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

Interreg

EUROPEAN UNION

Danube Transnational Programme

DanuBioValNet

# Synthesis Value Chain Mapping Report BioBased Packaging

**WP3 D-3.3.1**

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

This report has been produced within the frame of the DanuBioValNet project (Activity 3.3 Value Chain Mapping, Deliverable 3.3.1), funded by the Danube Region INTERREG Programme of the European Commission. It was prepared by Gregor Švajger (Slovenian Ministry of Education, Science and Sport), Dr. Gerd Meier zu Köcker (ClusterAgentur Baden-Württemberg), and Mateja Dermastia (Poly4EmI, Slovenia).

This report was drafted with input gathered from all project partners over the second phase of the project implementation (July – December 2017). The authors would like to thank all partners for their contributions and significant efforts.

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For further information about the DanuBioValNet project, you will find a short description at the end of the document. To learn more and to download additional resources please refer to the project website http://www.interreg-danube.eu/approved-projects/danubiovalnet.

The information is provided without assuming any legal responsibility for correctness or completeness. The data presented in the report are based on the information given by the project partners.

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# INTRODUCTION

The DanuBioValNet project, launched in 2017 through a cross-regional partnership involving 17 partners from 10 Danube regions, will enhance transformation from fossil-based economy towards an economy using renewable resources by creating Danube bio-based value-added networks. The project will connect Danube actors in a bio-based industry to minimise greenhouse gases and to optimise biomass resource utilisation. These effects will improve the sustainability, regional development through diversification of the local economy and will positively affect the workforce. The emerging transnational cooperation of clusters is put in the focus to foster bio-economy and eco-innovations and lead to a strengthening of the regional economies.
Partners agreed that phytopharma, eco-construction and bioplastic/advanced packing (bio-based packaging) are high potential value chains that allow partners to connect SMEs, farmers, universities, and research institutes within a value-added DanuBioValNet network. The partners intend to develop and implement a long-term, industry-driven roadmap for such collaboration along the entire value chain based on cluster partnerships for these processes. Focusing on the selected high potential, and harnessing the nature of regional clusters within wider cross-regional selected value chains, DanuBioValNet will implement pilot actions, involving SMEs, universities, research institutions, policymakers, and civil society among others. The pilot actions serve as the prerequisite for creating a blueprint for cross-regional cooperation.

## VALUE CHAIN MAPPING

The present Value Chain Mapping Report is the third key deliverable of the project. It is the first Value Chain Mapping Report in the Danube region. Coinciding with the period during which the block chain technology proved to change the added value creation logic and with the time that perception of strategic timeframe shrinks to one year and less.
The findings and conclusions of this report summarise the regional Value Chain Mapping Reports, with the specific focus on the missing links, main gaps, and constraints along the selected value chain and illustrate the most promising cooperation areas within this particular value chain. The report also provides observations and considerations to be taken into account of the upcoming roadmapping activity. The report follows the guidelines stipulated in the approved application form. This report also takes into account the learning and feedback received during a discussion with a partner, the kick-off conference in Prague, and the SCOM meetings.

## OBJECTIVES OF THE REPORT

The report's objective is to provide an overview of the interviews conducted with representatives of the bio-based industry in the DanuBioValNet region. The report should serve to highlight the tendencies and patterns that emerge from the aggregate information collected through the interviews. To reach the particular respondents, the contacts and networks of the clusters were used, or, when there is no cluster organisation identified, the interviews were done with the companies perceived as market leaders.
The summary statements relating to the topics listed below are based on the total number of cases interviewed. All respondents are anonymous.

## METHODOLOGY

The initial value chain of bio-based packaging was developed among the project partners based on the research for relevant information material, among them studies, reports, global market studies, academic papers, including related policies. The lead partner provided a predefined value chains structure as base for further considerations. The regional reports on Bioeconomy (WP 3.1) identified three most promising value chains. It was supplemented with series of methodological templates on how to do the cluster mapping along selected value chains. In close collaboration cluster managers, and regional stakeholders/project partners completed the value chain and cluster maps, including NACE codes which describe the structure of three related industries: phytopharma, bio-based packaging, and eco-construction. Partners were encouraged to conduct the quality check on information received (activity and corresponded NACE Code). The quality check was performed with back calls to the cluster managers and selected firms.
Given that the ultimate interest is to stimulate value added activities in selected regions of Danube, it is useful to understand the current and potential market considerations appropriate for each of the value chains. In the context of end markets, the value chain assessment explores the critical success factors of DanuBioValNet value chains to gain insight into the related gaps and to understand the primary drivers of value chain development. For the purpose of this activity, end market analysis is defined in terms of end market producers that are selling final products to the end consumer. The face-to-face interviews were conducted to collect related information. Three task groups were established among the DanuBioValNet partners to elaborate questionnaires for the value chain mapping. The groups were formed based on the motivation of partners and regional strengths in each of the selected value

chains. Questionnaires were semi-structured by nature aims to be used for face-to-face interviews. All project partners, in cooperation with cluster managers, conducted face-to-face interviews with selected end manufacturers in the region (see more in the regional Value Chain Mapping Reports). Questionnaires were analysed and findings were used for the identification of common gaps and constraints and promising cooperation areas. Partners discussed the findings and ideas at the workshop held in Stuttgart on December 5th, 2017.

Partners finalised the activity by drafting regional Value Chain Reports. The following table provides an overview of what value chain analyses were conducted in each of the project partner regions. Some regions covered all three value chains, while other covered only two or one, depending on regional preferences.

**Table 1:** Overview of conducted Value Chain Analyses in each Project Partner Region (Source: Regional Value Chain Reports)

| | ECO Construction | BIO Packaging | Phytopharma |
|---|---|---|---|
| **Romania** | X | | |
| **BW Germany** | | | X |
| **Upper Austria** | X | X | |
| **Czech Republic** | X | X | X |
| **Croatia** | X | | |
| **Slovenia** | X | X | X |
| **Slovakia** | X | X | X |
| **Serbia** | X | | X |
| **Bulgaria** | X | | X |

Along those lines, the objective of this report is twofold. First, it summarises findings of regional reports on value chain mapping. Second, it provides vital observations to be taken into account in the roadmapping of the selected high-potential value chains.

### STRUCTURE OF THE REPORT

The rest of the report is organised as follows. The next section provides an introduction to the bio-based packaging value chain methodology. Chapter 2 presents a summary of findings of regional reports on value chain mapping and the following chapters provide some vital observations to be taken into account in the roadmapping exercise of the selected high-potential value chains.

This report's aim is to assess the situation of bio-based packaging in Danube region based on conducted interviews and represents opinions of the interviewed respondents from the bio-plastic industry. It is intended to give an overview of the current situation and future development. So, it should stress what the biggest challenges and obstacles at the moment are and what must be done to strengthen the sector, both in Danube region and in Europe. Currently, it is a niche market in the region and there is still a lot of research required to turn it into a strong industry. Besides, better cooperation with R&D facilities and also better collaboration across European countries is necessary. The preconditions would be given as all surveyed companies are interested in closer cooperation in the Danube region. Respondents are all part of the wider network of plastic producers and members of regional clusters, for instance, plastic cluster Plasttehnika in Slovenia, Plastic Cluster and Czech technology Platform in Czech Republic, and Slovak Plastic Cluster. The summary statements relating to the topics listed below are based on the total number of cases interviewed. All the interviews were conducted on anonymous basis.

## BIO-BASED VALUE CHAIN

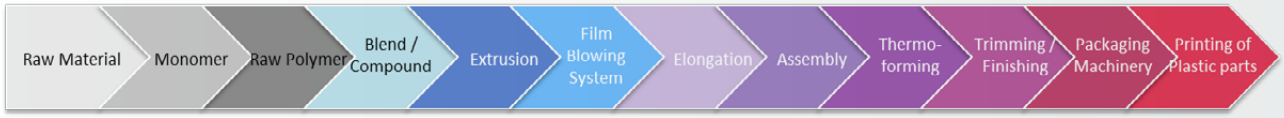
Bio-based packaging materials can be defined as "materials derived from renewable sources". In addition, such materials, recognised as biodegradable according to the standards outlined in related EU Standards, can be also understood as bio-based materials[1].

By the 1970s petroleum-based material replaced materials derived from natural resources. But this trend is about to change again since recent developments are raising the prospects that natural based resources will be a major contributor to the production of industrial products. Significant steps

1) Claus J. Weber (eds), 2000, Bio-based Packaging Materials, The Royal Veterinary and Agricultural University, ISBN 87-90504-07-0.

forward have been made over the recent past in terms of new products, material and processes that will bring down costs and optimise performance of bio-based packaging materials. At the same time environmental concerns are high on the policy agenda of industrial countries and public debates are intensifying the interest in agricultural and forestry resources as alternative feedstocks. However, the biggest challenge that remains is the development of new markets and costs and performance competitive bio-based packaging materials. A high potential market for such materials is the food packaging, a highly competitive area with increased demand from the market side. Many national and multinational initiatives further fuel the demand for new bio-based packaging material. Among others, compostability, which is a very appealing property when the packaging meets its end of useful like, is a key functional behaviour to successfully reach the goal of Circular Economy.

**Figure 1:** Value Chain for Bio-based Packaging Sector (source: DanuBioValNet)




The respondents of the survey represent different companies within the bio-based packaging industry, mainly operating in the end of the related value chain.

**Table 2:** Interviewees and the Value Chain notes covered

| Country | A | CZ | SI | SK |
|---|---|---|---|---|
| **Number of companies** | 5 | 4 | 4 | 4 |
| **The size of the companies** | SMEs; big companies | SMEs; big companies | SMEs | SMEs |
| **Main areas covered** | Producers | Printing, producers | Producers | Producers |

In **Austria**, most of the companies interviewed were founded several decades ago. The production of bio-based (advanced packaging) materials plays a subordinate role in comparison to the overall production output.
The range goes from 1-10 %, representing advanced bio-based materials compared to the total units produced. It should be noted that four of the five companies surveyed have their own research department for the further development of biopolymers, and that they also work closely with universities and universities of applied sciences. The majority of the companies (4) are producing packaging materials for the food and pharmaceutical industries. One representative produces spice mills and containers for the pharmaceutical industry.
Interviewed companies in **Slovenia** produce packaging products from polymers and are Small-Medium Enterprises, with 5 to 240 employees. Three companies produce and sell their own bio-based packaging products and one is looking into developing bio-based products – they sell bio-based products from other brands. Interviewed companies stated that the development of the bio-based products is time and cost consuming and hope this will improve within the next years. Three companies sell their products directly to other wholesale business, while only two offer products or brands for general consumers. All of the companies stated that bio-based products sales consist of 5-8 % of their overall income.
The respondents of the survey in **Czech Republic** represent the companies in the field of production of plastic packaging, rubber and plastics storage and packaging. The interviewed companies are middle-sized (51-250 employees) and big-sized (more than 250 employees). Regarding the bioplastic products, there are big differences between the companies. Some of them do not have any product on the market right now, but they do the research on bioplastic packages especially for the food industry (yogurt packages, coasters). Companies reported that bioplastic products are available in their portfolio even if they do not produce it currently due to a lack of interest of customers (high price of the products). Other interviewed companies stated that their current product range of bioplastic products is significantly less than 1 % of their total production. Regarding the technologies of bioplastics processing, the respondents mentioned, among others, the blown film extrusion, moulding, injection moulding with subsequent shaping and subsequent printing (manufacture of bags and sachets made of film). They are also able to print with bio-colours.
**Slovakian** interviewed companies have production lines for extruding, film blowing, injection

moulding and also thermoforming, whereby half of them have given production lines in order to be able to develop and test a large scale of defined applications for biodegradable material. Given companies are also focused on the production of biodegradable plastic semi products – blends –, in order to introduce those materials into different plastics applications. Although they use also the bio-based plastics, such production currently forms negligible percentage of their activities.

The bio-based plastics are used mainly for the production of packaging materials, but given production is not at the commercial level – all bio-based plastics are still at the testing phase. There is a specific form of cooperation among the interviewed companies – two of them develop biodegradable compostable plastics materials, while the other two test the production processes on their technologies.

## SUPPLIERS OF THE SOURCE MATERIAL

The source materials for further processing are very different and widely distributed, but the most important raw material is Polyactide (PLA). Other starting materials, which are mainly used, are Polybutylene succinate (PBS), cellulose acetate, bio-based Polyethylene (PE), biodegradable polyester and starch. All companies from the region reported that quality, price and processability are the most important criteria when purchasing their raw materials. Most of the source material comes from distributors from Germany, France, Italy and from outside Europe, for instance from USA and Brazil. Czech companies also buy the bioplastics foils, which are suitable for food industry (contact with food), from the USA, Japan, and Great Britain. For future perspectives, regarding the availability of source bio-based material companies stated that they expect lower prices, better supply and 100 % biodegradable material to replace current source material. One company answered that the road to that adaptation will be hard and will have to include improved public view of plastic packaging, impact on environment and public health.

## RELATED INDUSTRIES AND SUPPORT SERVICES

The most relating industries, now and probably also in the future, are the food and pharmaceutical sector. Especially stronger cooperation with food processing and manufacturing companies are key to further develop bio-based packaging materials. The pharmaceutical and especially the phytopharma sector are also interested in new packaging solutions and thus can be a promoter. Only if sufficient customers are available the sector of bio-based packaging materials can produce cost-effectively and thus reduce the prices. Main technology for processing of bio-plastic is injection moulding and all companies mentioned same disadvantages, i.e. processing temperature. One of the respondents did state though, that they do a lot of in-house testing of the processing technologies and material quality, so they significantly improved the process and lowered risks. For all of the companies R&D activates are important and most of them were involved in the projects under EU framework programmes. They are also looking for future funding under similar conditions. Support services for the companies in the bioplastics industry are mainly done through the research activities of universities and research centres.

According to the answers of the respondents, customers want the bioplastic shopping/advertising bags (from „eco"-friendly material) to accentuate their ecological approach and to support the natural character of their own products. Some respondents claim that the bioplastics/"green" lobby is the marketing issue, while the demand of biodegradable bioplastic packages is increasing slowly thanks to the efforts of companies to look more ecological and "green". Although bio-based packaging covers a wide range of products, respondents are focused mainly on the packaging materials, with the aim to produce 100 % biodegradable plastics.

In **Austria**, there is a possibility to cooperate with the following research institutes and Universities:

- University of Applied Life Sciences Vienna (BOKU),
- IFA Tulln – Department for Agrobiotechnology
- TCKT – Transfercenter for Plastics Technology
- TGM – Technologisches Gewerbemuseum (research institute)
- University Leoben – School of Mining – Department Polymer Engineering
- Wood K Plus – Kompetenzzentrum Holz GmbH
- Agrana Research Institute & Innovation Center (developing products made with starch).

Companies in **Slovenia** are cooperating with:

- University of Maribor Faculty of Mechanical Engineering
- University of Maribor Faculty of Polymer Technology
- University of Ljubljana Faculty of Mechanical Engineering,
- University of Ljubljana Biotechnical Faculty
- National Institute of Chemistry
- TECOS (Slovenian Tool and Die Development Centre) and other

The research activities of universities and research centres can be considered as support services for the bioplastics industry in **Czech Republic**. The companies cooperate with:

- Tomas Bata University – Centre of Polymer Systems
- Mendel University in Brno
- University of Pardubice
- University of Chemistry and Technology in Prague
- Independent packaging laboratories

Interviewed companies in **Slovakia** cooperate with the Slovak Technical University for the development of biodegradable compostable plastics and for the appropriate specification of materials and technologies used during production processes.

## QUALITY AND LABOUR FORCE

The majority of interviewed companies state that the key requirements when purchasing bio-based plastics are quality, price, and available volume. Regarding quality company representatives answered and stated that the quality of their products correlates to the source material quality and clients' needs and requirements. These are very strict when it comes to bio-based materials. Most of the quality guarantees comes from the supplier side, but they have additional in-house quality checks in place. Most of the companies in Austria, Czech Republic, Slovakia, and Slovenia are doing in-house research and development of their products and are collaborating with R&D facilities. This, in fact, is a good base for innovative product developments in the future. But according to the companies asked, many companies still face major challenges in the production of bio-based packaging materials.

The most important current obstacles that companies face to obtain more material are as follows difficulties to get material in volumes needed, high prices, life cycle assessment method, and standard production processes. Interviewed companies did not have an opinion on the labour force, as in general, there is no problem with the human resources associated with the production. The issue presents itself with the lack of experts in the area of R&D.

## COMPETITION

In terms of biodegradable compostable plastics, respondents claimed competitive regional and national levels, but the real competition is still in the field of oil-based plastic products. Respondents from the region are of opinion that the countries, like Great Britain, Denmark, Italy, France, Germany and USA in particular, are already well developed or at least more advanced than the rest of the world in the use and promotion of bio-based packaging materials. Same goes for the Scandinavian countries. As for the questions, what countries have the most sophisticated clients and who is ready and willing to pay better prices, companies stated that Europeans and European region in general are most likely the ones. In case of the substitutes of bio-based packaging products are either non-biodegrabale plastics materials or plastics that consist only of some percentage of biodegradable materials. However, interviewed companies in the region see a big and unexploited potential in 100 % biodegradable compostable plastics and thus expect the increase in the market share of such products.

## FUTURE PERSPECTIVES

According to the respondents, there is much work to be done on regional and EU policy level to push the bio-based plastics market forward. At 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, and significant efforts have to be made to raise awareness of the public regarding benefits of bio-based materials against raw materials, public health impacts and environmental impacts. This is why better recycling strategies in general and a better end-of-life infrastructure must be developed on national and on EU level.

Stronger cooperation across national borders and across different value chains is necessary in order to build up the missing know-how. In addition, on EU level, there should be a progressive ban of plastic packaging and better mechanisms in place for promotion of biodegradability and environmentally friendly plastics.

For the region, the potential markets for bio-based products are the packaging sector, disposables and consumables and in general products with a short lifespan. In addition, products that can be used in the agricultural sector are attributed high market development opportunities. To further develop the sector, all companies are interested to cooperate within the Danube Region. There is a huge and unexploited potential within the area of biodegradable compostable materials. Due to various environmental concerns, the use of biodegradable materials may contribute to the sustainability and the reduction of environmental impacts, to the greenhouse gas balances, etc. Based on this, respondents seek for the suppliers of necessary raw material and are willing to subsequently expand their production operations. Although some technological adjustments would be needed, they are ready to change the direction of their production operations.

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 a big issue. According to the respondents, the improving of the current recycling system of oil-based plastic products is still more eco-friendly then production of bioplastics. However, on the other hand, there are also non-biodegradable bioplastics, which have the same properties as the oil-based plastics and can be recycled together with them. Nevertheless, the respondents from Austria, Czech Republic, Slovakia and Slovenia agree that the most potential markets for bioplastic products in the next 5–10 years are: disposable bioplastic packaging, disposable bioplastic products (yogurt packages, barbecue coasters, bioplastics cutlery, etc.) and the packaging of luxury goods where the cost of the packaging is not substantial. They also see the potential of biodegradable bioplastics as a part of strict waste management system. Advancements in technical field and development of the innovative materials and products would improve the value chain, thus getting more source material. The potential markets for bio-based plastics in the next few years are in Europe, primarily in Germany, Austria, France and Scandinavian countries. Companies are interested in further cooperation along the local value chain and along the Danube Region, so they can get a steady supply of raw materials and develop new products.

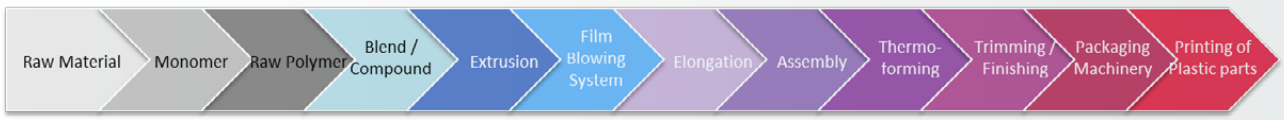
## REGIONAL VALUE CHAIN NARRATIVE

As already mentioned in the beginning, the sector of producing advanced packaging materials with biopolymers is still a niche market. Nevertheless several companies are already operating in this field, even if it is only on a small scale basis and no large quantities are produced. Although just a few companies are working on it, almost the whole value chain can be covered by different activities (either by doing research or by production activities).

### VISUAL MAP

Below is a visual map, which illustrates the bioplastic value chain from the suppliers' side towards the end market. Bioplastics are still an underdeveloped part of the industry and not many companies offer products that can compete with general alternatives. Most of the countries in the Danube region get their raw materials from foreign intermediaries. So, in many cases the first part of the bio-based packaging value chain is represented with R&D facilities and universities. The rest of the value chain in the Danube region is well developed, in terms of production and R&D, but only a few of the companies actually produce bio-based packaging or similar products.

**Figure 2:** Advanced Packaging: Bioplastic Value Chain from the Suppliers' perspective towards the End Market




### LIST OF MAIN ACTORS/STAKEHOLDERS

In **Austria** some companies are much more developed in producing packaging materials with biopolymers than others. This is also a question of the size of the enterprises. Larger firms often have more R&D budget available than SMEs and thus are already one step ahead in this field. In addition, research institutes are an important partner in these affairs. Just through cooperation with them the lack of knowledge, which still exists, can

be reduced. Another important partner to foster the advanced packaging industry is or will be the food industry as well as the Agro and pharmaceutical sector.

In **Czech Republic** the identified number of companies that produce bio-based packaging products is small. The universities and research institutions are important and significant actors in the industry and a valuable source of information. They can see them as the knowledge hubs of the bioplastic industry in the Czech Republic.

In **Slovakia** two business oriented companies (KM-System s.r.o., ESOX-PLAST spol. s.r.o.) were identified, which produce bio-based products. For development of biodegradable compostable plastic materials two companies (Enviro-Care s.r.o., Panara s.r.o) were found. All of the companies are part of the Slovak Plastic Cluster.

**Slovenia's** interviewed companies represent the middle and the last part of the value chain (end market of the bioplastic packaging value chain). Research institutes and Universities also play important roles in developing the value chain.

### MAIN GAPS

- Due to the high price, the market of the bioplastic products is still very small and limited for the final products. The cost of bioplastics as an input for the further processing is an alpha and omega and it hinder them from spreading.
- Better production processes that fit for the used raw materials must be developed first.
- Whole production process is expensive → weak price/performance ratio.
- Lack of knowledge.
- Better "end-of-life" infrastructure must be set up (recycling infrastructure, better waste separation, etc.)
- The price of the bio-based source material and constant supply amount. Higher price of the source material means that the bio-based end product is more expensive and it is still a niche product.
- Technical problems with manufacturing are seen as a secondary gap. This also relates to insufficient degradability, costly production and energy consumption.
- Technological obstacles are seen as a gap as well. Especially, the technical properties of the biodegradable bioplastics are problematic. The bioplastic materials can have different parameters and thus behave differently, e. g. there is a different strength, slipperiness and could be a problem with gluing. In addition, unlike oil-based plastics, the waste of bioplastic processing is higher and it causes a financial loss of the manufacturer. So finally, the companies produce more waste than necessary. In addition, the more energy is needed and the technology process has to be well tuned (production requires great discipline and experience).

### MISSING LINKS/KEY STAKEHOLDERS

- Better connections and networks to companies from other regions, countries operating in the same or a similar business through these economies of scale might be possible.
- Suppliers of cheap raw materials and suppliers of adequate machinery/technical solutions suitable for processing used raw materials.
- Missing market and demands of the bioplastic packaging.

### POLICY-RELATED OBSTACLES

- There is a need for a joint bio-based strategy that also involves bioplastics on regional and national levels.
- Lack of legal regulations at EU and on national level, which would favour the use and development of advanced packaging materials made from biopolymers (e. g. prohibition of plastic bags).
- A clear distinction of compostable plastics from biodegradable plastics (e. g. oxo-plastics).
- There is a missing link between composting system of bioplastics and education of the population on how to handle them.
- Countries have to support the bioplastic products and provide support for agriculture to product the crops suitable for production of biopolymers.

### LIST OF SUGGESTED CROSS-REGIONAL COOPERATION AREAS WITHIN THE DANUBIOVALNET REGIONS

- Companies from all countries in question are interested in (further) cooperation within the Danube Region.
- Companies are also interested in knowledge exchange across Danube Region (to fill the gap of missing know-how).
- Promotion of the products with end market buyers and benefits of the bio-based products on public health and environment is one of the key suggestions.

Furthermore, the companies forwarded the following suggestions for the Danube region:

- Continues supply chain of raw materials for the region.
- Recommendations for legislation changes and restrictions.
- Enforcement of legislative changes, definition of bioplastics and composting system settlement.
- Getting new concrete contracts.
- Solving the issue of the exploitation of agricultural products for non-food processes.
- Separation/collection policy – the separation of biodegradable parts from non-biodegradable parts.
- The need of promotion, training and education – in relation to the biodegradable materials.

# THE DANUBIOVALNET PROJECT

The DanuBioValNet project is aiming at establishing bio-based industry networks across the Danube Region. The emerging transnational cooperation of clusters will foster bio-economy and eco-innovations and lead to a strengthening of the regional economies.

Consequently, with this project the partners pursue a strong strategic orientation beyond the immediate and medium-term economic objective of strengthening the regional economy. It is the strategic goal to establish cross-border strategic partnerships, particularly in developing regions, with the help of powerful cluster organisations. In this way, project results will be sustained beyond an immediate effect and the creation of strategic investments, especially in emerging industries such as the bio industry, will be enabled and facilitated. This will be achieved mainly by newly emerging or transforming value-added chains, which are increasingly being transnationally established and further developed as a result of the increasing internationalisation of value-added processes.

In this way, long-term economic effects are achieved, based on a network of agile clusters, which prepare the investment approaches in a targeted manner and implement them with high efficiency. One example of the present project is the establishment of bio-refineries in the regions, which can form a strategic technological backbone of a successful independent bio-industry.

The partners intend to develop and implement a long-term, industry-driven roadmap for such collaboration along the entire value chain based on cluster partnerships for these processes. With the project, a pilot function of the implementation is taken over and the prerequisite for creating a blueprint for similar and similar cross-national cooperation, also in other industries, is created.

For achieving these tasks, 17 project partners from 10 countries have joined forces. The project will pave the way from an economy based on fossil resources towards an economy using renewable resources. The striving of the partners to minimise greenhouse gases and resource-saving as well as resource-efficient utilisation of available biomasses will result in synergistic effects. These effects will improve the sustainability, regional development through diversification of the local economy and will positively affect the workforce.

The development of new bio-based value chains from primary production to consumer markets needs to be done by connecting enterprises from different regions and industries. However, due to a missing holistic transnational approach, Danube actors in bio-based industry still operate disconnected and cannot properly benefit from the potential. Therefore, the aim of this project is to develop new methods, strategies and tools to connect enterprises transnationally.

Clusters as the strong representatives of a group of industries that are closely linked by common products, markets, technologies and interests are chosen to organise and bear the industry cooperation and creation of new value chains, because they are performant and sustainable partners and guarantee the upgradeability in the dimension industry, sciences and also politics.

One of the planned outputs of this project will be the development of a Joint Bio-based Industry Cluster Policy Strategy (JBCS) to describe the procedure and to make it actionable and reusable. Furthermore, a bundle of new methods and tools to support clusters for transnational working will be developed and joint into a strategy. They will be tested in three pilot actions where it is planned to create new bio-based value chains in the Danube region.

The main target groups are on the one hand the policy – four Ministries are involved –, on the other hand clusters and their SMEs – nine cluster organisations are involved. The policy level will benefit from the JBCS, which can be used as a political framework.

The clusters and SMEs will benefit from the new innovative tools and methods developed for transnational cross-clustering. Successfully established new bio-based value chains in the pilot actions can motivate other clusters and SMEs to test this newly developed approach in the future.

The following partners commit to the implementation of the cluster partnership and transnational cooperation:

| Role | Official Name in English | Acronym | Country |
|---|---|---|---|
| LP | BIOPRO Baden-Württemberg GmbH | BIOPRO | Germany |
| ERDF PP1 | ClusterAgentur Baden-Württemberg | CA BW | Germany |
| ERDF PP2 | Anteja ECG | ANT | Slovenia |
| ERDF PP3 | PROUNION | PU | Slovakia |
| ERDF PP4 | Romanian Cluster Association | CLUSTERO | Romania |
| ERDF PP5 | Association of Business Clusters | ABC | Bulgaria |
| ERDF PP6 | National Cluster Association – CZ | NCA | Czech Republic |
| ERDF PP7 | Business Upper Austria – OÖ Wirtschaftsagentur GmbH – Upper Austrian Food Cluster | UAFC | Austria |
| ERDF PP8 | Ministry of Economy | ME | Romania |
| ERDF PP9 | Ministry of Economy, Entrepreneurship and Crafts | MEC | Croatia |
| ERDF PP10 | Ministry of Education, Science and Sport | MIZS | Slovenia |
| ERDF PP11 | Croatian Wood Cluster | CWC | Croatia |
| ERDF PP12 | Institute for Economic Forecasting | IPE | Romania |
| ERDF PP13 | Business Upper Austria – OÖ Wirtschaftsagentur GmbH – Cleantech-Cluster | BizUp | Austria |
| IPA PP1 | Innovation Center of Faculty of Mechanical Engineering | ICME | Serbia |
| ASP1 | Montenegro Vine Cluster | MVC | Montenegro |
| ASP2 | Ministry of Economic Affairs, Labour and Housing Baden-Württemberg | WM | Germany |

LP = Lead Partner, PP = Project Partner, IPA = Instrument for Pre-Accession, ASP = Associated Strategic Partner, ERDF = European Regional Development Fund

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# ANNEX
# VALUE CHAIN MAPPING REPORTS BIO-BASED PACKAGING

## CZECH REPUBLIC

**1. The objective of the Regional Report**

The objective of the Regional Report is to provide overview from the interviews conducted with representatives of the bio-based packaging in the Czech Republic. The report should serve to highlight the tendencies and patterns that emerge from the aggregate information collected through the interviews. To reach the particular respondents the contacts and networks of the Plastic Cluster and the Czech Technology Platform – Plastics were used.

The summary statements relating to the topics listed below are based on the total number of cases interviewed. All the respondents are anonymous.

**2. General Information**

The respondents of the survey represent the companies in the field of production of plastic packaging, rubber and plastics storage and packaging. The interviewed companies are middle-sized (51-250 employees) and big-sized (more than 250 employees).

Regarding the bioplastic products, there are big differences between the companies. Some of them do not have any product on the market right now but they do the research on bioplastic packages especially for the food industry (yogurt packages, coasters). Despite the fact that they did not launch any product on the market yet, they are dealing with moulded and injected bioplastics and are able to produce e.g. the bioplastic toys and construction systems for children, bags and sachets and print them with biocolours. So, the bioplastic products are available in their portfolio even if they do not produce it currently due to a lack of interest of customers (high price of the products).

Other interviewed companies have the bioplastic products on the market, mainly the compostable foils, bags, sachets (all made of compostable foils), shrink sleeve packaging, laminate packaging (shrinkable material), printings based on bioplastics, etc.

Nevertheless, their current product range of bioplastic products is significantly less than 1% of their total production.

Regarding the technologies of bioplastics processing, the respondents mention, among others, the blown film extrusion, moulding, injection moulding with subsequent shaping and subsequent printing (manufacture of bags and sachets made of film). They are also able to print with biocolours.

**3. Suppliers of the resource material**

There is no big company specialized on production of a bioplastic resource material in the Czech Republic. The interviewed companies import the bioplastic granulates for the next processing from foreign countries, such as Germany, France and Italy. There are companies that produce some bioplastic material in the Czech Republic but the material does not reach the necessary requirements/quality, such as suitability for contact with food. Some of the respondents do the research on mixing the bioplastic granulates for own production.

Others buy the bioplastics foils which are suitable for food industry (contact with food) from the USA, Japan, and Great Britain.

The most often, the respondents use the PLA bioplastic material, foils based on cellulose/cellophane, PLA and starch polymers.

Regarding the availability of the resource material, they do not see any technical and logistical barriers to obtain more resource material. On the contrary, they would like to import less amounts of bioplastics to cover only the needs of their small specific contracts.

In addition, they have information that some new bioplastic factories will be built aiming at the production of bioplastics (PLA) for the next processing. The capacity should increase 3 times. So they are not afraid of the lack of source material.

**4. Related industries and support services**

As the related industries to the bioplastic packaging, mainly the classic plastic industry and food industry are mentioned. But in fact, the packaging is connected with many other industries.

Regarding the customers, some of the respondents do not have any customer buying the bioplastic products now. But they see the big international companies as potential clients, such as LEGO, IKEA and Nestlé (bioplastic coffee capsules). The international companies are willing to pay more for "eco" biodegradable bioplastic products. Nevertheless, currently the companies still have not found the acceptable bioplastic products for both sides (price vs. technical parameters).

According to the answers of the respondents, the most of the customers want the bioplastic advertising bags (from „eco" friendly material) to accentuate their ecological approach and to support the natural character of their own products. Some respondents claim that the bioplastics/"green" lobby is the marketing issue, while the demand of biodegradable bioplastic packages is increasing slowly thanks to the efforts of companies to look more ecological and "green".

The customers are mainly from foreign countries (Germany, Austria, Slovakia, Poland, and Hungary)

and in different industries. Some small contracts with Czech companies (packages for food industry) occur.
The respondents of the survey mention that they informed their customers about bioplastic products. They have the projects on carbon footprint reduction and production of sustainable products, use of recycling materials, processing of recycling materials and sustainability of blue packaging. They promote their bioplastic products on their websites, in their company catalogues, at conferences and press advertisements.
The research activities of universities and research centres can be considered as support services for the bioplastics industry. The companies cooperate with the Tomas Bata University – Centre of Polymer Systems, Mendel University in Brno and the University of Pardubice in particular research activity. Some of the respondents do the research on mixing the bioplastic granulates for their own production in cooperation with the University of Tomas Bata – Centre of Polymer systems. The university helps them with mixing and testing of granulate.
The University of Chemistry and Technology in Prague, the independent packaging laboratories are also mentioned but they do not carry out research dedicated to the bioplastics directly.
Some of the respondents inform about their own R&D activities (in-house R&D centre) in the Czech Republic and the research team in Austria (Linz Technical University).

**5. Quality and Labour Force**
The contract arrangements dedicated to bioplastic products are negligible in comparison with the total production of the interviewed companies. Their customers almost do not existing due to still unacceptable price and parameters (quality, suitability for food industry, etc.) of the bioplastic material/products. The customers want the certification and declaration of compostability of the bioplastic material/products (e.g. according to ČSN EN 13432), and the proof that the material comes from organic farming. Some customers require a certificate that the bioplastic foils are not made from genetically modified plants (they do not want the foils from e.g. genetically modified corn).
Regarding the labour force, the respondents do not see it as the topic of today.

**6. Competition**
There is almost no regional/national competition within the bioplastic packaging in the Czech Republic. The market is too small that it is not reasonable to talk about market threats/market competition. Key players in the bioplastic industry in the world are more forward than the companies in the Czech Republic.
Real competition is in the field of oil-based plastic products.
The respondents consider the countries such as United Kingdom, Denmark, Scandinavia, Germany, Austria, as the leaders and the most sophisticated clients. But, according to them, the e.g. biofoil market and the consumption of bioplastics is a completely marginal area and talking about the most sophisticated customers/clients is still unreasonable.

**7. Future perspectives**
The respondents of the survey stress that the future of the bioplastic packaging depends on the price of the bioplastic material. Currently, the price is still very high in comparison with oil-based plastics and thus the demand is very low. The bioplastic products are almost unsaleable for the high cost of input material that is 3 times more expensive than oil-based plastics. All other factors have either been resolved over the past period (technical factors influencing the process) or are totally ineffective (advertising to support consumption).
Some of them claim that, in the shortest 3 - 5 years, they expect a decrease in the prices of bioplastic material by 10 – 20 %. Newer material that will be really applied on a wider scale is PHA (Polyhydroxyalkanoates).
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 big issue. According to the respondents, the improving of the current recycling system of oil-based plastic products is still more eco-friendly then production of bioplastics now. But, on the other hand, there are also non-biodegradable bioplastics which have the same properties as the oil-based plastics and can be recycled together with them.
Nevertheless, the respondents mention that the most potential markets for bioplastic products in the next 5 – 10 years are: disposable bioplastic packaging, disposable bioplastic products (yogurt packages, barbecue coasters, bioplastics cutlery, etc.) and the packaging of luxury goods where the cost of the packaging is not substantial. They also see the potential of biodegradable bioplastics as a part of strict waste management system.

**8. Regional value chain narrative**
In general, the bio-based packaging (using the bioplastic materials) is relative new industry in the Czech Republic. Thus, there are not so many companies in this field. But currently, the bioplastic initiative (Bioplastic cluster) is launching thanks to the activities of the NAFIGATE Corporation a.s., Czech Republic.

• **Visual Map**


There are almost no companies at the first part of the value chain of the bioplastic packaging and there is no large resource of the bioplastic material for industry in the Czech Republic. Only several companies do research on biopolymers either by themselves or in cooperation with universities.


Within the last part of the value chain, there are companies dealing with biodegradable bioplastic bags, sachets, foils, etc. The companies buy the resource material mainly from abroad (bioplastic granulate, bioplastic foils).

• **List of mail actors/stakeholders**

There are 4 companies participated in the survey. There are also identified other companies which focus on bioplastic packaging in the Czech Republic but their number is small and they do not want to participate in the survey. The universities and research institutions are important and significant actors in the industry and valuable source of information. We can see them as the knowledge hubs of the bioplastic industry in the Czech Republic.

• **Main gaps**

The price of bioplastic material is considered to be the main gap/problem of the bioplastic packaging. Due to the high price, the market of the bioplastic products is still very small and limited for the final products. The cost of bioplastics as an input for the further processing is an alpha and omega and it hinder them from spreading. Other obstacles are more or less marginal.

The recycling issues are mentioned within the future perspective (point 7) in detail.

Technological obstacles are seen as a gap as well. Especially, the technical properties of the biodegradable bioplastics are problematic. The bioplastic materials can have different parameters and thus behave differently, e.g. there is a different strength, slipperiness and could be a problem with gluing. Also, unlike oil-based plastics, the waste of bioplastic processing is higher and it causes a financial loss of the manufacturer. So finally, the companies produce more waste than is necessary. In addition, the more energy is needed and the technology process has to be well tuned (production requires great discipline and experience).

• **Missing links**

There are no missing links nowadays. But, there is almost missing market and demands of the bioplastic packaging.

• **Policy related obstacles**

Despite the fact that the price is the most crucial obstacle for the bioplastic packaging, there are also identified some policy related obstacles. The interviewed companies mention:

- There is no legislation on bioplastics in the Czech Republic – only a reduction of plastic bags (oxo-plastics) was accepted;
- We need a clear distinction of compostable plastics from biodegradable plastics (e.g. oxo-plastics);
- There is a missing composting system of bioplastics, education of the population how to handle them;
- State has to support the bioplastic products and provide support for agriculture to product the crops suitable for production of biopolymers.

• **List of suggested cross-regional cooperation areas within DanuBioValNer regions/partners**

Some interviewed companies can see the potential for cooperation along the value chain in the Danube Region especially in:

- Enforcement of legislative changes, definition of bioplastics and composting system settlement;
- Getting new customers who would accept products with a high price (3 times higher than the cost of conventional polymers);
- Getting new concrete contracts.

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# SLOVAKIA

**1. General Information**

The main activities of companies interviewed within DanuBioValNet project are focused on the production of plastic materials/parts and then on the development of biodegradable compostable plastics – from renewable raw materials with different properties and with the possibility to adjust material according to customer needs and in the main time to be processed on standard production lines used for plastics.

Although there are many firms dealing with the plastic production in Slovakia, very small number of them use the bio-based plastics. All of the identified companies are members of Slovak Plastics Cluster.

Interviewed companies have production lines for extruding, film blowing, injection moulding and also thermoforming, whereby half of them have given production lines in order to be able to develop and test large scale of defined applications for biodegradable material. Given companies are also focused on the production of biodegradable plastic semi products – blends, in order to introduce those materials into different plastics applications.

Respondents that are focused on business operations (their primary focus is not on the development of biodegradable compostable plastics) are selling plastic materials/parts to their customers, hence they act as suppliers of plastic components. Although they use also the bio-based plastics, such production currently forms negligible percentage of their activities. The bio-based plastics are used mainly for the production of packaging materials, but given production is not at the commercial level – all bio-based plastics are still at the testing phase.

There is a specific form of cooperation among the interviewed companies – two of them develop biodegradable compostable plastics materials, while the other two test the production processes on their technologies.

**2. Suppliers of the source material**

As was mentioned above, there is the specific cooperation between interviewed companies, thus given producers do not have any other suppliers of biodegradable materials. However, the respondents aim to produce 100% biodegradable products, but they face a problem of insufficient amount of raw materials. The main reason is the issue of the exploitation of agricultural products for non-food processes. Therefore, respondents search for the suppliers of the waste oil from fryers.

In case of the production of not fully biodegradable products, companies need the supply of other bioplastic materials, such as the corn starch, plant oil derived plastics and PLA (polylactic acid).

**3. Related industries and support services**

Although advanced packaging covers wide range of products, respondents are focused mainly on the packaging materials, with aim to produce 100% biodegradable plastics.

Interviewed companies cooperate with the Slovak Technical University, for the development of biodegradable compostable plastics and for the appropriate specification of materials and technologies used during production processes.

**4. Quality and Labor Force**

The majority of interviewed companies state that the key requirements when purchasing bio-based plastics are:

1. Quality
2. Price
3. Volume available

However, the most important current obstacles that companies face to obtain more material are as follows:

1. Difficulties to get material in volumes needed
2. High prices
3. Life cycle assessment method

The interviewed companies do not provide any kind of external trainings for their staff – employees are trained within the companies. In general, there is no problem with the human resources associated with the production – the issue is the lack of experts in the area of R&D.

**5. Competition**

In terms of biodegradable compostable plastics, respondents claimed very low competition on regional or national level –> even if their production operations are only at the testing phase, currently they have a monopoly in the country. Although they have not made a market research on international level and have only little information about foreign companies dealing with 100% biodegradable plastics, the respondents are aware of recent export of similar products from the USA to the Europe.

The substitutes of above mentioned products are either non-biodegrabale plastics materials or plastics that consist only of some percentage of biodegradable materials. However, interviewed companies see a big and unexploited potential in 100% biodegradable compostable plastics and thus expect the increase in the market share of such products. For this reason, they intensively search for the suppliers of needed raw materials.

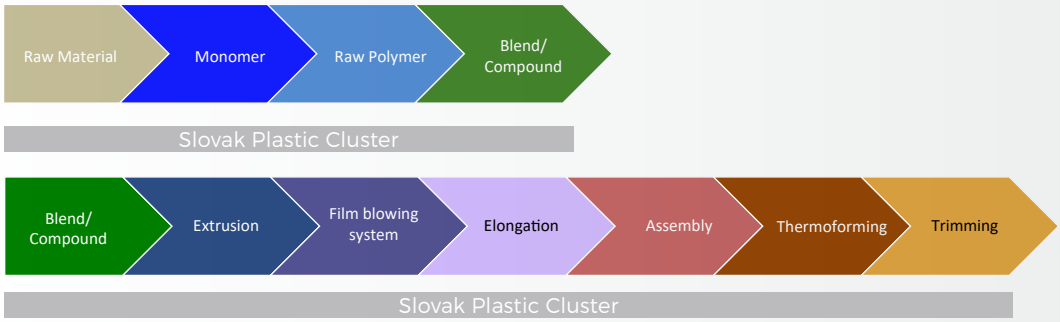
The most frequently mentioned country considered as the "best in class" was the United States of America.

**6. Future Perspectives**

Regarding the future perspectives, all respondents see a huge and unexploited potential within the area of biodegradable compostable materials. Due to various environmental concerns, the use of biodegradable materials may contribute to the

sustainability and the reduction of environmental impacts, to the greenhouse gas balances, etc. Based on this, respondents seek for the suppliers of necessary raw material and are willing to subsequently expand their production operations. Although some technological adjustments would be needed, they are ready to change the direction of their production operations.
The most promising market in the area of biodegradable compostable plastics is currently considered China. However, it is expected that this "more environmentally friendly option" will be subsequently significantly spread to both developed and emerging markets.

**7. Regional Value Chain Narrative**
Visual map that illustrates the way the product flows from raw material to end markets and shows the type ad number of regional actors involved in all value-added activities in the region:




**List of main actors/stakeholders, their position and activities in the VC:**
- Slovak Plastic Cluster
  - two business oriented companies: KM-System s.r.o.; ESOX-PLAST spol. s.r.o.
  - two companies oriented on the development of biodegradable compostable plastic materials: Enviro-Care s.r.o.; Panara s.r.o.

**Main gaps** (for example in technology, standards, IPR, workforce, access to market, suppliers, regulation):
- Lack of raw materials
- Lack of expert groups (only experts dealing with biodegradable compostable plastic materials)

**Missing links and/or key stakeholders:**
- Lack of suppliers of raw materials (granulates for the production of 100% biodegradable plastics)

**Policy-related obstacles from a cross-regional cooperation point of view:**
- The issue of the exploitation of agricultural products for non-food processes
- Separation/collection policy – the separation of biodegradable parts from non-biodegradable parts
- The need of promotion, training and education – in relation to the biodegradable materials

**List of suggested cross-regional cooperation areas with DanuBioValNet regions/partners:**
- All companies showed the interest in further contacts to DanuBioValNet project and relevant partners (if Prounion as a project partner will act as an intermediary)

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# SLOVENIA

**1. The objective of the Regional Report**
Regional Report's aim is to provide a summary of the interviews conducted with representatives of the bio-based/advance packaging sector in Slovenia. The report is an aggregate of the information gotten through the interviews and represent opinions of the interviewed respondents from the bioplastic industry. Respondents are all part of the wider network of plastic producers and members of Plasttehnika (plastics cluster of Slovenia). The summary statements relating to the topics listed below are based on the total number of cases interviewed. All the interviews were conducted on anonymous basis.

**2. General Information**
All of the interviewed companies produce packaging products from polymers and are Small-Medium

Enterprises, with 5 to 240 employees. Main activities of the companies are defined by the following NACE (Statistical Classification of Economic Activities) codes: C22.290, C13.100. Three companies produce and sell their own bio-based packaging products and one is looking into developing bio-based products – they sell bio-based products from other brands. All of the companies stated that development of the bio-based products is time and cost consuming and hope this will improve in the next years. Three companies sell their products directly to other wholesale business, while only two offer products or brands for general consumers. All of the companies stated that bio-based products sales consist of 5-8 % of their overall income.

**3. Suppliers of the resource material**

All companies reported that their source material comes from distributors. Two companies stated that they get the source material from local distribution center, which is part of a larger global cooperation from USA, while other two stated that they get their material from Germany. In general, the main criteria are the price and availability (timely delivery). Companies use Polyactide (PLA) and Polyethylene (PE) from sugar cane. In terms of key requirements, companies stated that mostly value quality and technical properties of the material. As for the current obstacle for getting the source material, they stated that high prices and technical difficulties affect the supply.

For future perspectives, regarding the availability of source bio-based material companies stated that they expect lower prices, better supply and 100% biodegradable material to replace current source material. One company answered that the road to that adaptation will be hard and will have to include public view of plastic packaging, impact on environment and public health.

**4) Related industries and support services**

Main technology for processing of bio-plastic is injection moulding and all companies mentioned same disadvantages, i.e. processing temperature. One of the respondents did state though, that they do a lot of in-house testing of the processing technologies and material quality, so they significantly improved the process and lowered risks. For all of the companies R&D activates are important. Three out of four companies were involved in the projects under EU framework programs. They are also looking for future funding under similar conditions. Support services for the companies in the bioplastics industry are mainly done through the research activities of universities and research centres.

Companies are cooperating with University of Maribor Faculty of Mechanical Engineering, Faculty of Polymer Technology, University of Ljubljana Faculty of Mechanical Engineering, Biotechnical Faculty and other research institutes like National Institute of Chemistry. Companies are also involved with collaboration with Development Centre TECOS (Slovenian Tool and Die Development Centre). Two of the companies were involved in Poly4EmI project, funded by European Commission (DG Enterprise and Industry), to develop or test new products from advance materials or bio-based polymers. Collaboration with research institutes, competence centres and companies is very strong, as all the companies stated the benefits of such support activities.

**5) Quality and Labour Force**

Regarding quality, only one company representative answered and stated that the quality of their products correlates to the source material quality and clients' need and requirements. These are very strict when it comes to bio-based materials. Company in question holds the following quality certificates ISO 9001, ISO 14001, IWAY, and OHSAS. Most of the quality guarantees comes from the supplier side, but they have additional in-house quality checks in place. Interviewed representatives did not give opinions on the labour force.

**6) Competition**

For local markets, the four companies did not specify exact competitors, but they did reference a very competitive European and global market, which will grow in size in the future. For questions about substitutes for the products or about best-in-class per product area only one company answered and listed competitive products and brands. As for question, regarding what countries would be the most sophisticated clients and who is ready and willing to pay better price, companies stated that Europeans and European region in general is like that. Two of the companies also mentioned Scandinavian countries, Germany and France as having sophisticated clients.

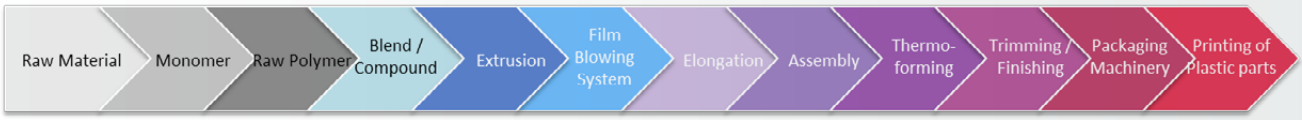
**7) Future perspectives**

According to the respondents, there is much work to be done on regional and EU policy level to push the bio-based plastics market forward. One of the respondents stated the promotion of the bio-based material should be strengthened in the scope of the economic strategy. In addition, significant efforts have to be made to raise awareness of the public regarding benefits of bio-based materials against raw materials, public health impacts and environmental impacts. On EU level, there should be a progressive ban of plastic packaging and better mechanisms in place for promotion of biodegradability and environmentally friendly plastics.

All of the companies stated that advancements in technical field and development of the innovative materials and products would improve the value chain, thus getting more source material. The potential markets for bio-based plastics in the next few years are still based in Europe, primarily in Germany, Austria, France and Scandinavian countries. Companies are interested in further cooperation along the local value chain and abroad, along the Danube Region, so they can get a steady supply of raw materials and develop new products.

**8) Regional value chain narrative**

Below is a visual map, which illustrates the bioplastic value chain from the suppliers' side towards the end market. Bioplastics are still an underdeveloped part of the industry and not many companies offer products that can compete with general alternatives.




There are no suppliers of raw materials at the first part of the value chain of the bioplastic/advance packaging; foreign intermediaries do all of the distribution. The rest of the value chain is equally represented, but only a few of the companies actually produce bio-based packaging or similar products.

- **List of main actors/stakeholders**
  - Four interviewed companies represent the middle and the last part of the value chain (end market of the bioplastic packaging value chain).
  - Research institutes and Universities play an important role in developing new materials and are seen as important partners to get funding through the EU framework programmers.

- **Main gaps**
  - The main gaps are the price of the bio-based source material and constant supply amount. Higher price of the source material means that the bio-based end product is more expensive and a niche product.
  - Technical problems with manufacturing are seen as a secondary gap. This also relates to insufficient degradability, costly production and energy consumption.

- **Missing links**
  - No missing links were reported.

- **Policy related obstacles**
  - There is a need for a joint bio-based strategy that also involves bioplastics on a national level. Even though this is somewhat touched upon in the Slovenia's Smart Specialization Strategy and Circular Economy guidelines, there is a need for State support of the bioplastics (from research, biomass production, biopolymer production and bio-based end products).

- **List of suggested cross-regional cooperation areas within DanuBioValNer regions/partners**
  - Promotion of the products with end market buyers and benefits of the bio-based products on public health and environment.
  - Continues supply chain of raw materials for the region.
  - Recommendations for legislation changes and restrictions.

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# UPPER AUSTRIA

**1. Short Summary of the Regional Report**

This report aims to assess the situation of advanced packaging in Austria based on 5 interviews. It is intended to give an overview of the current situation and future development. So it should stress what are the biggest challenges and obstacles at the moment and what must be done to strengthen the sector both in Austria and in Europe.

Currently it is a niche market in Austria and there is still a lot of research required to turn it into a strong industry. Beside better cooperation with R&D facilities also better collaboration across European countries is necessary. The preconditions would be given because all companies surveyed are interested in closer cooperation in the Danube region.

**2. General Information**

Most of the companies interviewed were founded several decades ago. The production of biobased (advanced packaging) materials plays a subordinate role in comparison to the overall production output. The range goes from 1 to 10 %, representing advanced biobased material compared to the total units produced. It should be noted that four of the five companies surveyed have their own research department for the further development of biopolymers, and that they also work closely with universities and universities of applied sciences.

The majority of the companies (4) are producing packaging materials for the food and pharmaceutical industries. One representative produces spice mills and containers for the pharmaceutical industry. The average annual sales (overall business) of the companies ranges from EUR 8 million to EUR 581 million.

**3. Suppliers of the source material**

Unfortunately, only one company answered the question as to who are the most important suppliers of raw materials. This company buys mainly granulate from Brazil or the USA. The other companies did not want to answer this question.

In the companies surveyed, the starting materials for further processing are very different and widely distributed. But the most important raw material is PLA. Other starting materials which are mainly used are PBS, cellulose acetate, biobased PE, biodegradable polyester and starch.

The points quality, price and processability are the most important criteria for all companies when purchasing their raw materials. In one case material availability and in another case material properties are also an important obstacle.

Currently, the raw materials are still very expensive and technically difficult to process. But all companies assume that more raw material will be available in the future and as a result prices will fall. However, the quality of the raw materials which is currently on the market will also have to be improved in the future, only then a further development of the production processes is possible.

**4. Related industries and support services**

The most relating industries at the moment, and probably also in the future, are the food and pharmaceutical sector. Especially stronger cooperations with food processing and manufacturing companies are key to further develop advanced/biobased packaging materials. But also the pharmaceutical and especially the phytopharma sector are interested in new packaging solutions and thus can be a promoter. Only if sufficient customers are available the sector of advanced/biobased packaging materials can produce cost-effectively and thus reduce the prices.

For further development also the right advertising strategy is a factor of success. At the moment only two of the companies are already pursuing their own PR strategy to advertise their products to B2B or B2C customers. This is largely done at trade fairs and conferences or directly during customer visits. The other companies do not have a special advertising strategy yet. However, they already have started the development of possible PR strategies and will be implemented once their products have been successfully further developed.

The companies mentioned that they cooperate with research institutes during the development process, but no concrete names of institutions were mentioned. But possible partners in this field are the University of Applied Life Sciences Vienna (BOKU), IFA Tulln – Department for Agrobiotechnology, TCKT – Transfercenter for Plastics Technology, TGM – Technologisches Gewerbemuseum (research institute), University Leoben – School of Mining – Department Polymer Engineering, Wood K Plus – Kompetenzzentrum Holz Gmbh (doing research on composites with wood and biopolymers) or Agrana Research Institute & Innovation Center (developing products made with starch).

**5. Quality and Labor Force**

As mentioned under point 2 all of the companies are doing research on further developing their products and are collaborating with R&D facilities. This in fact is a good base for innovative product developments in the future.

But nevertheless according to the companies asked, many companies still face major challenges in the production of biobased packaging materials. Especially with regard to production processes. Largely "standard production processes" such as those used in the production of conventional plastic packaging materials get just adapted. However, this can only be an interim solution, since problems with the thermal stability and moisture sensitivity can occur with the output materials used. In addition, high temperatures and pressures cannot be

achieved by injection moulding processes.
At the moment, suitable technical manufacturing processes are therefore still lacking. In addition, a larger build-up of know-how is necessary, which, according to the companies, can only be achieved through international cooperation and exchange of experience.

**6. Competition**

None of the companies surveyed responded to question of regional or national competition. This is to be understood in such a way that there are no companies at this level which would be in a strong competition. In fact, the production of (advanced packaging) material from
biopolymers is a niche market in Austria so far. Although more than the companies surveyed in Austria research, develop and produce products made from biopolymers, there is no significant competition between companies producing similar products.
Concrete international competitors were mentioned by two companies. The other companies have not provided any information on this. It can be assumed that they do not know their international competitors in detail.
However, all respondents are of the opinion that the countries/regions Italy, Scandinavia, France, Germany and the USA in particular are already well developed or at least more advanced than the rest of the world in the use and promotion of biobased packaging materials.
In Italy, for example, the use of fossil plastic bags has been banned several years ago. In the opinion of the companies surveyed, this has also led to a strengthening of the sector for biobased packaging materials. Thus Italy has become to a leader in biobased packaging.

**7. Future perspectives**

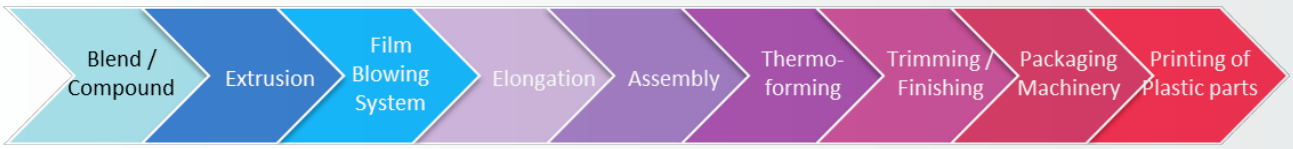
In order to strengthen the industry, the company believes that the following needs to be done:
-At EU and national level, it is necessary to create better legal frameworks for the use and application of bioplastics
- The price/performance ratio of the process chain must become more favourable
- The public must be better informed and teached that the use of biobased plastic packaging material is sensible and important. Consumers must be made aware of the fact, that the right waste separation is essential for the successful biodegradability of the materials.
- Better recycling strategies in general and a better End-Of-Life infrastructure must be developed on national and on EU level
- Stronger cooperation across national borders and across different value chains is necessary in order to build up the missing know-how. Therefore you need strong networks and partners.
Three companies believe that the most potential markets for biobased products are the packaging sector, disposables and consumables and in general articles with a short lifespan. Also products that can be used in the agricultural sector are attributed high market development opportunities. To further develop the sector all companies are interested to cooperate within the Danube Region.

**8. Regional value chain narrative**

As already mentioned in the beginning, the sector of producing advanced packaging materials with biopolymers is still a niche market in Austria. Nevertheless several companies are already operating in this field, even if it is only on a small scale basis and no large
quantities are produced. And although just a few companies are working on it, almost the whole value chain can be covered by different activities (either by doing research or by production activities)

• **Visual Map**


In this steps of the value chain the main activity is research work which is done by R&D facilities and universities (e.g. Agrana Research Institute, Wood K Plus,..




In this steps of the value chain a few companies are operating and producing advanced packaging materials or other products out of biopolymers. But also research is done in this steps of the VC.

• **List of main actors/stakeholders**

Five companies participated on this survey. Some of them are already further developed in producing packaging materials with biopolymers than others. This is also a question of the size of the enterprises. Larger firms often have more R&D budget available than SMEs and thus are already one step ahead in this field. But also research institutes are an important partner in this affairs. Just through cooperation with them the lack of knowledge, which still exists, can be reduced. Another important partner to foster the advanced packaging industry is or will be the food industry as well as the Agro and pharmaceutical sector.

• **Main gaps**

- Raw materials are relatively expensive
- Better production processes which fit for the used raw materials must be developed first
- whole production process is expensive → weak price/performance ratio
- still a lack of knowledge
- Better "End-of-Life" infrastructure must be set up (recycling infrastructure, better waste separation → for example it doesn't make sense if a yoghurt cup, which is 100% biodegradable is mixed with its cover which is mostly made with aluminium,...)

• **Missing links and/or key stakeholders**

- Better connections and networks to companies from other regions, countries operating in the same or a similar businessàthrough this economies of scale might be possible
- Suppliers of cheap raw materials
- Suppliers of adequate machinery/technical solutions suitable for processing used raw materials

• **Policy related obstacles**

- Lack of legal regulations at EU and on national level which would favor the use and development of advanced packaging materials made by biopolymers (e.g. prohibition of plastic bags)

• **List of suggested cross-regional cooperation areas within DanuBioValNer regions/partners**

- all companies asked are interested in (further) cooperation within the Danube Region
- knowledge exchange across Danube Region (to fill the gap of missing Know-How)

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