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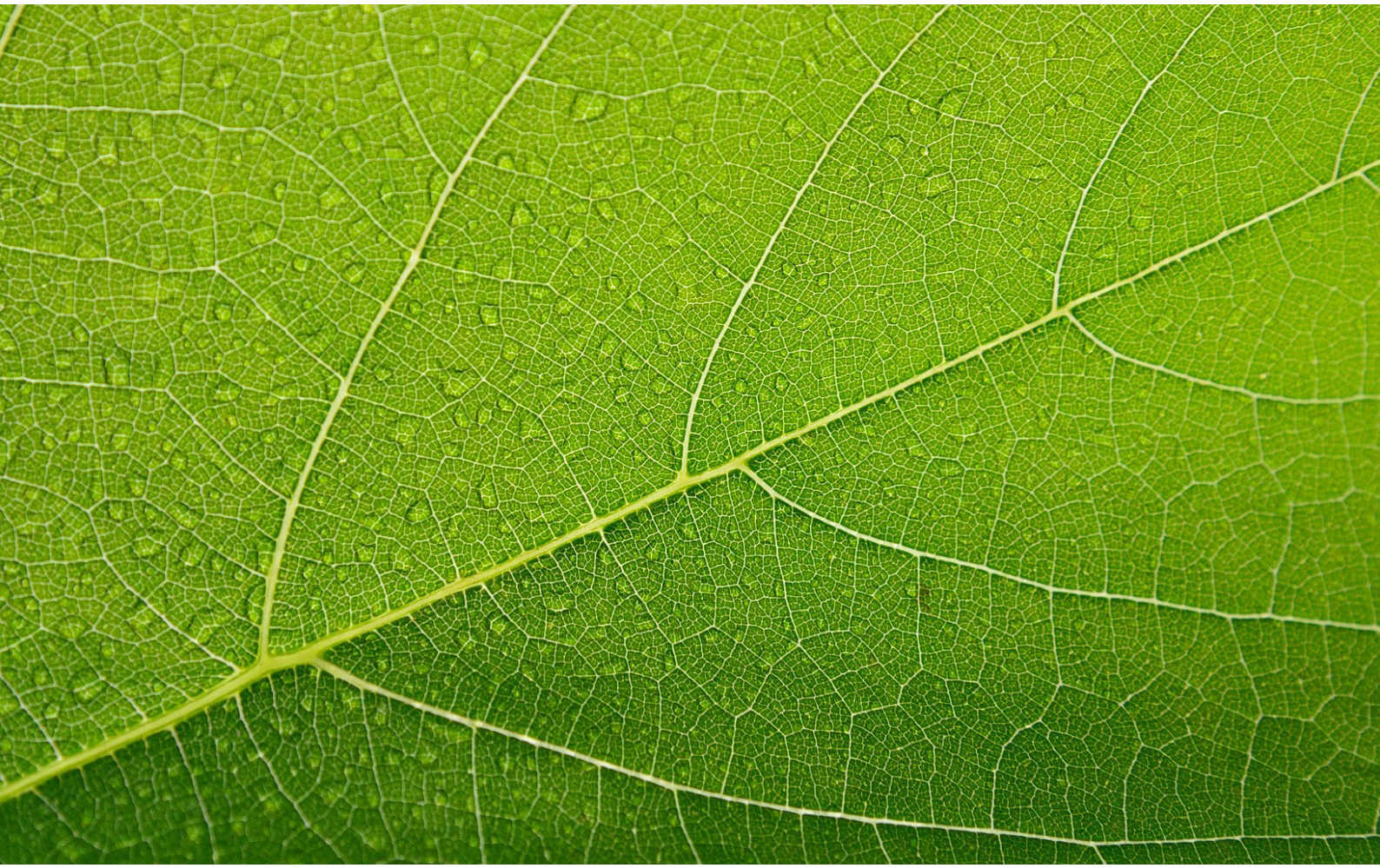

The Eco-Construction Value Chain in the Danube Region

Project co-funded by European Union funds (ERDF, IPA)
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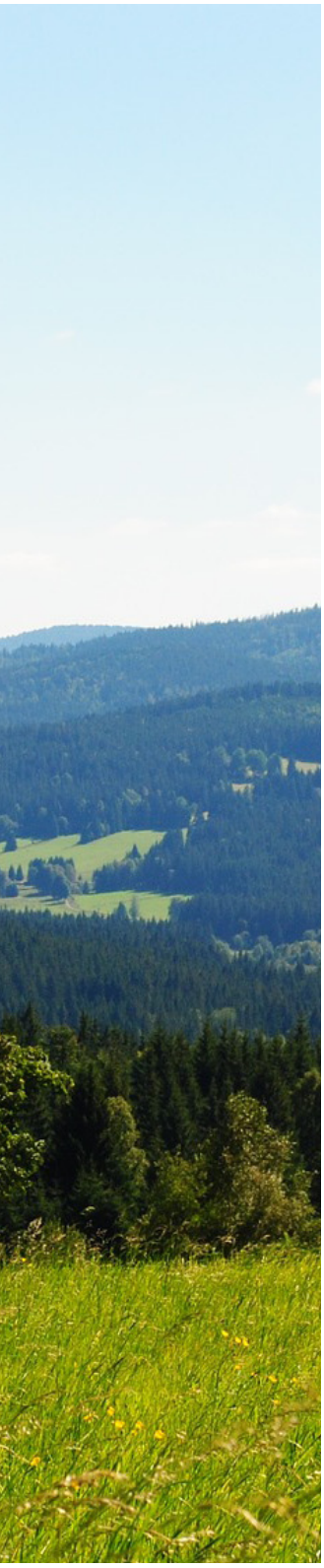

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Disclaimer

Glossary

Bioeconomy	The bioeconomy covers all sectors and systems that rely on biological resources (animals, plants, micro-organisms and derived biomass, including organic waste), their functions and principles. It includes and interlinks: land and marine ecosystems and the services they provide; all primary production sectors that use and produce biological resources (agriculture, forestry, fisheries and aquaculture); and all economic and industrial sectors that use biological resources and processes to produce food, feed, bio-based products, energy and services. *(Source: European Commission (2018). A sustainable bioeconomy for Europe: strengthening the connection between economy, society and the environment. Updated Bioeconomy Strategy. p. 4)*
Cluster	Clusters are geographic concentration of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (for example, universities, standards agencies, and trade associations) in particular fields that compete but also cooperate. *(Source: M. Porter (1998). On Competition, Updated and Expanded Edition. Harvard Business Review Book, p. 213)*
Cluster initiative	Cluster initiatives are organised effort to increase the growth and competitiveness of a cluster within a region, involving cluster firms, government and/or the research community. *(Source: Ö. Sölvell, G. Lindqvist and Ch. Ketels (2003). The Cluster Initiative Greenbook , p. 9)*
Cluster organisation	By a cluster organisation one should understand organised efforts to facilitate cluster development, which can take various forms, ranging from non-profit associations, through public agencies to companies. *(Source: PricewaterhouseCoopers (2011). Uncovering excellence in cluster management, p. 6)* Cluster management can be defined as the organisation and coordination of the activities of a cluster in accordance with certain strategy, in order to achieve clearly defined objectives. *(Source: PricewaterhouseCoopers (2011). Uncovering excellence in cluster management, p. 3)*
Eco-innovation	Eco-innovation aiming at significant and demonstrable progress towards the goal of sustainable development. Eco-innovation projects will therefore aim to produce quality products with less environmental impact, whilst innovation can also include moving towards more environmentally friendly production processes and services. Ultimately, they will contribute towards the reduction of greenhouse gases or the more efficient use of various resources. *(Source: European Commission (2015). Eco-innovation, When business meets the environment. FAQ: What is Eco-Innovation? Online).*
Value Chain	The value chain describes the full range of activities that firms and workers do to bring a product from its conception to its end use and beyond. A value chain refers to the full lifecycle of a product or process, including material sourcing, production, consumption and disposal/recycling processes. This also includes activities such as design, production, marketing, distribution and support to the final consumer. *(Source: University of Cambridge (2017). What is a value chain? Definitions and characteristics. Online).*

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1. The Bio-based Economy

Climate change and decreasing biodiversity are critical problems for modern society which must be tackled in order to protect our planet. Fossil resources are finite, and alternatives need to be developed. Another issue that should not be underestimated is sustainable consumption – currently a major focus of attention among academics as well as in many other fields. So how can we best tackle these issues, and where can we seek solutions?

This is where the bioeconomy (also known as the bio-based economy) comes into play. The bioeconomy is defined as "the production and utilization of biological resources (including knowledge) to provide products, processes and services in all sectors of trade and industry within the framework of a sustainable economy". The aim of the bioeconomy is to make the carbon stored in renewable resources accessible for industrial value-added chains. This may mean using food and feed crops for the sustainable production of food and feed products. Alternatively, it may mean utilizing specific technologies (e.g. biogas plants, biorefineries, gasification and other conversion methods) to convert plants, residual biomass and biowaste into ethanol, methane, phenol, biopolymers, pharmaceuticals and many other products for use in industrial applications. Those involved in the bioeconomy are keenly aware that natural resources (such as arable land and water) are limited, so there is a concerted focus on sustainability, resource efficiency, and material/waste cycles. As a result, the burden on individual resources is considerably lower than in fossil-based economies. Furthermore, the technologies associated with the bioeconomy can open up additional development potential for rural areas. This applies to countries that have large areas available for agriculture and forestry. By unlocking such new opportunities, the technologies used in the bioeconomy can facilitate progress.

The concept of the bioeconomy is gaining traction and prominence worldwide. A number of countries have already launched their own bioeconomy strategies, and many more are working towards this. The European Union promotes the bioeconomy in a variety of ways; national and European governments have established many programmes in recent years aimed at fostering the bio-based economy.

The Danube Region too is seeking to build an innovative economic system that makes sustainable agriculture and the industrial use of renewable resources possible while also protecting the environment and safeguarding biological diversity. Furthermore, eco-innovations are likely to boost regional growth by diversifying local economies and creating new employment opportunities. New bio-based value chains (leading from primary production to consumer markets) need to be developed by bringing together enterprises from different regions and industries. However, no holistic transnational approach currently exists, so bio-based industry stakeholders in the Danube Region are not able to act in a connected way or properly benefit from existing potential.

This is where the DanuBioValNet project ("Cross-clustering partnership for boosting eco-innovation by developing a joint bio-based value-added network for the Danube Region") comes into play. The project is financed by the EU under the Danube Transnational Programme. Its main aim is to develop new methods and tools to connect businesses (SMEs) from different regions and countries involved in bio-based industry. This can only be achieved through effective, coordinated interaction among relevant stakeholders – including policymakers and participants from industry, public institutions and academia. The stakeholders in the DanuBioValNet consortium come from ten countries in the Danube Region. Clusters representing a number of companies are sustainable partners which guarantee upgradeability across industry, science and government, and they have been selected to coordinate cooperation among the industrial partners and to spearhead the creation of new value chains. The project focuses on three bio-based value chains – phytopharma, bio-based packaging, and eco-construction – and it also forecasts their future development in the Danube Region. The vision is for the region to become a front-runner in the bioeconomy by supporting "bioeconomic distributed manufacturing environments" to achieve manufacturing scenarios that use locally available renewable raw and residual materials for conversion into locally required materials.

2. The Formation of Closed Bio-based Value Chains

2.1 Competitive Danube Region

The Danube Region possesses good potential for biomass production due to the large available area of forests and agricultural land in all project partner countries. Forests make up a significant proportion of the landscape in the Danube Region: in Montenegro they comprise 70% of the country's entire area, in Slovenia 63.3%, in Croatia 47%, and in both Austria and Slovakia 42%. In fact, Romania has the largest area of old-growth forests in Europe. Woodland and forests have traditionally been very important in the DanuBioValNet countries – ecologically, economically and socio-culturally. They contain a great diversity of species, ranging from broad-leaved trees (with oak and beech the most widespread species) to conifers (mostly spruce and pine).[1] According to the latest data provided by the project partners, almost half of the territory of the participating countries (49.4%) consists of agricultural land. This includes arable land, permanent crops, agricultural grasslands and horticultural land. The proportion of agricultural land is well above the EU-27 average (40% of the total land area in 2014). A wide variety of agricultural crops are cultivated in the Danube Region. Most of the land is used for cereal crop production (wheat, barley, rye, oats, maize, millet, sorghum – Romania and Serbia rank among the top 5 maize producers in Europe), oilseeds (particularly rape, soy and sunflowers), vineyards and orchards, wild and cultivated medicinal plants, grass, clover, and alfalfa.

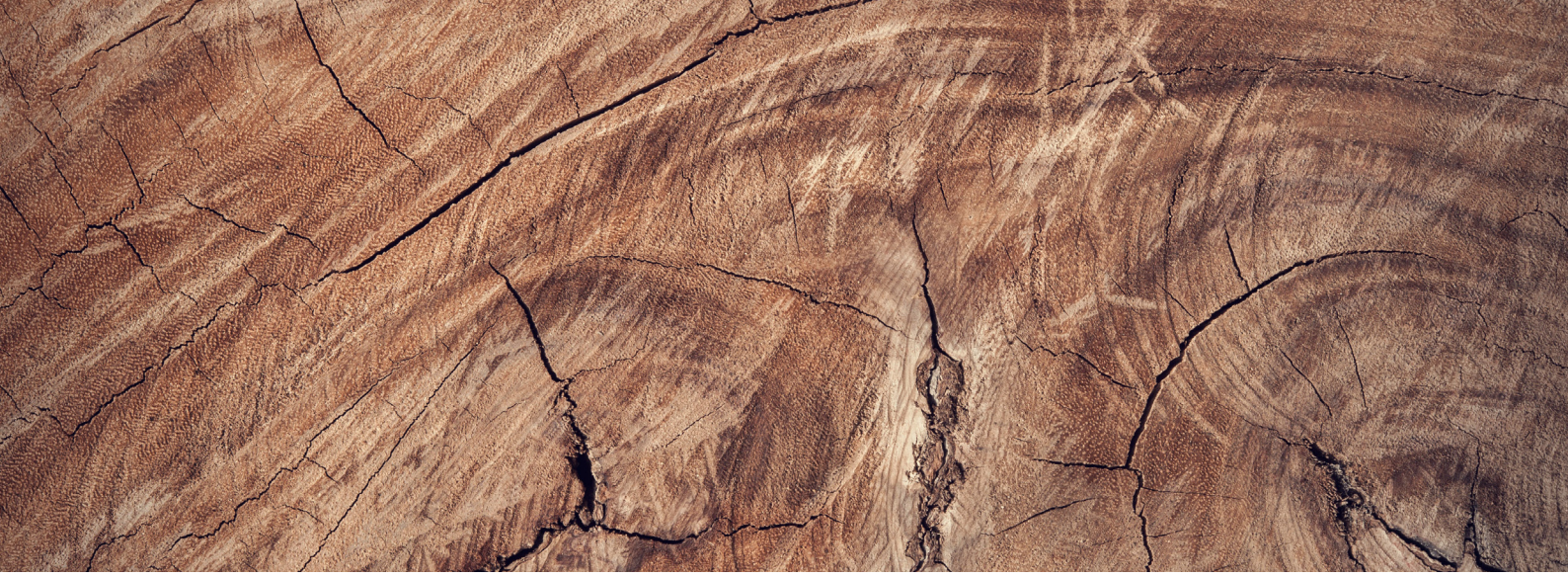
Figure I: Area of forested land

x axis = DanuBioValNet countries;
y axis = area of forested land as a percentage of total surface area

Figure 2: Area of agricultural land

x axis = DanuBioValNet countries;
y axis = area of agricultural land as a percentage of total surface area

1) Dermastia, M. & Maric, Z. (2017). The Bio-based Status in the Danube Region Report. DanuBioValNet.



Wood, agricultural biomass and bio-waste are the most important biomass sources in the Danube Region. However, their industrial use varies in different parts of the region. In most cases, the biomass that is not used for food and feed is used as a primary energy source for power and heating plants, for domestic use (combustion), and for the production of biofuels and biogas. Agriculturally produced bio-based feedstock is now used in the production of medicines, cosmetics, food, fine chemicals, construction materials, textiles, chemical building blocks, and fuels for electricity production or transport. A highly developed bioeconomy uses green resources firstly in the production of food and feed, and only afterwards (or simultaneously in the case of waste products) to produce chemicals, materials and energy. This is known as the cascading principle.

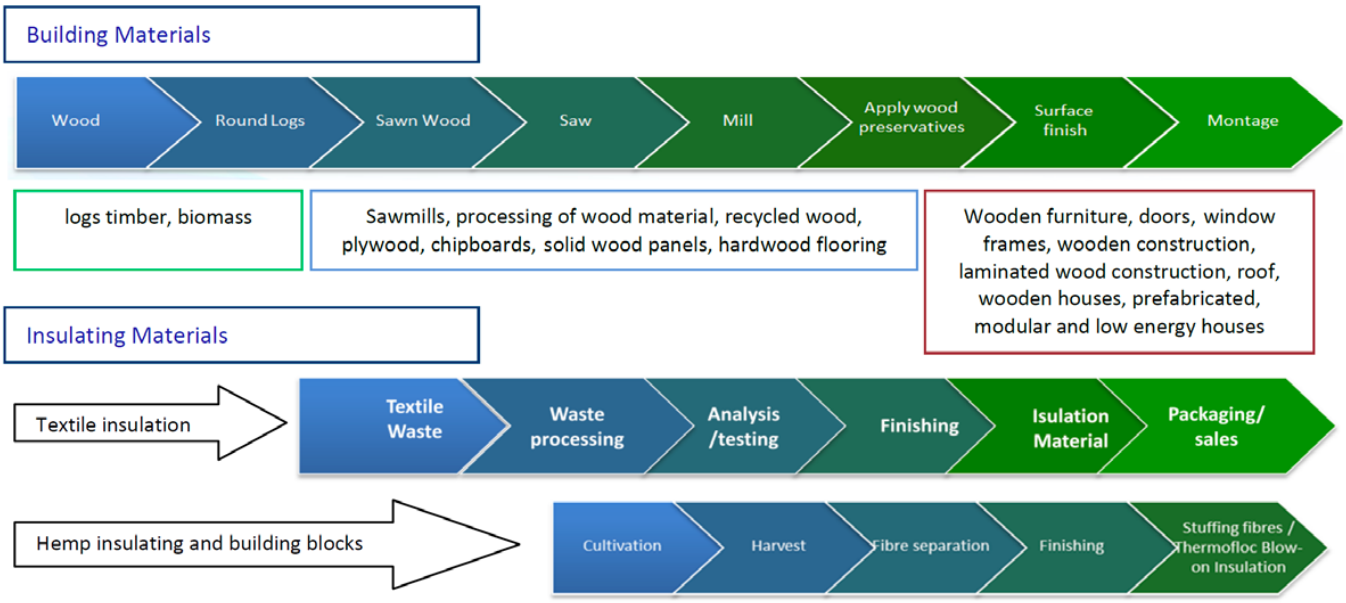
The industrial structure of the DanuBioValNet participating countries includes all industries related to the bioeconomy. An analysis of the strengths and opportunities of the bioeconomy in the DanuBioValNet countries shows that all ten Danube countries/regions possess good preconditions for conversion to a bio-based economy in terms of their natural geographic conditions and resources, traditional industries, R&D infrastructure, and high-quality human resources. This capacity also offers new opportunities to complement traditional products with new products and services in order to maintain and boost the region's competitiveness. In addition to the potential within the industrial sector (where agriculture and forestry have long played a key role), the development of the bioeconomy also offers inherent opportunities for the increased use of biomass raw materials within other commercial sectors. This applies to areas such as plastics and biopolymers, construction, phytopharmaceuticals and packaging.

2.2 The Eco-Construction Value Chain

Eco-friendly construction (eco-construction) involves building structures that are beneficial or non-harmful to the environment and are also resource-efficient. Also known as green building, this type of construction is especially efficient in its use of local and renewable materials (wood, sheep wool, natural fibre-based insulation and others). Eco-construction is likewise resource-efficient in terms of its energy production and consumption, as it focuses on obtaining the required energy from green sources. Eco-construction has developed in response to the knowledge that buildings often have negative impacts upon our environment and our natural resources. These negative impacts include transporting materials hundreds or thousands of kilometres, which increases the energy required for transportation; another issue is the emission of hazardous chemicals from a poorly designed building that creates and traps them.

Important producers (ranging from round log processors to producers of end products and bio-based insulation material) from 8 countries/regions were interviewed in order to map the eco-construction industry's value chain. The figure below illustrates the structure of the eco-construction value chain for the purposes of the DanuBioValNet project.[2] The entire value chain of the eco-construction sector (i.e. all the value-adding steps which make up the chain) is represented in the Danube Region.

Figure 3: DanuBioValNet eco-construction value chain



The above illustration of three simplified eco-construction value chains consists of several levels – starting from the raw material (which may originate from forestry, agriculture or waste recycling) and passing through several refinement steps before reaching the final product.

The companies in the first part of the wood processing value chain use raw wood material, sawdust and recycled wood. The companies at the end of the value chain use the final timber/wood products (e.g. chipboard, plywood, veneer, DTD, OSB boards, MDF, LTD, HPL laminates) purchased from their suppliers. Textile waste is the raw material for the production of insulation material, and other resources (such as hemp from farms) is the resource material for insulation, facades, as well as hempcrete used in constructing houses. Wood material is usually sourced locally (from state-owned or privately-owned forests) and only in small quantities from abroad – mostly from neighbouring countries. Materials are imported in some special cases, e.g. if there is a need for higher-quality material or tree species that are not available in the required quantity in the country where the company is located.

A key requirement for the wood-based value chain is the quality of the material. Companies are generally not afraid of a lack of source materials, nor do they see substantial obstacles to obtaining more material in the future. Some expect lower prices and better quality (Slovenia).

Out of the current obstacles, almost all respondents identified the lack of a skilled workforce in the sector as the primary problem. Another issue is that clients often do not focus on eco-construction products, but are only interested in certification and price; the "eco"-impact is less important to them. There is also a lack of certified source material, and certificates are not valid across Europe (this is also the case with fire protection standards).
The eco-construction value chain challenge is substantial. Strategies to increase the use of eco-friendly construction materials are frequently absent, and support is needed on the national and European levels to stop illegal cutting.

Along the value chains there is only minor institutionalized cooperation with R&D centres; most cooperation is with individual experts rather than with organizations.

2) *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.*

3. Innovation Ecosystems for Closing Eco-Construction Value Chains

3.1 Sustainable Partners for Change: Clusters

A cluster can be understood as a geographic concentration of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (e.g. universities, standards agencies and trade associations).[3] By definition, enterprises in clusters naturally tend to align themselves along the value chain of a particular industry, harnessing and exploiting the positive spill-over effects of the network. Cluster organizations can help companies to better engage with other local actors within their cluster and to organize collective actions to strengthen their competitiveness.

Cluster mapping is the process of measuring the presence of cluster actors (companies, R&D institutions, public sector bodies) in a given region across defined sector-specific value chains. Cluster mapping, especially in "emerging industries" such as eco-construction, is of substantial importance as it enables us to better understand the key competencies of the cluster actors as well as to evaluate the extent to which the relevant value chain is properly covered.

There are numerous cluster initiatives in the field of eco-construction, many of them well established and with a good critical mass. Selected cluster initiatives in the eco-construction sector within the Danube Region are listed in the table below.

Name	Country	Number of cluster actors	Establishment
Furniture & Wood Cluster Upper Austria	Austria	245	2000
Wood Cluster Steiermark	Austria	150	2001
Wood Cluster Salzburg/Pro Holz Salzburg	Austria	N. A.	2004
The Wood Cluster Slavonian Oak	Croatia	31	2010
Croatian Competitiveness Cluster of Wood Processing	Croatia	78	2013
Croatian Wood Cluster	Croatia	77	2013
Wood Chain Black Forest	Germany	200	
Wood Industry Cluster Slovenia	Slovenia	100	1999
SRIP Smart Building	Slovenia	N. A.	2017
Moravian Wood Cluster	Czech Republic	12	2010
National Wood Cluster	Czech Republic	22	2005
Czech Furniture Manufacturers	Czech Republic	29	2006
PRO WOOD	Romania	46	2010
Construct Cluster Oltenia	Romania	36	2013
Constructors Guild Iasi	Romania	26	2016
Timber Cluster	Serbia	19	2010
Hemp Cluster	Slovakia	32	2015
Czech Hemp Cluster	Czech Republic	N. A.	2018

3) M. Porter (1998). On Competition, Updated and Expanded Edition. Harvard Business Review Book, p. 213

3.2 Engaging New Business Models

The bio-based industries, such as eco-construction, have been identified as cross-sectoral, highly innovative industries in which most parts of the Danube Region possess complementary competitiveness advantages and strong potential that can be harnessed by the development of eco-innovation, thus contributing to the prosperity of the region as a whole. From this perspective, bio-based value chains require companies to adopt new technologies and to act as part of interconnected value chains (VCs). These VCs must bring together producers, users, service providers, academics and buyers within the individual parts of the Danube Region and connect them along the axis of the Danube. A systematic multilevel approach to improving framework conditions for eco-innovation in bio-based industries demands new tools and business models on all levels. Cluster services are the key tools enabling cluster organizations to support their cluster actors' efforts to innovate and become more competitive. The DanuBioValNet project has identified the most promising cluster services that cluster management organizations and other similar bodies may use when helping SMEs (including SMEs operating in bio-based industries, such as eco-construction, to engage in cross-sectoral innovation along VCs or when matching up appropriate partners in order to bridge existing VC gaps.

One outcome of the project is the Cluster Tool Box, which provides a variety of ready-to-use best-practice services supplied by well-established and competitive cluster management and business support organizations. The tools can be used by any cluster management organization or similar body seeking to facilitate competitiveness and enhance cluster excellence.

The main types of cluster services usually provided by cluster management organizations are:

- Innovation-related activities reaching beyond mere information-sharing: collaborative technology development, technology transfer, R&D etc.;
- Matchmaking and general sharing of information and experience among cluster participants (internal networking);
- Matchmaking and networking with external partners/promotion of cluster locations etc. (external networking);
- Business and commercial activities: export promotion, sales promotion, offshoring/outsourcing etc.;
- Entrepreneurship support;
- Policy support.

Practical examples of these cluster services form a part of the Cluster Tool Box publication "New Cluster Services to Support SMEs in Bio-based Industries".[4]

4) http://www.interreg-danube.eu/uploads/media/approved_project_output/0001/32/92be3e66154430dbe1e68b16d5fe324bd9068316.pdf

3.3 A Supportive Environment

In order to successfully develop the eco-construction industry in the Danube Region, a supportive environment, especially on the policy level, is an essential requirement.

In general, the bioeconomy is still in the emerging phase – despite the fact that some bio-based industry value chains, such as eco-construction, have already achieved good levels of development in the Danube Region. Nevertheless, the more effective involvement of policymakers, as well as stronger international links among them, could facilitate, synchronize and catalyze financing schemes and programmes for clusters and other actors in bio-based industries.

Eco-construction is an emerging market in the construction industry, and its future potential is huge. The demand for environmentally-friendly products is increasing every year due to the relatively wide variety of possible products. Given that this industry possesses very high potential, it should be backed by systematic and serious policymaking with structural and programmatic interventions. The Danube Region therefore needs to make a joint effort in designing a suitable pathway and taking actions as well as influencing and engaging all relevant policymakers. It is important to develop appropriate policy measures that can de-risk investments in this industry and to apply synchronized measures/funding schemes at the macro-regional level along the entire eco-construction value chain in order to plug existing gaps and fill missing links. To achieve this, it is essential to use follow-up Calls in order to implement all conclusions on the level of local and national politics, as well as on the cluster level.
To support activities that push the boundaries of knowledge forward, it is critically important to remain well-informed about evolving market tendencies and opportunities as well as to gain a better understanding of socio-economic and environmental impacts. Where certain gaps in the eco-construction value chain have been detected or highlighted, specific policy directives or programmatic measures can be of value.

The main socio-economic constraints on the eco-construction industry in the Danube Region were identified as the lack of general awareness about its positive environmental impacts, the lack of a skilled workforce, and low motivation among young people to work in the industry. In addition, consumers tend to be strongly focused on price rather than on environmental benefits.

Regarding policy, the business environment and legislation affecting the eco-construction industry, the Danube Region suffers from a lack of knowledge of biomass feedstock availability and a lack of support measures/financial incentives at national and EU levels; these are obstacles that need to be overcome.

The Danube Region should play a more proactive role, and some incentives and measures providing better support to the eco-construction industry should be introduced. Some particular measures are of particular importance: harmonization/upgrading of wood construction standards (e.g. fire standards), stopping illegal cutting, etc.

It would also be beneficial if policymakers (governments) took a more proactive approach, especially by promoting eco-construction (green buildings) and environmentally friendly approaches as a whole.

4. Eco-Construction: Designed for Sustainability

4.1 Future Perspectives for Eco-Construction

The eco-construction sector is fully integrated into the general construction industry. Important aspects of sustainable construction include constructing buildings on the basis of renewable and recycled raw materials, minimizing water and energy consumption in the construction process and during the building's operational life, and also conserving resources and protecting the environment while taking biodiversity into account.[5] In an extensive report entitled The Challenge of a Greener European Construction Sector: Views on Technology-Driven (Eco) Innovation, Sergio Jofre (2011) stated that due to the transformation in the framework conditions at EU level, the eco-construction sector is undergoing several significant changes, such as the increased role being played by renewable resources. These changes have been brought by the strengthening of internal markets, the development of new services, and a well-established European market in construction materials.

Comparing green buildings with regular buildings (which have a negative impact on the environment and natural resources), more benefits of the eco-construction sector become clearly visible. These benefits include better access to research and innovation programmes supporting knowledge creation and networking, increased levels of innovation and technological development, intensified servicing, customer satisfaction (producing positive financial impacts), and last but most importantly, the positive environmental effects.[6] The environmental benefits, both direct and indirect, are nowadays driven by technologies which offer wide scope for application in sustainable building. Among the most dynamically developing areas where environmentally-friendly technologies play a role are photovoltaics, insulation, thermovoltaics, lighting, water purification, environmental sensors, and land/air remediation. As public awareness of key environmental issues and their solutions continues to grow rapidly, framework conditions are also likely to change, as more and more people will become interested and involved in eco-friendly construction solutions. Innovation in the eco-construction sector is related to the development and accessibility of new technologies.

Eco-construction is an emerging market in the construction industry, as interest in resource efficiency is catching up with interest in energy efficiency. Every year, demand for a multitude of environmentally-friendly products continues to increase. These new products emerge from new technologies and innovation driven by wood-based construction, such as multi-storey wooden buildings, eco-friendly insulation (straw, paper, hemp, cellulose and wool), composite beam design, smart eco-houses, 3D printing, etc. The costs of eco-based composite materials and prefabricated structures are expected to decrease, making them more affordable to a wider range of customers.[7]

5) https://www.biooekonomie-bw.de/de/fachbeitrag/dossier/nachhaltiges-bauen-aktiver-klimaschutz/
6) EC. (2016). The European construction sector. A global partner. Ref. Ares(2016)1253962 - 11/03/2016
7) Dermastia, M., Maric, Z. & Meier zu Köcker, G. (2017). Synthesis value chain mapping report Eco-Construction. DanuBioValNet.

4.2 Future Perspectives for Eco-Construction in the Danube Region

The wood processing industry in the Danube Region has a long tradition and is very well-developed, with strong know-how, research capabilities, quality and design.6 However, the idea that complex building structures could potentially be completely made of renewable materials (such as hemp – e.g. hempcrete, wood foam, typha, sheep wool, green fixing systems such as dowels, and many others) is quite new to the sector, and cross-sectoral cooperation is essential. At the same time, related industries are making their own efforts to advance the development of products using renewable materials. These include the textile industry (insulation materials), packaging production (compressed and pressed cardboard), agriculture (insulation materials), the automotive industry (textile waste) and others, such as non-toxic paints, wood preservatives, low energy light bulbs, and IT for smart houses.

In regions with a highly developed eco-construction industry, young people are interested in working in this sector, so the lack of a skilled workforce in other regions could be solved by training programmes at regional level, with external trainers teaching the new technologies, parallel or dual education provision already at secondary school level, and – crucially –practical training (learning by doing) and programmes at technical colleges. Additionally, the lack of communication between industry and education on the one hand, and architects and technicians on the other hand, could be addressed by fostering better cooperation among these actors, organizing events that combine business and research/education perspectives, integrating digitization into training programmes, and organizing study tours and mentoring schemes.[8]

Wood should be considered in the context of global warming, as carbon storage in wood products is quite significant.7 Consequently, life cycle cost calculation methods should take into consideration the complete process, from the initial planning phase until the end-of-life options for wooden materials used in construction. An increased number of wood-based (or hybrid) buildings in cities would raise awareness and make these structures more acceptable for the public.7 Another way to promote wood-based buildings would be to implement pilot projects such as the Customer Information Centre and Event Forum “Haus des Brotes II” (“House of Bread II) in Asten. Increased visibility of wood-based construction for young people could be achieved by building more wood-based kindergartens and public buildings such as schools.[7]

Considering all the benefits of eco-construction products, efforts should be made to promote them at various levels. Special attention should be paid to the problems caused by the lack of institutionalized cooperation between R&D centres and companies (beyond the R&D projects initiated by clusters in which companies can also participate). Lobbying organizations for wood could be used to communicate the ecological, economic and structural advantages of wood as a building material and to encourage its increased use.[7]

The state should play a more proactive role; incentives and measures providing better support to the eco-construction industry should be introduced, and it is also important to harmonize the different regulations concerning wood construction in different countries. Measures may include standardized funding schemes, harmonization/upgrading of wood construction standards (e.g. fire standards), as well as stopping illegal cutting. On a regional level, support for innovation should be provided to SMEs via adequate funding or other measures.[7]

8) Bruckner, A., Rogl, D., Eder, K. & Schönmayr, D. (2018). Roadmap Report. Eco-Construction Value Chain. DanuBioValNet.

4.3 Next steps

Energy efficiency and the sustainable use of materials are becoming more important, and these issues need to be approached in an integrated manner. 50% of commodities consumption and 60% of waste production originate from the construction industry.[9] It is necessary to rethink the entire construction process in order to minimize its negative impacts on the environment. The wider use of renewable insulation and construction materials could have a positive impact on resource efficiency within a region.

Ongoing urbanization produces increased demand for housing, which creates a need for rapid construction methods with low emissions. Architects, investors and politicians should therefore seek solutions that enable sustainable and flexible living spaces to be built quickly and cost-effectively. Prefabricated timber-structure room modules offer flexibility, variability and favourable construction and operating costs, short construction times due to a high degree of prefabrication, and easy dismantling due to detachable connections and a high level of recyclability.[10]

Modern timber construction techniques are becoming an increasingly interesting option for multi-storey buildings, especially residential buildings in cities. The best practice example of the Dornbirn LifeCycle Tower in Vorarlberg, Austria (8 floors), has shown that it is possible to achieve 40% less building weight and 50% less primary energy ("grey energy") compared to a standard concrete building.[8] Despite the comparatively higher raw material costs of wood, the LifeCycle Tower was less than 3% more expensive than a conventional reinforced concrete building. It should be noted that this calculation is based purely on construction costs and not on operating or life cycle costs – areas in which significant savings are achieved compared to a conventional reinforced concrete building.

Regions could benefit greatly from focusing on wooden multi-storey buildings in urban areas and wooden public buildings (community centres, kindergartens etc.). A focus on such projects could support a region's progress towards resource efficiency. With regard to both types of structure it is necessary to bring together architects, technicians, policymakers and construction developers in order to initiate further pilot projects in the Danube countries and to facilitate knowledge transfer.[11]

Strong collaborative links between researchers and industry should be created, in order to develop products from bio-based side streams of the wood processing industry which meet all the requirements of modern construction standards and sustainable building. In addition, SMEs in most of the Danube Region still have relatively limited access to R&D, which is a crucial activity for the development of bio-based products.

It is essential to raise awareness of the importance of eco-construction projects, especially with regard to the sustainable development of urban areas. Accordingly, it is important to involve customers in the process and to improve the incentive models that could encourage customers to purchase more bio-based products – which are still often more expensive than products made from non-renewable resources.[12]

9) Presentation Ecologisation of the local building industry - Energy Institute Vorarlberg, 13.03.2019
10) LifeCycle Tower Energieeffizientes Holzhochhaus mit bis zu 20 Geschossen in Systembauweise, Bundesministerium für Verkehr, Innovation und Technologie, 2010
11) Bruckner, A. & Boyarintseva, O. (2019). Pilot actions for closing bio-based value chains: Eco Construction – building with wood, recycling and reuse. DanuBioValNet.
12) Dijan, A. (2019). Pilot actions for closing bio-based value chains: Challenges and Opportunities of Eco-construction in the Southeast Europe. DanuBioValNet.

5. Solutions for the Danube Region: Bioeconomic Distributed Manufacturing Environments

The bioeconomy is a modern way of dealing with renewable raw materials and associated biological resources in an ecologically prudent and economically viable manner.[13] The transition from a fossil-based to a bio-based economy reduces society's dependency on fossil fuels, increases sustainability and contributes to environmental and climate protection. However, even though excellent initiatives and bio-based products already exist, this complex transition will not happen suddenly and unexpectedly; it will most likely take up to several decades. In order to succeed, this process must be wanted and prepared for by governments, science, industry and society – especially in the Danube countries, with their great diversity of cultures and landscapes. Moreover, this process must be gradually integrated into the existing value systems of all economic sectors – including industry, services and agriculture. Consequently, large-scale national and international programmes, cooperative measures and initiatives are critically needed. Measures also need to be implemented on the regional level in order to achieve a successful transition. An important feature of the bioeconomy is its strongly regional character – meaning that it primarily targets local resources which move along short supply chains. Regional bioeconomy-centred strategies will help bring the strengths of a region to the fore, making existing development potential more clearly visible and promoting the utilization of regional resources rather than relying on imports – thus making communities more self-sufficient. Furthermore, these regional strategies will integrate regional research and industry capacities, analyze material flows and establish interfaces with internal and external partners.[2]

Local bio-based product chain scenarios offer the potential for diversification in the local economy, creating employment opportunities in rural areas, yet many goods and services are still produced

13) Jonischkeit B., Bächtle C. (2013). Bioeconomy – Baden-Württemberg´s path towards a sustainable future.

only in specific parts of the Danube Region. Consequently, due to the re-orientation of the global economy into distinct transnational and local solutions, regions can benefit from local or regional excellence and competencies via cross-sectoral and cross-border cooperation.

Many new business models and income opportunities are to be found in distributed bio-based concepts, which not only contribute to positive environmental impacts, but are at the same time a powerful engine for economic growth in rural areas. Educated and competent people are needed to operate distributed plants and to design products and services with higher added value. Primary production, cultivation, and harvesting will be closely linked to secondary production and the utilization and recycling of products. New opportunities will thus arise not only in agriculture, forestry and fish farming, but also in the food, chemical, pharmaceutical and energy industries. This will boost manufacturing of technologies and equipment, and it will generate a need for knowledge-intensive services such as consulting and legal services in planning, operation, optimization and maintenance.[14]

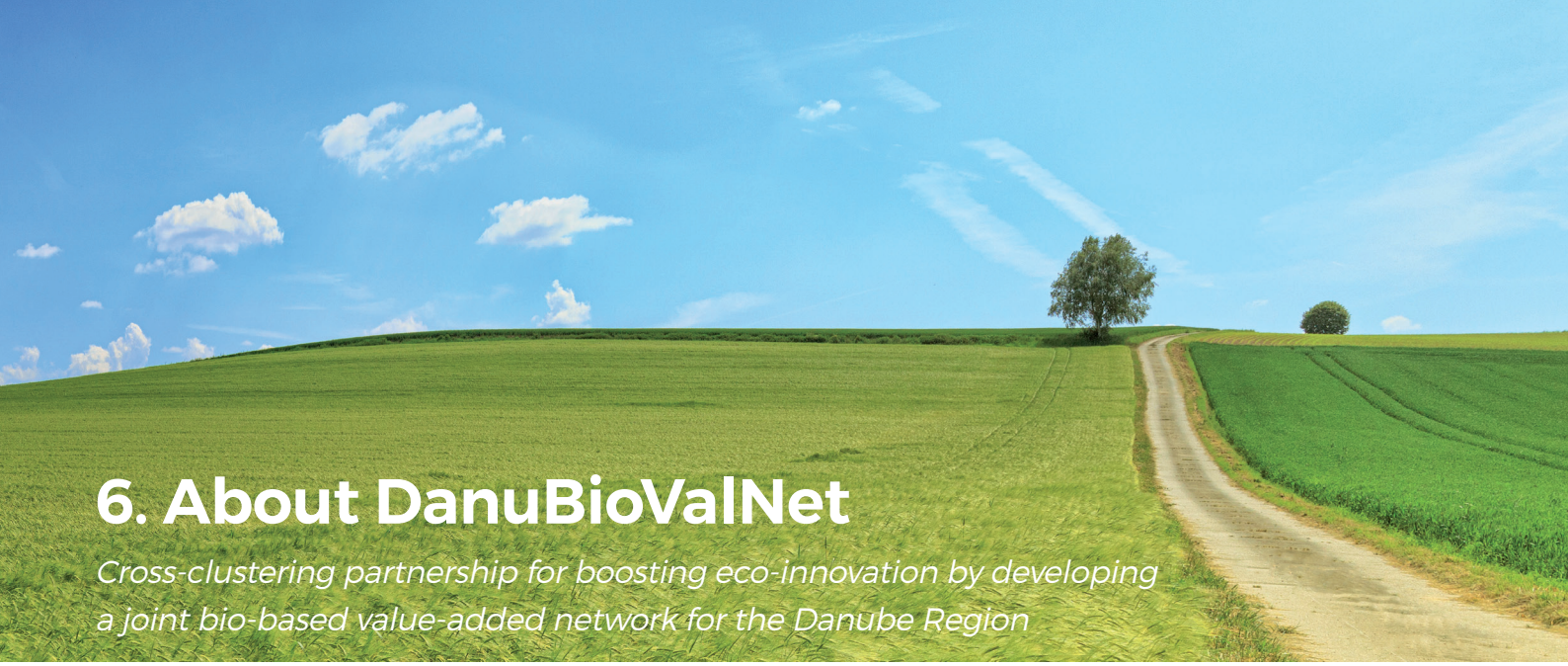
If properly implemented and managed, the approach described above – which is also known as the Bioeconomic Distributed Manufacturing Environments (BDME) approach – offers strong potential to help build a highly sustainable way of life by providing opportunities to substitute scarce resources with renewable ones. The BDME approach focuses on distributed manufacturing in order to achieve local manufacturing scenarios that use locally available renewable raw and residual materials in conversion processes in order to deliver locally required materials. The current idea is to develop a bioeconomy focused on the introduction of renewable resources and their conversion products as intermediates in existing value-added chains. In some more complex scenarios, value-added chains are interconnected with wider value-added networks, so that more sophisticated products can be developed. In this manner, all components of a particular plant (or another regionally available renewable resource) can be synergistically used. Examples may include the following:

1) Fully integrated eco-constructed buildings, in which all structural elements are made from renewable sources and high-tech bioeconomic applications (wooden buildings, bio-based fixing systems, bio-based insulation materials designed for sustainability and easily recyclable after end-of-life);
2) By-products from corn refined into glue for construction elements.

Such condensed decentralized manufacturing environments need machinery infrastructure of a highly integrated, scaled-down modular type. As this machinery is potentially transportable in 40-ft container setups, it means that modern logistics scenarios (in which raw material streams converge at conversion plants) are replaced by scenarios in which manufacturing equipment is used for the conversion of locally available resources. This joint usage of highly advanced technologies is applied especially by agricultural cooperatives. The applicability and economic sense of the BDME approach needs to be investigated by using value chain models as well as applying technological and economical manufacturing simulation tools.

The bioeconomy model is interdisciplinary, as it encompasses and influences many areas of the economy, science and society. Thus, the bioeconomy concept must be understood as a system, within which many subsystems and processes are interlinked. The transition from a fossil-based to a bio-based economy will only be successful when many stakeholders are involved and when we are ready to change our mindset.[15]

14) Luoma P., Vanhanen J., Tommila P. (2011). Distributed Biobased Economy – Driving Sustainable Growth
15) Jonischkeit B., Bächtle C. (2013). Bioeconomy – Baden-Württemberg´s path towards a sustainable future.



6. About DanuBioValNet

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

The DanuBioValNet project is a cross-clustering partnership which seeks to boost eco-innovation by developing a joint bio-based value-added network for the Danube Region. DanuBioValNet stands for the development of a joint bio-based industry cluster policy strategy, clusters connecting enterprises transnationally, new bio-based value chains in the Danube Region, and eco-innovations supporting regional development.

The DanuBioValNet project, launched in 2017 through a cross-regional partnership involving 17 partners from 10 Danube regions, will enhance the transformation from a fossil-based economy towards an economy using renewable resources by creating bio-based value-added networks. The project will connect Danube actors in bio-based industry to minimize greenhouse gas emissions and optimize biomass resource utilization. These measures seek to enhance sustainability and regional development through diversification of the local economy, with a positive impact on the workforce. The focus on emerging transnational cooperation among clusters will serve to foster the bioeconomy and eco-innovations, leading to a strengthening of regional economies.

In order to develop new bio-based value chains leading from primary production to consumer markets, it is essential to connect enterprises from different regions and industries. However, due to the current lack of a holistic transnational approach, the Danube actors in the current bio-based industry still operate disconnected from each other, and cannot properly benefit from their mutual potential. Therefore, the aim of this project is to develop new methods, strategies and tools to connect enterprises transnationally. Clusters represent groups of industries that are closely linked by their products, markets, technologies and interests. They are chosen to organize and spearhead the industry cooperation that is necessary to create new value chains. Properly performing clusters can help upgrade industrial practices, generate new knowledge, and contribute to regional policymaking.

The partners in the DanuBioValNet project have agreed that phytopharma, eco-construction and bioplastic/advanced packaging (bio-based packaging) are three areas where there exists strong potential for improvement in their respective value chains; hemp is considered to be an appropriate raw material for all three value chains. The project activities are designed to enable partners to form links with SMEs, farmers, universities and research institutes within the value-added DanuBioValNet network. The partners intend to develop and implement a long-term, industry-driven roadmap for this collaboration encompassing the entire value chain, based on cluster partnerships. Focusing on the three selected high-potential areas, and harnessing the potential of regional clusters within wider cross-regional value chains, DanuBioValNet will implement pilot actions involving SMEs, universities, research institutions, policymakers, civil society groups and other stakeholders. The pilot actions are an essential first step before creating a blueprint for cross-regional cooperation.