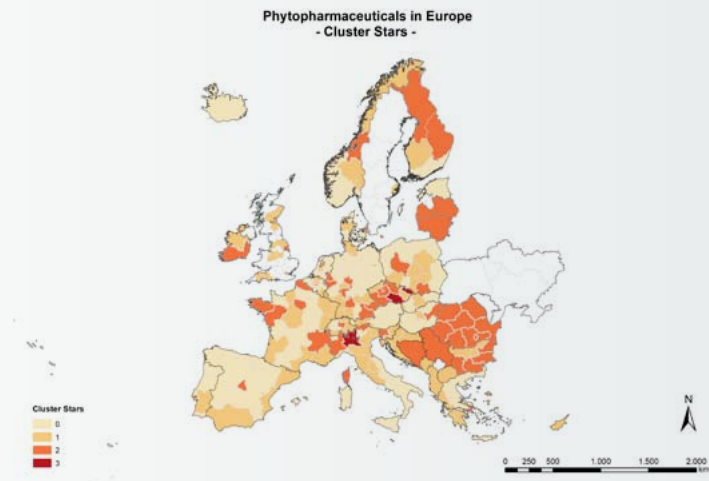


Source: DanuBioValNet

Figure 6: European top regions in (Phyto)pharmaceutical Industry⁴

Figure 6 profiles all European regions according to the Cluster Stars in the Phytopharmaceutical industry. The strong regions are spread rather across Europe with the largest concentrations in Bulgaria, Czech Republic, Germany, France, Romania and Slovenia, whereas the strongest ones are located in the Czech Republic and Italy (Lombardy).

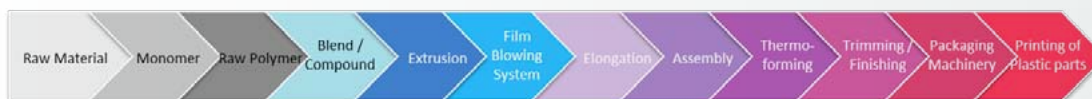
Source: Cluster Mapping Synthesis Report, Eco-Construction, 2017



BIO-BASED PACKAGING VALUE CHAIN

Bio-based packaging materials can be defined as „materials derived from renewable sources“. In addition, such materials (recognised as biodegradable according to the standards outlined in related EU Standards) can be also considered to be bio-based materials.

Figure 11: Value Chain for Bio-based Packaging Sector

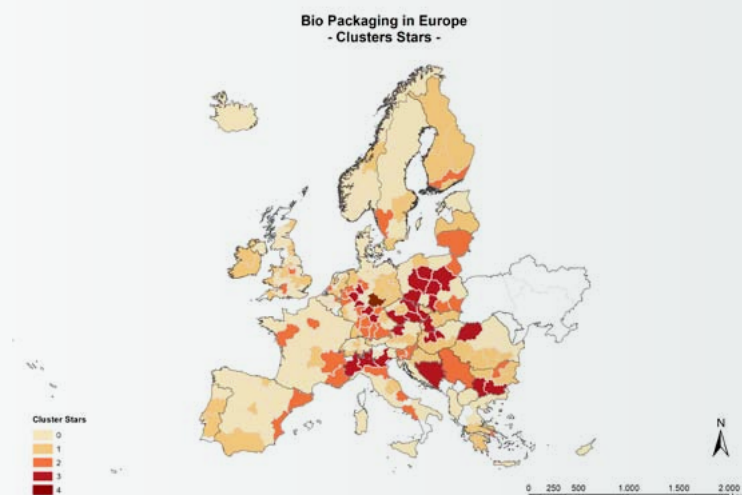


Source: DanuBioValNet

Figure 7: European top regions in (bio-based) packaging industry

Here again, the Danube Region countries of Upper Austria, Baden Württemberg, Bulgaria, Czech Republic, Slovakia, Slovenia, Croatia, Serbia, Romania and Montenegro are shown to have a high level of cluster stars with regard to bio-based packaging activities.

Source: Cluster Stars, 2014



4) Meier zu Köcker, G.; Dermastia, M.; 2018, Cluster Mapping Synthesis Report Phytopharmaceutical Industry, DOI: 10.13140/RC.2.2.20871.09126

ECO-CONSTRUCTION VALUE CHAIN

Eco-friendly construction (eco-construction) is building a structure that is beneficial or non-harmful to the environment and resource efficient. Also known as green building, this type of construction is especially efficient

in its use of local and renewable materials (preferably wood-based materials). Also, in terms of energy production and consumption, eco-construction focuses on obtaining the required energy from green sources.

Figure 8: Value Chain for Eco-Construction

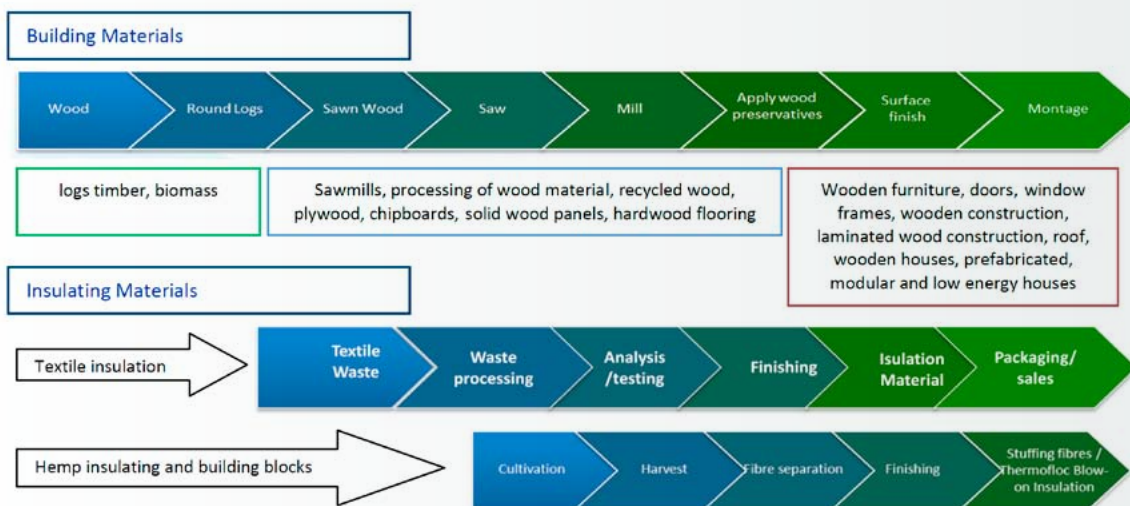


Source: DanuBioValNet

The Eco-Construction industry composition illustrated in Figure 8 is based on the intensive work of the project partners and related cluster managers and is based on more than 350 companies and their related NACE classifications identified. The size of the

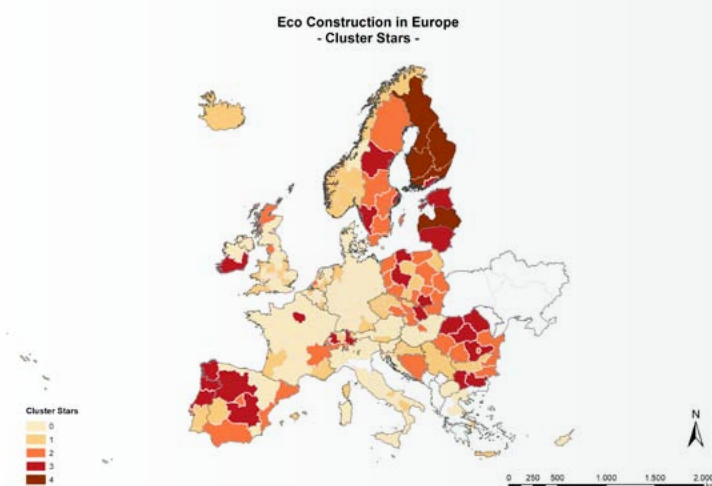
different boxes (NACE classifications) is proportional to number of enterprises. As Figure 2 illustrates the biggest share of enterprises (about 21 %) operate in the sector "Sawmilling and planing of wood" (NACE Code C16.10).

Figure 9: Coverage of Interviewees along the Eco-Construction Value Chain



Source: DanuBioValNet

Figure 10: European top regions in Eco-Construction



Source: Cluster Stars, 2014

Figure 10 profiles all European regions according to the Cluster Stars in the Eco-Construction industry. Most strong regions are located in Finland and Latvia. According to Figure 3, especially Finland can be determined as a major player in terms of Eco-Construction industries. It can be noted that

the Danube regions/countries of Upper Austria, Baden Württemberg, Bulgaria, Czech Republic, Slovakia, Slovenia, Croatia, Serbia, Romania and Montenegro are well-represented among those areas with higher level cluster stars in relating to eco-construction.

III. POLICY CONSIDERATIONS AND OPTIONS

A fundamental objective of the DanuBioValNet project **is to inform the policy-making process at all relevant levels of government and industry as well as in participating cluster organizations.** Policy considerations and options can be framed in both active and passive terms. This includes actions to be taken and conditions to be maintained. **Where certain gaps in the respective value chains have been detected or articulated, the DanuBioValNet project points out where certain policy directives or programmatic measures can be of value.**

The project discussions and exchanges with stakeholders have made clear, however, that all such interventions **must continue to be market driven,** and must **conform to the particular stage of development of the target value-chain.** It is also the case that policy-level interventions can be both direct and indirect in their effect on the particular sector and associated value chains. Furthermore, **not all policy considerations dealt with in the DanuBioValNet project are sector specific** but are rather more directed at the general bioeconomy ranging from financial to technological to logistical measures.

Policy instruments discussed in the present Synthesis Report include incentive packages, regulatory provisions, matchmaking venues, workforce training programs and more. This report stresses the need **for both structural and programmatic interventions** at the national, regional and extra-regional levels. The present report points out that, in addition to addressing gaps and opportunities, policy interventions can be designed to maintain environmental sustainability and resource efficiency. In this regard, the appropriate public and quasi-public agencies must maintain continuous engagement with the respective clusters and cluster organizations.

While the DanuBioValNet project was directed at three separate sectors of interest (Phytopharma, Bio-packaging, Eco-construction), the principal policy-related considerations, relevant to all three areas, can be best represented by the Phytopharma sector. As illustrated in the following chart, the Phytopharma sector also provides a window on how the relevant policy challenges can be addressed in a comprehensive manner through a Joint Bio-based Industry Cluster Policy Strategy.

Table 2: Recommendations for the Bio-based Industry Cluster Policy Strategy for Phytopharma sector

Topics / Issues	Recommendations/ Solution Proposals
Lack of skilled workforce	<ul style="list-style-type: none"> Review and benchmark of the existing training programs and VET needed for farmers and pickers in the Danube Region, align it with current needs; Development and availability of on-site trainings for them; define the incentives for businesses to engage in provision of such trainings.
Lack of service provisions for farmers, intermediaries, SMEs	<ul style="list-style-type: none"> There is a need to interlink actors/stakeholders with related support institutions: laboratories, certification bodies, advisory services on national level and Danube wide; appropriate modality to be discussed. The support to the establishment of Cluster organizations where they do not yet exist; Capacity building of cluster organizations to be able to provide relevant services to their members, including linking to other support institutions. Commit all stakeholders at the national and Danube level to develop support environment for sustainability and quality assurance of plant material. Nationally and internationally harmonized procedures for quality plant material and simplification of administration for compliance is needed.
Industry/ academia communication and cooperation	<ul style="list-style-type: none"> A central Danube-wide as well as national contact points, e.g. in form of a database for a specific region should be developed. The database could provide basic and expert knowledge on cultivation/harvesting and processing strategies, pests and adjustments of machinery for harvesting, knowledge about plant and soil ecology, etc. The database could further serve as a technology/knowledge offer and request portal, science and business-related matchmakings and a follow up on project development, funding identification. It is suggested that the time frame for the development of the central contact point should be determined as soon as possible. Dedicated governmental national/Danube Region/EU funding schemes, in support of the transfer of inventions towards innovations, e.g. support to pilot schemes, commercialization strategies of technology driven start-ups, etc.

Holistic approach to economy, environment and social issues	<ul style="list-style-type: none"> · Consistent and logically developed regulatory framework which should serve to promote and support highly ethical and economically justifiable business. Tax incentives as well as other forms of incentives should be introduced (where they do not currently exist) to promote Phytopharma. Political elites should promote sustainability in the phytopharmaceutical industry, together with business elites and vocational experts. · Incentives for the technologies that should help in bringing sustainability issues in front, especially the development of green technology and biotechnology.
Demographic change: Aging population; De-population of villages	<ul style="list-style-type: none"> · Aging population has several important implications for phytopharmaceutical business: (1) elderly population is becoming an important issue for traditional healthcare systems in various ways; (2) elderly population has high health consciousness, which turns them into users of not only conventional healing remedies but also of the growing market of phytopharmaceutical products and services. · Depopulation of villages in South Eastern Europe is evident and represents a great obstacle for the development of phytopharmaceutical input base – among others, plant cultivation, collection, harvesting and many more. · General consciousness about healthy life styles and the advantages of living in non-urban areas is of key importance in meeting this challenge. The political elites, urban planners, and also, business and NGOs should be called upon for building an adequate infrastructure to support high-quality life standards in rural areas as they are in urban areas – road infrastructure and Internet access, new job possibilities as the most important, among others. That would be the task of a long-term strategy.
Legislation	<ul style="list-style-type: none"> · Spreading the information · Lobbying

In the area of bio-based packaging, inputs for policy strategy include proposals for national and Danube-wide platforms for providing and extending knowledge about current technology, processes, and information about suppliers of raw bio-based materials. Said inputs also include opportunities for cross-sectoral collaboration and innovation. These central points of contact can provide knowledge on existing national and international initiatives for bioplastics and bio-composites throughout the Danube Region. Additional policy considerations include subsidies and quotas to be developed for bioplastics and the bio-based packaging industry. Enhancing the cooperation between science and business is encouraged in the area of applied research for concrete products, processes and services. Innovation vouchers, contracted research and rewarding professional performance of R&D institutions can potentially increase the output of joint projects. Sustainability and environmental impact measures should also be developed on the national and the Danube Region level along with advanced recycling strategies. It is also important to assure adequate data inputs and outputs for basic LCA (lifetime cycle assessment) for different bio-based packaging products as well as to better inform consumers by involvement of NGOs and consumer organisations. Other policy inputs in this area include the provision of a market-driven approach to using advanced packaging as a substitute for common non-reusable packaging by involving multinational corporations and retailers. Finally, information, explanation and awareness on bio-based products must be spread by involvement of all actors in the bio-based ecosystem.

Policy strategy examples in eco-construction. The area of eco-construction provides further examples of inputs for policy strategy formulation. These include: (a) Enhancing the cooperation between science and business with a funding

call on measures like tailor-made training offers for research and innovation personnel. (b) In addition to promoting energy efficiency, there should be an indicator on material efficiency/renewable materials connected to housing subsidies or other incentives. (c) Developing measures to better inform the consumers by involvement of regional energy consultants in order to attract interest in Eco-Construction, and (d) Better integration of Eco-Construction with the issuance of building certificates.

Pilot actions as policy-related initiatives. At a different level of policy, it is appropriate to recognize certain pilot actions which have been proposed through the project workshops with the essential stakeholders. Such pilot actions are intended to address issues, challenges and opportunities such as visibility, industry/academia communication and cooperation gap, holistic approach to the economy, environment and social issues. What has been proposed is a central Danube-wide “contact point” in the form of a knowledge/exchange platform. In the case of phytopharma, such a contact point could provide basic and expert knowledge on cultivation/harvesting and processing strategies, pests and adjustments of machinery for harvesting, knowledge about plant and soil ecology, legislation, regulatory, and other issues. The contact point could further serve as technology/knowledge offer and request portal for companies and research institutes who need cooperation along the value chain. As indicated in the table 3, the main constraints and gaps for selected value chains centre on: (a) the respective technology areas and applications, including R&D activities; (b) market development; (c) socio-economic factors including legal considerations, population income conditions, human resources and others; (d) general enterprise policy, business environment and related legislation.

IV. ANNEX 1: MAIN CONSTRAINTS AND IDENTIFIED GAPS FOR SELECTED VALUE CHAINS

Field/VC	Bio-based sources / feedstock	Technology and application (R&D)	Market development	Socio-economic factors (legal, economic, social conditions, HR etc.	Policy / business environment /legislation
Phytopharma	<ul style="list-style-type: none"> uncoordinated wild collection lack of monitoring and indicators for MAPs lack of national and EU statistical information and assessments on MAP resources lack of sustainability strategy 	<ul style="list-style-type: none"> lack of suitable machines for all steps connected to the farming and harvesting of the plant materials lack of R&D capacities not sufficient laboratories to provide compliance with EU regulations lack of sufficient technologies demand for high-tech solutions for harvesting and drying technologies, compound identification, traceability of the product with genetic markers lack of industry/academia communication and cooperation 	<ul style="list-style-type: none"> average age of Consumers of MAP-related products continues to advance upward (aging population) growing sustainability standards phytopharmaceutical products are under increasing demand (comparing with synthetically derived products) need for obtaining high quality raw materials 	<ul style="list-style-type: none"> lack of training / technical assistance in terms of quality improvements lack of skilled labour force lack of support institutions / clusters lack of service provisions for farmers, intermediaries, SMEs increasingly educated consumer base lack of data and information for consumers ownership of land (public/private) 	<ul style="list-style-type: none"> insufficient knowledge about bio-based potentials stable high-quality standards better regulation on the EU level regarding use of phyto-based medicines and prevention of pesticide pollution increased regulation and complex regulatory framework visibility of Phytopharma, awareness raising campaigns need for dedicated programs for phytopharma and bioeconomy lack of promotion of sustainability in the phytopharmaceutical industry
Eco-Construction	<ul style="list-style-type: none"> need for assured quality of raw material. 	<ul style="list-style-type: none"> lack of institutionalised cooperation 	<ul style="list-style-type: none"> slow changing trend from energy efficiency to resource efficiency regional/national market development and orientation 	<ul style="list-style-type: none"> lack of awareness about environmental impacts lack of qualified workforce low motivation of young people to work in the industry price -orientation of consumers and industry 	<ul style="list-style-type: none"> lack of knowledge of biomass feedstock available lack of support measures /financial incentives on national and EU level
Bio-based Packaging	<ul style="list-style-type: none"> lack of support for agriculture to produce the crops suitable for production of biopolymers. lack of constant supply of source material lack of continues supply chain of raw materials for the region missing suppliers of raw materials 	<ul style="list-style-type: none"> lack of adequate machinery/technical solutions suitable for processing used raw materials problematic technical properties of the biodegradable bioplastics lack of manufacturers of adequate machinery for suppliers of raw materials technical problems with manufacturing need for specialized tools to be developed for streamlined research projects 	<ul style="list-style-type: none"> lack of triggers for market demand for bio-based packaging products greater involvement of brands (brand messages) and retailers for using the bio-based packaging lack of cross-regional connections and networks - economy of scale missing market and demands of the bioplastic packaging weak price/performance ratio very small and limited market of the bioplastic products for the final products inadequate / lack of market demand 	<ul style="list-style-type: none"> missing composting system of bioplastics, education of the population insufficient knowledge about bio-based potentials lack of information, explanation and awareness issue of the exploitation of agricultural products for non-food processes lack of training and education in relation to the biodegradable materials lack of better "End-of-Life" infrastructure lack of knowledge and SME knowledge exchange 	<ul style="list-style-type: none"> lack of cross-sectional/sectorial strategies need for a joint bio-based strategy that also involves bioplastics and bio-based packaging better recycling strategies need for positive legislation lack of data inputs and outputs for basic LCA (life-cycle assessment) for different bio-based packaging products need for involvement of NGOs and consumer organisations

V. ANNEX 2: POLICY FORUM ON BIOECONOMY MASTERPLAN FOR THE DANUBE REGION

DanuBioValNet project took an important step in gathering and addressing policy makers from 11 CEE and SEE countries to discuss gaps and opportunities of the bioeconomy in the Danube Region. Policy Forum on Bioeconomy Masterplan was organized by the Ministry of Education, Science and Sport of the Republic of Slovenia and Ministry of Economic Affairs, Labour, Housing Baden-Württemberg Germany in Ljubljana on 25 September 2018. Policy Forum had a goal to identify, discuss and proactively set the concrete activities that need to be implemented on all three levels: cluster, national and macro-regional aspect.

Franc Bogovič, Member of European Parliament and holder of MEP Award 2018 for research and innovation opened the forum. The speakers of the forum were dr. Peter Volasko from Ministry of Education, Science and Sport of the Republic of Slovenia, dr. Judit Schrick, Priority Area Coordinator for the PA8 of the EU Strategy for the Danube Region, Ministry of Economic Affairs, Labour and Housing Baden-Württemberg Germany, Diego Mattioli from NOESIS, BIOECO-RDI, Adrion Interreg and prof. dr. Ralf Kindervater from BIOPRO Baden-Württemberg GmbH. The forum discussion for three experts' groups was based on identified hurdles, gaps and constraints identified during the

mapping and road mapping measurement tools implemented in work package 3 of DanuBioValNet project.

The Policy Forum pointed out that Danube bio-based approach has a triple impact on cohesion, environmental and social-economic sustainability. It points in the direction that Danube countries can play a critical role in cohesion and in achieving European sustainability and Bioeconomy Goals 2030. Responsible actions are needed that convey a deeper understanding of the concept of bioeconomy, integration of various actors, and promotion of the bioeconomic as an opportunity and not as a threat to industry and in conjunction with zero waste and Circular Economy models. The innovative aspects of the actions proposed lie in the ability to create critical mass and de-risking investments by delivery support to industries along Bio-based value chains in a cost-effective manner. To this end, follow up calls for taking all conclusions to the local and national political level as well as to the cluster level. Moreover, it is of critical importance to present and discuss the macro regional aspect of bioeconomy and bio-based value chains with the most relevant institutions on a EU level such Bio-Based consortium / BBI JU, DG Growth, DG Regio, and DG Research.

Policy Forum agenda

Opening welcome address and key notes

- Welcome Address by Mag. Peter Volasko, acting Head of Science Department, Ministry of Education, Science and Sport of the Republic of Slovenia
- Bioeconomy in the Danube Region – Policy should support cross-border cooperation for people and businesses of the Bioeconomy sector in the Danube Region by Franc Bogovič, Member of European Parliament and holder of MEP Award 2018 for research and innovation
- How the Macro-regional strategy can support you? by Dr. Judit Schrick, Priority Area Coordinator for the PA8 of the EU Strategy for the Danube Region, Ministry of Economic Affairs, Labour and Housing Baden-Württemberg Germany
- Bioeconomy in Europe –Trends, achievements and upcoming challenges - by Diego Mattioli, NOESIS
- Award Ceremony European Cluster Excellence Initiative (ECEI): Silver and bronze label award for Slovenian Clusters TECES, Wood Industry Cluster and PLASTTEHNIKA Cluster

Part 1 – Strategy

- Presentation of benefits to the local economy, environment, society (case studies Algen d.o.o. and Abelium d.o.o.)
- Gaps and Hurdles for uptake of bio-based industry in Danube, Prof. Dr. Ralf Kindervater, BIOPRO Baden-Württemberg, Germany
- "How to foster structural change for the Bioeconomy?" - Panel discussion on policy level, policy makers from Danube, Panel discussion moderated by Jadranka Jezeršek Turnes

Part 2 – Forum and discussion: How to foster structural change in Bioeconomy?

- Group discussion A - Cluster policy aspects - facilitated by Svetlin Rangelov, ABC Bulgaria
- Group discussion B - National policy aspects – facilitated by Dominik Patzelt, BIOPRO, Baden-Württemberg, Germany
- Group discussion C - Macro-region policy aspects – facilitated by Zorica Marić, ICME, Serbia
- Reporting: proposition of solutions, tactics or action plans
- Closing and wrap up by Prof. Dr. Ralf Kindervater, BIOPRO / mag. Mateja Dermastia, Anteja ECG

A. CLUSTER ASPECT

For the Bio-based Industry Cluster Policy Strategy the following concrete proposals and solutions regarding the **cluster aspects** were discussed:

Topic question 1: Cluster emerges (or exists) in a market-driven process. How can policies better help bio-based clusters in general?

- Fostering networking between researchers/academia and SMEs (both stakeholders bring knowledge and ideas) and industry (bring money) – clusters could benefit from such cooperation (e.g. Meet&Match events)
- Incentives specifically for start-ups in bio-based industries since they are also most often the creators of ideas and innovations. If start-ups are engaged in clusters, the latter also should get benefits.
- Incentives for the bio-based market actors that use local raw materials and apply local manufacturing approach (similar to Bioeconomic Developed Manufacturing Environment).
- Implementation of „3 bottom line approach“ (economy, society, environment) in the process of policy elaboration/development.

Topic question 2: How to “bio-economise” existing clusters not yet active in the bio-based world and how to better enable obvious existing bio-based cluster (agricultural production) (Cross-Sectoral Approach)

- Networking between the so-called traditional (e.g. IT, automotive, packaging, construction etc.) and bio-based clusters, both at the national and cross-country level in the Danube Region (e.g. trainings for cluster manager, Meet&Match events)
- In general, raising awareness of clusters regarding benefits from working together in the bio-based industries. Benefits can imply different dimensions: financial, industries interaction, cooperation with R&D, getting young talents, attracting new customers, assessing new markets, etc.

Topic question 3: Funding for development and cluster strategy development - cross border / cross sectorial cooperation

For cross-border cooperation no funding scheme exists yet! The discussion goes in the direction to identify only the need to create a database/platform of existing and emerging clusters in order for them to cooperate efficiently at cross-regional as well as EU level. Information is still at the beginning stage. There are already some initiatives for clusters in general on the EU level, very rare, but not for the clusters of the bio-based industries. Proposal goes to the creation of a cross-border/cross-regional funding scheme for internationalisation of bio-based clusters/value chains (from resources to production to market) and to the development of new bio-based clusters (like phytopharma).

B. NATIONAL POLICY ASPECT

For the Bio-based Industry Cluster Policy Strategy the following concrete proposals and solutions regarding the **national aspects** were discussed:

Topic 1: Regional vs Supra-National bio-based policies. Think globally act locally to empower regions. Respect the regional competitive advantage.

- Start with what you have, build on regional strengths. Some policies are centralized or decentralized (conflict). Start with opinion development differentiation. Respect culture of the region.
- Setting macro-region as a frame and let region/country work within the frame.
- Framework should be set, but not strict. If government delegates responsibility to regional level, support for the implementation must be set.

Topic 2: How to achieve better alignment of inter-ministerial work as bio-based topics are part of several ministries as a prerequisite?

- The government must set the priority. The final objective, the end point (where we would like to go) must be set by government. Then an action plan must be developed - who, when, costs, etc.
- Get ministries in touch with experts.
- Define concrete actions and motivate for the realization.
- Responsibility and ownership of the results must be taken by the ministries and intermediary bodies. Let them work, don't do their job.

Topic 3: How to engage actors, deploy services and business linkages, cooperation and commercialization for clusters (involvement of SME's)?

- To engage actors, go through industry associations, talk to opinion leaders.
- To accept bioeconomy goals, the benefits must be shown to the actors, like how it contributes to the environment.

C. MACRO-REGION STRATEGY ASPECTS

For the Bio-based Industry Cluster Policy Strategy the following concrete proposals and solutions regarding the **macro-region aspects** have been discussed:

Topic 1: What kind of policy measures should be developed (Catalogue of Measures - example Input for Action Plan; overall or specific measures based on VC) - Bioeconomy industrial calls for new policy instruments.

- public procurement for biodiesel, demonstration projects, business opportunity;
- business friendly procedures for calls balanced with monitoring evaluation process;
- preparatory action fund in Danube;
- synchronized national schemes with programs;

Topic 2: Targeted bio-based business intelligence

- Motivation and information for the bioeconomy development;
- Demonstrate business opportunity;
- Set penalties (environment) and incentives (bio-based, biodegradable, low CO₂);
- Develop a “brain trust” as a network;
- BBI observatory tool should be set as BBI JU;

Topic 3: Connection to other policies (example bioeconomy policies, sustainable development goals, etc.). Bioeconomy strategy level.

- cooperation with Alpine and Adrion space – capitalisation of projects;
- develop and support small project fund;

Many regulation-related issues exist and have to be addressed at EU and national level at the same time. However, without proper policy measures that can de-risk investments in this emerging industry and without applying synchronized measures along the transnational value chains to fill gaps and missing links, the bio-based potential of the Danube Region might remain largely untapped and push Danube countries into “bio-based isolation”.

It is important to establish the Inter-ministerial cooperation, setting up policy instruments (need for concerted national bioeconomy strategies) and close multinational cooperation within the Danube Region. The recommendations to the policy for clusters and business support environment goes into direction of “Bio-economisation” of existing clusters, development of sustainability strategies (Mentoring/Companionship), focus regional strengths (“smart specialization approach”), cross-sectoral cooperation along value chains, support for development of new bio-based clusters, funding competitions and creation of a small projects fund for involving more SMEs into the bio-based value chains.

The Future of the Bioeconomy should adapt new models (that suit for the region) like creation of “bioeconomic distributed manufacturing environments”, interlinking various business sectors into value added networks and to create social-economic sustainability.

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