



Bio-based strategies and roadmaps for enhanced rural and regional development in the EU



Business models for regional bioeconomies

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EXECUTIVE SUMMARY

The shift towards a bioeconomy became an essential development for political, industrial and societal initiatives that want to ensure that today's society and future generations can rely on renewable resources without foregoing economic growth. Therefore, business models and ideas are needed that contribute to economic growth, wealth generation and at the same time create societal and environmental value by addressing some of humanity's great challenges. Rural areas with abundant biomass resources are expected to play a crucial role in developing and establishing bioeconomy businesses and strategies. Thus, biomass producing sectors can contribute significantly to the development of a bioeconomy, stimulate rural development (job creation, generation of new income streams, etc.) and create new markets for advanced bio-based products and services. Therefore, private initiatives are needed, as much as governmental interventions, for the creation of a fruitful framework.

In fact, there are already plenty of bioeconomy businesses running worldwide. Nevertheless, this report focusses on small-scale businesses that are suitable for rural areas and addresses the business opportunities of BE-Rural's OIP regions (Stara Zagora, Bulgaria; Szczecin Lagoon and Vistula Lagoon, Poland; Strumica, North Macedonia; Covasna, Romania; Vidzeme and Kurzeme, Latvia). Four exemplary small-scale businesses were selected and analysed with the business model canvas (a tool for developing and analysing business models) and their suitability for the OIP regions was assessed. It became obvious that the OIP regions have different prerequisites, chances and challenges that affect the development of new bioeconomy businesses. In addition to that assessment, the economic, social and environmental impacts of each business were analysed. While the overall analysis demonstrated that the OIP regions cannot just replicate the analysed businesses as they are, the results are of relevance for the development and establishment of future bioeconomy businesses and strategies in the five regional contexts.

BE-Rural collaborates with the Horizon 2020 project Power4Bio (<https://power4bio.eu/>), which also assesses technology options and business models for regional and local bio-based economies. A joint guidance document will summarise the relevant outputs of the two projects and provide concrete recommendations for policy-makers regarding the application of bio-based technology options and business models in specific regional contexts. The present report will contribute to this joint output. For further complementary information from the Power4Bio project, we encourage the reader to visit: <https://power4bio.eu/project-material>.

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Abbreviations

BMC	Business Model Canvas
CHP	Combined Heat and Power
EC	European Commission
EU	European Union
FLAGS	Fisheries Local Action Groups
GHG	Greenhouse gas
OIP	Open Innovation Platform
R&D	Research and development
SME	Small and medium-sized enterprise
WP	Work Package

1 Introduction

The shift towards a bioeconomy became an essential development for political, industrial and societal initiatives that want to ensure that today's society and future generations can rely on renewable resources without foregoing economic growth (Reim et al. 2019). The bioeconomy offers a plethora of entrepreneurial opportunities that may contribute to economic growth, wealth generation and at the same time create societal and environmental value by addressing some of humanity's great challenges.

Rural areas with abundant biomass resources play a crucial role in developing and establishing bioeconomy businesses and strategies. Thus, biomass producing sectors can contribute significantly to the development of a bioeconomy, stimulate rural development (job creation, generation of new income streams, etc.) and create new markets for advanced bio-based products and services. Therefore, private initiatives are required as much as governmental interventions for the creation of a fruitful framework.

In order to understand how bioeconomy businesses are structured and run, the business model canvas can give an overview on which elements need to be considered (Osterwalder 2004). Its nine elements help to investigate how and where value is created and where fine tuning or rearrangements are needed. This tool is applied to analyse existing bioeconomy businesses that were considered by the authors to be relevant for BE-Rural's five OIP regions (Stara Zagora, Bulgaria; Szczecin Lagoon and Vistula Lagoon, Poland; Strumica, North Macedonia; Covasna, Romania; Vidzeme and Kurzeme, Latvia) on the basis of the potential business opportunities identified here. The latter are derived from Deliverables 2.2 and 2.3 of the BE-Rural project and outlined in a condensed form. By analysing each of the chosen business models along the business model canvas, the OIP facilitators and local stakeholders can get an impression on how and what elements need to be considered to create value sustainably. This may help to achieve an improved understanding of all elements, their interaction and how they facilitate the market uptake of innovative businesses in a bioeconomy. Moreover, a focus lies on the environmental, economic and social impact of the analysed business models. Therefore, some elements of the business model canvas are extended, following the approach of social enterprises, and interpreted in order to outline relevant impacts.

2 Methodology

To get an understanding of the value generation in a bioeconomy, the present study gives an impression on how business models in a bioeconomy can look like. An analysis of business models is conducted in order to achieve the highest degree of replicability and transparency. This will help to draw conclusions, even though gaps may appear during the analysing process.

A business model is defined as "an abstract conceptual model that represents the business and money earning logic of a company" and further as "a business layer between business strategy and processes" (Osterwalder 2004). Beside the internal forces which define and shape the business model, external forces need to be considered when it comes to the continuous adjustment of business models. Thus, every company is responsible for altering their business model in terms of a changing environment (business model innovation). Nevertheless, it is important to stress that businesses in the 21st century do not only offer products and services anymore, but also deliver values, which can become highly important for businesses in a bioeconomy (Fogarassy et al. 2017). Consequently, the type of business model correlates with the value the organization or company wants to create for its customers or users of their products (Stratan 2017).

Osterwalder and Pigneur (2010) developed a tool (business model canvas) which helps to analyse business models and the value created within them. The business model canvas consists of nine distinctive elements. Based on these elements, the businesses can be defined and analysed.

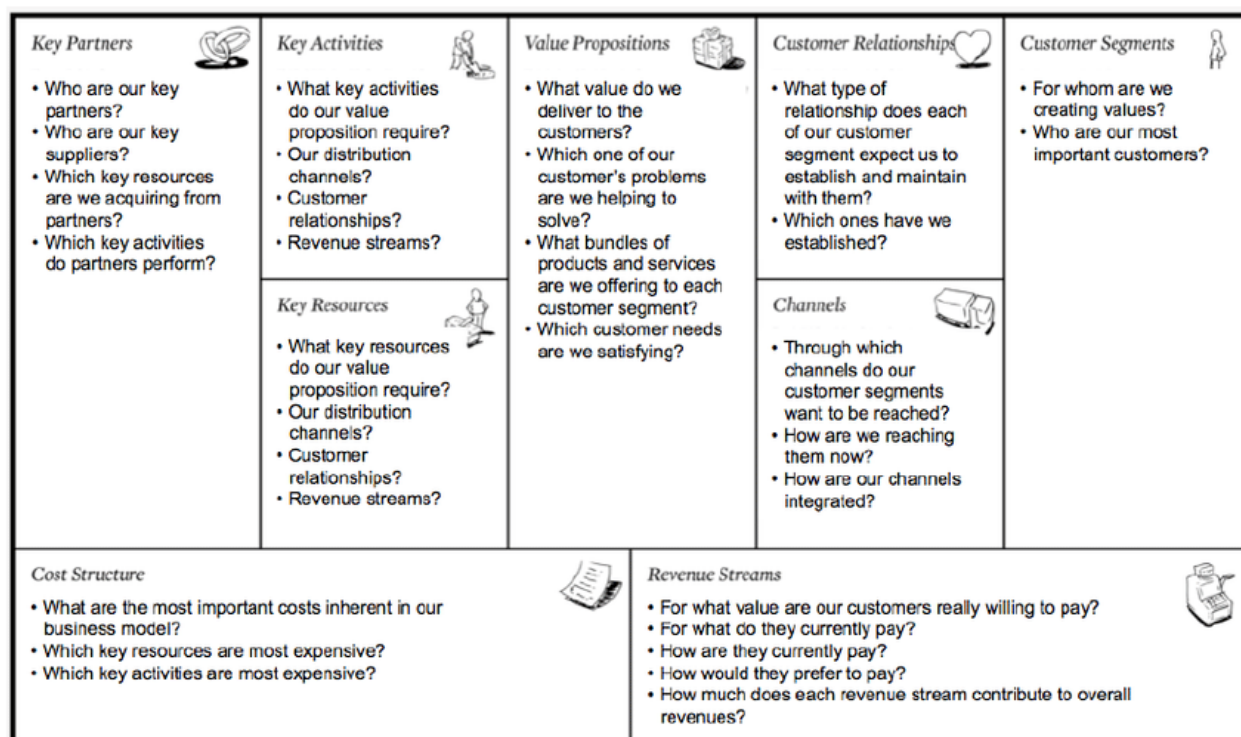


Figure 1: Osterwalder and Pigneur's business model canvas (Osterwalder and Pigneur 2010).

These nine elements can be summarised into four groups. The first one is the value proposed to the customer. This group, which consist of only one element, needs to be defined with special regard to the market needs, which derive from the customer-related elements such as the target group (and its need) and channels to communicate and deliver the value to the costumer (marketing strategy, distribution channels, service form, etc.). These elements compose the second group. Based on that, each company needs to decide what activities should be considered for the development of key processes, what cooperations should be build up and what kind of resources they need to create the value proposed and these elements constitute the third group. The fourth group covers the expected costs, the revenue and its overall balance (Fogarassy et al. 2017).

Reim et al. (2018, 2019) used the business model canvas to analyse bioeconomy businesses from the forestry sector. The team of authors conducted a literature analysis based on the nine elements of the business model canvas, which appeared to be covered to different extents. The current study uses a more practical approach, coming from existing bioeconomy businesses and to see which elements are covered or not and to which degree. Moreover, the analysis of each business model canvas will include social, economic and environmental impacts of the investigated business models. This impact analysis is based on results of the BioSTEP project (Hasenheit et al. 2016) and studies on social enterprise design, such as the ones from Burkett (n.d.) or Qastharin (2015). In this context, it is important to stress that mission-related impacts are considered here and not only wealth creation. Of course, social enterprises generate profits, but the focus lies more on achieving sustainability and providing a social benefit (Qastharin 2015). This approach could also be transferred to "environmental enterprises", where the focus could lie on sustainability and environmental benefits and changes. In both cases, enterprises focus on achieving social/environmental purposes beside the profit they generate. Thus, the business model canvas elements can be extended and interpreted from a social and environmental point of view.

To collect information from existing technologies, a prepared guideline, which includes mainly the nine elements of the business model canvas, was used to serve three purposes. Firstly, this guideline was sent as a questionnaire via email to relevant contact persons from selected technology options (as presented in BE-Rural Deliverable 2.1, c.f. Colmorgen and Khawaja 2019). Secondly, it was used for conducting telephone interviews, addressing the same contacts and thirdly, it was used for conducting desk research. The selection of the businesses was based on the business opportunities identified in

chapter 3 of the current report. The aim was to fill in one business model canvas for each selected business model, to analyse them and to derive socioeconomic and environmental impacts.

3 Business opportunities in the OIP regions

Building on the outcomes of BE-Rural Deliverables 2.2 (Anzaldúa et al. 2019) and 2.3 (Khawaja et al. 2019), this section gives an overview of business opportunities in the OIP regions. These opportunities are displayed for each region in a condensed and summarised form.

3.1 OIP Stara Zagora, Bulgaria

Beside the rather small forest biomass potential there is a significant biomass potential from agriculture since the agricultural sector plays a crucial economic role in this region. Especially the latter can be used for energy purposes and to produce bio-based products. Nevertheless, businesses using both, biomass potentials from forestry and agriculture are especially attractive for the region. Moreover, there is a high biomass potential coming from the pulp and paper industry (Khawaja et al. 2019).

The diverse economy in the Stara Zagora region offers some unexplored business potential in the bioeconomy. Various levels of authorities are aware of being an important puzzle piece for the implementation of a regional bioeconomy strategy, which makes the region a good breeding ground for future bioeconomy development. The Stara Zagora region of Bulgaria already contains a collaboration among some key bioeconomy stakeholders such as educational institutions, research and development units, and local businesses (Anzaldúa et al. 2019, Khawaja et al. 2019). The regional economic growth rate is above the national average and the number of SMEs offers good opportunities for further economic growth and job creation, which is vitally important for rural areas in terms of lowering unemployment and rural exodus. Since the region's economy is comparatively robust and the infrastructure in good condition, the perspective for a resource-efficient bioeconomy with new technologies is promising, also because potential synergies that can facilitate innovation already exist (Anzaldúa et al. 2019).

Policies such as the Regional Development Strategy 2014-2020 help the region to move forward towards more economic, social and environmental sustainability and to develop bioeconomy strategies. Due to ongoing structural changes in Stara Zagora's rural areas, jobs in fossil-based industries will decrease and the development of a bioeconomy can facilitate the transition in terms of offering new perspectives in a newly emerging field. Because of good education and health conditions and the raising awareness of quality and composition food, the societal environment within the region has a remarkable potential for stimulating the development of bioeconomy strategies (Anzaldúa et al. 2019).

Stara Zagora's most promising sector for future bioeconomy businesses is the agricultural sector. The agricultural production and its residues and by-products provide a solid raw material base for the development and establishment of new businesses. To valorise the currently untapped resources and develop new businesses, the already existing collaborations of bioeconomy key stakeholders must be strengthened while making more use of the advantageous SME landscape. Since the financing systems is rather weak, businesses with less investment effort are favourable at the moment. Finally, the agricultural sector is highly receptive but also demanding for new business, since they have abundant raw materials. In addition to that, renewable energy business and technologies may help energy companies to increase the share of renewable energy in the region.

Based on the turned-out opportunities, the businesses models from Spawnfoam, Spinnova and Bio-Lutions may be interesting from the region's point of view (see Colmorgen and Khawaja 2019). Additionally, business models for briquetting, pelletizing, anaerobic digestion and pyrolysis could be relevant for Stara Zagora.

3.2 OIP Strumica, North Macedonia

The availability of natural resources in the Strumica region of North Macedonia is a sound base for the future economic development, also with regard to a rural bioeconomy. The Strumica region is the

largest producer and exporter of agricultural products in North Macedonia (Anzaldúa et al. 2019). Agricultural residues as well as waste from the agri-food industry are important raw material sources that build a solid base for the development of innovative small-scale biorefining concepts. The raw material coming from the forest industry can be expected to be sufficient for the small-scale processing, too (Khawaja et al. 2019). Since the region's economic focus lies on agriculture, the most relevant applications of biotechnologies and bio-based products are pelletizing and briquetting, gasification or pyrolysis, anaerobic digestion and composting (Anzaldúa et al. 2019). Nevertheless, proven and innovative biorefining technologies that can process both, agricultural and forest residues, are interesting when it comes to the processing of larger amounts of biomass. The region has a favourable geographical position since the accessibility by roads from all directions is good. Thus, the region is well connected to the rest of the country as well as with its neighbours Bulgaria and Greece (Anzaldúa et al. 2019).

Currently some untapped business potential exists in the region (e.g. energy production from biomass), but there is a strong willingness to exploit it. Thus, Strumica's four municipalities are committed to a common economic development, aiming to benefit from existing resources and potentials. A strong will for EU integration triggers the genesis of political conditions that facilitate the development of bioeconomy strategies and roadmaps. Since the bioeconomy is a fixed component of EU policies since 2012¹, the development of such strategies helps adopting EU policies at the same time (Anzaldúa et al. 2019). Financing options exist in this region. Those consist of public entities, private banks and payment agencies, which can finance and support bioeconomy-related projects (e.g. Agency for Financial Support in Agriculture and Rural Development) (Khawaja et al. 2019).

Since the agricultural and forestry sectors have the largest biomass potentials in the region, special emphasis should lie on developing and establishing bioeconomy businesses in these fields. Even though financing options exist in the region, there is still a lack of direct investments which could hinder the development of bioeconomy businesses. A better collaboration between key stakeholders (e.g. educational institutions, R&D units, etc.) is required in order to develop new business. In the first place, businesses with less investments are advantageous for the agricultural and forestry sectors, the main demanders for new business ideas in the region.

Business models for pelletizing, briquetting, anaerobic digestion and pyrolysis (see Colmorgen and Khawaja 2019) may be relevant from Strumica region's perspective. The Spawnfoam business model can be considered relevant, too.

3.3 OIP Baltic Lagoons, Poland

The Polish OIP focusses on cyprinid fish (e.g. roach, bream) as source of biomass wished to be valorised. In the Lagoons, this feedstock can be used in two different ways as part of a new bioeconomy strategy. First, the cyprinid fish can be valorised as food for human consumption. Thus, the traditional way of using these fishes can generate new income for local small-scale fisheries by supplying the cyprinids as food and as a result of that by increasing the regions' touristic attractiveness. Here, the potential lies in promoting forgotten recipes by means of new marketing strategies and business models (Anzaldúa et al. 2019). Second, the available resources can be valorised by processing them with new technical applications into bio-based products for the cosmetics and pharmaceutical industries (Anzaldúa et al. 2019, Khawaja et al. 2019). Currently, the most cost-effective use for low-value fish seems to be the production of animal feed, but new technologies could help to diversify the processing for a range of various applications. Thus, both ways of valorising the feedstock can stimulate coastal development and help to bring underused fishery resources back into the mainstream. At present, most of the regions' catch is exported to Eastern European countries, but for the region it would be most beneficial to valorise and sell it locally. The logistics for the local extension of the value chain exists, even though most of the valorising process can be done on a very local scale (Anzaldúa et al. 2019, Khawaja et al. 2019).

Even though Poland has no bioeconomy strategy, the Regional Strategy of Innovation of the West Pomeranian Voivodeship for 2011-2020 (Szecin Lagoon area) mentions a bioeconomy based on the

¹ European Commission 2012, Innovating for sustainable growth - A bioeconomy for Europe.

natural resources, the economic and scientific potential and the touristic use of the natural landscape and cultural heritage within the region. Local cooperation between key stakeholders such as administrative units, interested entrepreneurs, scientific entities, already exists. There seem to be no obstacles to get financing for bioeconomy-related projects (potential financiers: e.g. European Maritime and Fisheries Fund line, FLAGS) and the high-level education is of great benefit for the development of a local bioeconomy (Anzaldúa et al. 2019, Khawaja et al. 2019). FLAGS connect different economic and social entities which are key players for developing regional strategies within the bioeconomy. Consequently, a pool of relevant stakeholders, entities, as well as a pool of knowledge exists. Thereby, the social and cultural importance of the fish industry must be considered at any time. Beside the potential use of the fish resources for human nutrition, touristic purposes and bio-based products, an increased catch of cyprinids could help to mitigate the eutrophication of the brackish water², which could have a positive impact on the environment. Nevertheless, clear goals must be defined at this point. Social workshops appear to be a good starting point, since the topic is deeply rooted in society of both lagoons and the awareness of sustainable fishery practices, focussing on local small-scale operations, increases. Thus, one could benefit from the rich local social infrastructure (Anzaldúa et al. 2019). A main challenge for the Polish OIP regions will be the establishing of a two-layered approach. Therefore, clear guidelines for each of the approaches need to be defined. In both cases, SMEs must be integrated in the defining process and supported in order to develop new bioeconomy businesses. Finally, each of the approaches and the businesses should be suitable for the handling of relatively small feedstocks.

For the Polish OIP region, the business model from Hédinn³ can be considered relevant, since the region is interested in the valorisation of untapped fish resources. Hédinn offers a technology which may help to diversify income in the fishery industry.

3.4 OIP Vidzeme and Kurzeme, Latvia

The primary sector of Vidzeme and Kurzeme is an essential part of both region's economy (Anzaldúa et al. 2019). Thus, the two regions have a significant biomass potential, coming mostly from agriculture and forestry as well as from related industries such as e.g. woodworking (Khawaja et al. 2019). Those are the most relevant bioeconomy sectors together with fisheries, the food industry and pulp and paper manufacturing (Anzaldúa et al. 2019). Since the biomass is currently only partly used, a big portion is still available and can be used for bioeconomy-related purposes. Thus, various technology options to produce bio-based materials or bioenergy come into question related to the bioeconomy. Both regions have a good infrastructure, which connects feedstock producers and consumers. Transport companies already arrange the biomass transport in the regions. Furthermore, the two regions have enough personnel (professionals and workforce) with the technical expertise to develop and start new businesses (including management, operation and maintenance of technologies). Local universities and institutions provide programs for start-ups and courses of study related to high added value product production and development and there is also a regional program, which supports new businesses with initial investments. Additionally, a healthy banking system is an advantage in terms of finding initial investment opportunities for bio-based businesses. In total, supporting institutions for R&D and financing as well as the necessary personnel exist, which compose a good potential breeding ground for bioeconomy projects and businesses (Anzaldúa et al. 2019, Khawaja et al. 2019).

A big underlying advantage of the two regions is the already existing bioeconomy strategy (Latvian Bioeconomy Strategy 2030), which was formulated for the country. That shows that the bioeconomy discourse is already underway and the bioeconomy a widely discussed political topic. Since the national bioeconomy strategy towards 2030 is approved by the EU, bioeconomy research funding is available through the EU's Horizon 2020 programme. This opens up additional financing and research & innovation opportunities to the already existing good prerequisites in Latvia in general and the OIP regions in specific. For instance, in Vidzeme, the *Action Plan for Development of a Knowledge-Driven*

² Antti I. 2017, Harvesting cyprinid fish helps mitigate eutrophication, <https://www.luke.fi/en/news/harvesting-cyprinid-fish-helps-mitigating-eutrophication/> (accessed 13.11.2019)

³ Hédinn 2019, <http://bibbico.com/Documents/HPP300Brochure.pdf> (accessed 19.11.2019)

Bioeconomy Innovation Ecosystem aims to support stakeholders with innovative bioeconomy-related business ideas, especially in the wood product and smart material manufacturing and healthy food and beverage production. The *Guidelines for the development of forestry and related sectors 2015-2020 in Latvia's Smart Specialization Strategy (RIS3)* aims to facilitate innovation capacity expansion with special focus on the forestry and wood manufacturing sector. This shows that innovations in the forestry value chains are of high importance in terms of bioeconomy innovation, projects and businesses. The overall prerequisites for the establishment of bioeconomy businesses are promising (Anzaldúa et al. 2019). A big challenge will be the efficient management of the stakeholders in order to establish bioeconomy strategies and businesses. Here, it'll be important to find a proper balance between openness for every interest stakeholder and restriction of the stakeholder pool regarding efficiency.

Since the region's focus lies on biomass coming from forestry and wood-manufacturing industry, the business model from Spawnfoam (see Colmorgen and Khawaja 2019) may be of interest from the region's perspective. Furthermore, business models for pelletizing and briquetting may be considered relevant.

3.5 OIP Covasna, Romania

The Covasna region has a significant biomass potential, mainly coming from the forestry sector (including wood manufacturing and furniture production), the main bioeconomy sector in the region. The second main bioeconomy sector is the agricultural (including agri-food and energy crop production) sector. Both bioeconomy sectors consist of various value chains that end with several untapped raw materials which have the potential to be valorised at a small-scale. Therefore, the relevant technologies mainly apply to these areas and value chains to implement the bioeconomy concept within the country's relevant sectors (forestry, wood and furniture, textiles, agri-food, renewable energy, etc.). Currently most of the woody biomass (wood, energy willow, etc.) is used as fuel (e.g. pellets and briquettes for big CHP) even though it could be used for alternative applications (renewable packaging materials, textiles, etc.), too (Anzaldúa et al. 2019, Khawaja et al. 2019).

The abundance of biomass resources in the region and the already existing specialised clusters are key elements when it comes to push innovation on renewable energy and environmental technologies, agri-foods, forestry products, and textiles. Additionally, the building of industrial parks attracts investors and stimulates synergies and cooperation. Thus, the prerequisites for the formulation and rollout of an integrated bioeconomy strategy are promising. By implementing and integrating such strategies in the region's economic system, the outcome (productivity and revenue generation) could further increase. Therefore, the interplay between key stakeholders needs to be coordinated perfectly (Anzaldúa et al. 2019). One of those key stakeholders are transport companies, which already exist (Khawaja et al. 2019).

Since the attention on bioeconomy-related issues is high in national and EU policies, public subsidies are more likely to flow. Thus, projects that include bioeconomy topics such as bioenergy production and the use of local biomass resources (e.g. use of degraded and less fertile land for growing shrub willow) can benefit from the importance of such topics in policies on different levels (Anzaldúa et al. 2019). The healthy private banking sector in the region allows an easy access to financial resources which is rather important when it comes to the development and implementation of new businesses (Khawaja et al. 2019). Nevertheless, there is still a lack of investment. The R&D infrastructure (universities, companies and institutes) and programs (e.g. start-up supporting initiatives) to support companies in the transition or new companies in the development and implementation exist. Nevertheless, a special task behoves the clusters, which play a key role in creating new business, supporting entrepreneurs (e.g. by providing their networks) and in building up new and sustainable cooperations between companies, politics and R&D institutions in order to achieve a well-developed bioeconomy (Anzaldúa et al. 2019).

The main demanding sectors for future bioeconomy businesses are the agricultural and the energy sectors. Therefore, a closer collaboration of the different key stakeholders (SMEs, clusters, R&D institutions etc.) is essential in the future in order to develop and implement bioeconomy businesses. Additional to that, more governmental support is highly required for the development of new local businesses.

With regard to the biomass potentials the region has, innovative business opportunities may emerge in the forestry and agriculture sector. Therefore, business models from Spawnfoam or Spinnova (see Colmorgen and Khawaja 2019) could be of interest for stakeholders of the mentioned sectors. Furthermore, businesses for pelletizing and briquetting may be considered relevant.

4 Analysis of relevant business models for the OIP regions⁴

Based on the business opportunities of the five OIP regions, derived and condensed from Deliverables D2.2 (Anzaldúa et al. 2019) and D2.3 (Khawaja et al. 2019), four business models were selected to be analysed along the business model canvas. It is important to stress that due to different survey methods (desk and literature research, interviews), the accuracy and depth of the business model canvases differ and so do the analyses. The main purpose of this section is to analyse existing businesses along the business model canvas (the tool will be used again in Task 5.3). Even though the chosen best practices are not analysed in every detail, it gets clear how business model elements interact, and which prerequisites are needed. The status of the presented businesses differs, which affects the scope of the business model description, too. This shows how some bioeconomy businesses are still in a developing process and others which are already proven and established in the market.

4.1 Business model analysis for small-scale pellet producers

Europe's pellet market can be divided into three major types (large-scale users, medium-scale users, small-scale users). Small-scale users often use domestically produced pellets (e.g. on farms) (Sikkema et al 2011). Thus, small-scale pellet production helps to strengthen the position of pellet heating systems and to replace outdated (fossil) heating systems at the same time. Small-scale pellet producers valorise biomass residues and thus facilitate the shift to heating systems based on renewable resources in the overall scope of a regional bioeconomy. The outcome of the business model canvas for small-scale pellet production is shown in Table 1, using the typical skeleton of the business model canvas presented before (this canvas is not company-specific but on a general level). The identified business drivers within the elements are described below as well as their impacts.

Table 1: Business model canvas for small-scale pellet production

Key partners	Key Activities	Value Proposition	Customer Relationship	Customer Segments
Biomass suppliers (from forestry, wood manufacturing, agriculture)	Production process and product optimization	Environmentally friendly alternative to fossil fuels	Personal contact	Households with pellet boilers and ovens
Logistics partner	Cost control management (to ensure a competitive product)	Independence from fossil fuels	Periodically (imitative: producer) and ad-hoc (initiative: consumer) interaction with the customer	Small-scale CHP plants
Technology supplier	Product quality control	Local job and income creation		
Associations related to forestry and agriculture (e.g. orcharding association, timber association)	Pellet distribution	Valorisation of waste and value chain extension		
	Maintenance of partnerships (with biomass suppliers and pellet)	High-quality/energy density pellets		

⁴ The business model analyses conducted in this report do not necessarily reflect the companies' opinions. The data was mostly collected by means of desk research conducted for each business case.

Investors for production units and infrastructure	customers), resource streams and pellet facility Customer acquisition (creating trust and conviction)			
	Key Resources Biomass resources Labour force Financial resources Pellet production unit Local willingness to make use of untapped biomass resources			
Cost Structure Investment costs, biomass supply, marketing, labour, maintenance, facility costs, storage, logistics		Revenue Streams Selling pellets, intellectual property (technology transfer)		

Value proposition

The value proposition is versatile since it can be extended to include social and environmental values besides the economic value the business creates (D'Amato et al. 2018). By valorising waste and residues coming mainly from the agricultural and forestry sector, economic and environmental value is created since disposal costs are saved and high-quality and energy-dense pellets produced. The local production of the product strengthens the local economy and reduces the dependence from fossil fuels at the same time. Thus, the focus here lies not only on the wealth creation, but also on mission-related impacts on society (e.g. income and job generation) and the environment (e.g. replacement of fossil-fuels, reduced logistics) (Qastharin 2015).

Customer segments

The main customer segment for small-scale pellet plants are households, using pellet boilers for heating and small CHP plants. Since the quantity of produced pellets is rather small in such plants, the customer segment is limited to ones with rather small demand compared to industrial use of pellets. Moreover, the producer can be a consumer/customer at the same time and use the produced pellets for self-consumption.

Channels

It is important to know how to raise awareness about the manufactured products and services. Small-scale pellet producers can use personal contacts and associations which promote the production and use of pellets. Furthermore, small facilities may also benefit from word-of-mouth advertising.

Customer Relationship

Good customer relationships are important for any kind of business. The relationships are highly important to small-scale pellet producers, since the customer base is comparatively small. Both parties, the pellet producer and the consumer can take the initiative in order to seal a deal. A focus should lie

on creating sustainable relationships with the limited customer base that has trust in the offered product. This can be achieved by fostering personal contacts.

Key partners

To run a successful pellet business, relationships with the right partners are essential. For small-scale pellet plant owners, biomass suppliers from agriculture, forestry or wood-processing industries which produce wood waste, such as the paper industry, are of major interest. Moreover, a logistics partner is needed, especially for the collection of the untreated biomass from several sites and for the delivery of the final product to the pellet user. Those stakeholders can be bound by contract with different durations. Before starting the business, it is important to purchase the most suitable pellet production facility. Therefore, the technology supplier must be considered a key partner, too. Stakeholders like investors, associations and policy makers need to be integrated as well, since they are of high relevance for defining the business model. Associations often already have a network of biomass suppliers, from which a pellet producer could benefit, and policy makers need to create an environment, where renewable fuels, such as pellets, can compete with fossil alternatives. Thus, the participation of several stakeholders is crucial.

Key activities

Key activities contribute to the value proposition for the customer. To produce an affordable competitive product with positive economic, social and environmental impacts, key activities must be defined. Therefore, the production process as well as the product need to be optimized continuously. This is highly important to ensure a competitive product at high quality in order to compete on the market and facilitate sales numbers. Continuous quality controls are needed to guarantee the highest homogeneity of the product and its consistent heating value at the lowest price possible. Moreover, it is important to acquire customers and create customer confidence by convincing them with the value the pellets have, their advantages compared to alternative (fossil) fuels and the mission behind it. Besides selling the product it is important to distribute it. This can be done through the producer or a logistics company. In case the user has own equipment for transportation, it can be done by the pellet user, too.

Key resources

Several key resources are needed for a pellet producer in order to create value. First biomass resources need to be available for running a pellet plant. Financial resources are crucial for the investment in the pellet production unit. The latter should be operated by labour forces in an efficient way to produce high-quality pellets. Local willingness is a prerequisite for new businesses, which is of high importance when positive social impacts are supposed to be created.

Cost structure

The costs that arise in a business model need to be monitored appropriately. These costs come from key activities, resources and partnerships that are highly required to run the business. It starts with the investment in the pellet production unit and continues with costs for operation (continuous facility, labour and marketing costs) and maintenance in order to run the business efficiently. Moreover, the purchase of biomass requires constant investment, which could be reduced by buying larger amounts of feedstock per purchase (storage space and logistics must be considered here). Nevertheless, these costs can vary in terms of biomass price fluctuations. In case, the biomass supplier (e.g. wood manufacturing industry, farmers or household with forest property) and the pellet producer is one party, there may appear benefits from economies of scope.

Revenue Streams

Revenue streams from small-scale pellet production are generated by selling the produced pellets to the customer segments. Additionally, expertise and intellectual property is generated by running a small-scale pellet facility, from which the operator, associations and networks can benefit. These additional benefits may appear by presenting the best-practice business models in workshops or when it comes to providing the knowledge about the technology/facility to third parties for financial compensation.

4.2 Business model analysis of Bio-Lutions

Bio-Lutions is a public limited start-up company that offers sustainable packaging and disposable tableware solutions made of agricultural residues. Because their technology can use even the shortest fibres (e.g. flax and hemp) from most agricultural residues worldwide, their business is suitable for regional bioeconomies worldwide, too. The small-scale business of Bio-Lutions is summarised in Table 2 and analysed after.

Table 2: Business model canvas of Bio-Lutions

Key partners Local biomass-suppliers from the agricultural sector Local logistics and storage companies Investors (e.g. investment companies) Technology suppliers and developers	Key Activities Production process and product optimization Environmentally friendly processing (energy efficiency, reduced use of chemicals) Local raw material collection and processing Maintenance of relationships with partners, customers and biomass suppliers Continuous (online) updates on the products' advantages and success	Value Proposition Ecologically sustainable and affordable packaging materials and disposable tableware Local value creation Replacement of fossil-based materials (decarbonisation) Raised awareness on the issue of plastic waste	Customer Relationship Personal contact Sales order (defined by the customer) Providing continuously updated content online (social media, blogs)	Customer Segments Online supermarkets and groceries Cafés Online food-delivery services Hospitals
	Key Resources Financial resources Local labour force (joint-venture partners and employees) Production unit Patented technology Biomass resources		Channels Newsletters and magazines with focus on sustainability and innovation Blogs Social media Company website Partners and investors	

Cost Structure	Revenue Streams
Marketing, labour costs, logistics and storage, maintenance of the production facility and business contacts, investment costs, biomass supply	Selling of the packaging materials and disposables, specialist knowledge

Value proposition

Bio-Lutions create ecologically sustainable packaging materials and disposable tableware which are affordable at the same time. Due to rather low raw material costs of normally unused agricultural residues, the company can compete with one-way plastic alternatives made of fossil resources. Moreover, they strengthen local economies since the company obtains its raw materials from local farmers. Thus, additional income for local farmers is created, which facilitates economic development in rural areas. The collection of the raw material and its pre-processing is organized locally, too. Therefore, it can be deduced that Bio-Lutions business creates economic, social and environmental value and thus facilitates the raise of awareness on sustainably produced products and its competitive properties in terms of market exploitation and fossil resources replacement.

Customer segments

The customers of Bio-Lutions are online supermarkets and grocery stores, online food-delivery services as well as shops and catering establishments that require packaging materials and disposable tableware. In addition to that, distributors purchase Bio-Lutions products in large quantities and resale them. Moreover, online food-delivery services and hospitals represent further customer segments. The mentioned customers require large amounts of packaging and disposables and therefore they may have a positive impact in countries with weak waste management and at the same time facilitate rethinking in their fields.

Channels

The channels Bio-Lutions utilizes for sharing information with customers, acquiring new customers and selling their products are versatile. Sharing of information with customers in order to update them continuously happens mainly online via newsletters, magazines and blogs with focus on sustainability and innovation in the fields of the targeted customers. Since the purchasers of the products are rather big companies, the product quantities transferred are large, too. Thus, the products are inquired online which is the base for a contractual agreement of both sides. Finally, partners and investors may facilitate the expansion of the outreach of Bio-Lutions and inform interested stakeholders and customers about their best-practice business.

Customer Relationship

In order to foster customer relationships, continuously updated content on the business is provided through different channels mentioned above. This kind of information sharing can be of utter importance to attract new companies that are interested in operating their business in a more sustainable way. Deals are initiated by the customer, since he is best informed about his product reserves that are necessary to keep the business running. Thus, Bio-Lutions is reacting on sales orders in order to sell their products. Therefore, personal contact with the demanding site need to be fostered continuously.

Key partners

A key partner in developing the business was the technology developer Zelfo, which supported Bio-Lutions during the re-engineering of the mechanical process of fibre production to produce a product that can compete on the market. That was the base to make use of the agricultural residues and to start the business. Moreover, key investors (e.g. DEG, an investment company and now Delivery Hero, an online-food supplier) are highly important for improving and expanding the business even though the initial investment is rather low. For the in-situ operating, contractual bound biomass suppliers and logistic companies are crucial.

Key activities

Because Bio-Lutions uses rather cheap untapped agricultural resources which were normally burnt or disposed, they can produce biodegradable and sustainable products that can compete with petroleum-based alternatives. In addition to that the process and the product are monitored continuously for potential optimization. The process is already highly resource efficient and environmentally friendly since no chemicals are used and the temperatures during manufacturing are kept low. The collection of local raw materials and their in-situ processing results in low emissions connected to transport and logistics. Thus, the value created affects the local society significantly while the carbon footprint is reduced. Moreover, relationships with the customers and further key partners are fostered continuously in order to receive feedback (e.g. for product and process optimization). The promotion of the product is indispensable when it comes to raising awareness of society and acquiring potential customers.

Key resources

Bio-Lutions key resources are financial resources that enabled them to develop their unique technology, build the production unit and run the business in a profitable manner. Even though, the initial investment was rather small, financial resources play an important role during the whole lifetime of the business. Another key resource for Bio-Lutions is the availability of local raw material and labour force. The production staff doesn't need specific technical skills why they can be trained on-site for working in the processing facility. This is a major advantage for the company itself and the region, since local jobs and incomes are created. Moreover, the company has a patented technology, which is a key resource to secure revenue streams from sales of products and to set itself apart from the competition.

Cost structure

Costs arise from wages, marketing, rents (for the production building), logistics and storage and energy needs. In addition to that, the facility requires continuous maintenance. The relationship management is another cost factor for the company. As already mentioned, the investment and raw material costs for Bio-Lutions business are rather small. Nevertheless, running, improving and expanding the business are arising costs during the whole lifetime of the business.

Revenue Streams

The main revenue is generated by selling sustainable packaging materials and disposables. Currently, the company generates \$8 million revenue annually.

4.3 Business model analysis of Spawnfoam

Spawnfoam, an innovative start-up company, developed a technology that turns organic and agroforestry residues into a renewable biocomposite which can be used for the manufacturing of plant pots, construction boards and ornamental vases. One core element of the technology is mycelium, a fungus which works as a bonding agent to cohere the biomass particles.

Spawnfoam is a public limited spin-off company from CITAB (Centre for the Research and Technology of Agro-Environmental and Biological Sciences) and one of eight Portuguese SMEs that integrated the H2020 Research SME Instrument⁵. Thus, the Spinnova project received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 827643. Against this specific background, Spawnfoam's business model is analysed in the following. Table 3 shows Spawnfoam's business model in a condensed form.

⁵ CITAP 2018, Spin-off company Spawnfoam distinguished by the European Commission, <https://www.citab.utad.pt/news/spin-off-company-spawnfoam-distinguished-by-the-european-commission> (accessed 19.11.2019)

Table 3: Business model canvas of Spawnfoam

Key partners Business incubators Educational institutions (universities, R&D institutes) Laboratories Biomass suppliers (e.g. vineries) Customers, retailers and online shop providers (promotion of the product) Social media companies Logistics partners for the collection of biomass and distribution of products Investors and funders (e.g. EU) Technology supplier	Key Activities Production process and product optimization Pre-processing (e.g. biomass chipping) Maintenance of relationships with partners, customers and biomass suppliers Continuous (online) updates on the products' advantages and success Sales and marketing	Value Proposition Sustainable and biodegradable biocomposite for various applications Replacement of fossil-based materials (decarbonisation) Extending life cycle of natural resources Ecological footprint reduction	Customer Relationship Providing continuously updated content online (social media, blogs) Sales order (defined by the customer) Personal contact	Customer Segments Private persons and households that are aware of environmentally friendly solutions Tree and plant nurseries Construction industry DIY stores Online shops
	Key Resources Skilled labour force for product development and marketing Laboratories for product development Biomass resources Production unit Financial resources (seed capital) Creative and stimulating environment for start-up establishment		Channels Newsletters and magazines with focus on sustainability and innovation Blogs Social media Company website Online shops and DIY stores Word-of-mouth promotion (e.g. by universities, research institutes partners, investors, etc.)	
Cost Structure Investment costs, biomass supply, marketing, (skilled) labour, rent for laboratories and business incubator spaces, logistics, maintenance of the production facility, energy			Revenue Streams Selling of the biocomposites, showcasing experience as a best practice on different occasions (workshops, fairs, etc) (major awards and prizes)	

Value proposition

The value proposition of Spawnfoam's business model can be divided into different values created. The most obvious one is the creation of a sustainable and biodegradable biocomposite which can be used for various applications and thereby replaces fossil-based alternatives which facilitates decarbonisation of nurseries, house construction and private households. Forming the biocomposite to plant pots appears to be environmentally beneficial twofold, since they can be reused for organic fertilization after their original application. Furthermore, local universities and institutes as well as local clusters may profit from such innovation, since the innovation location is strengthened which also has a social added value (increasing attractiveness of the region for companies may stimulate job creation). These institutions and clusters gain reputation through such successful businesses and become attractive partners for developing new businesses. More at the beginning of the value chain, additional income is generated since agroforestry residues generate new revenues for biomass suppliers.

Customer segments

The customer segment of Spawnfoam mainly consists of three groups of customers. Firstly, there are customers such as tree and plant nurseries and the construction industry (possible application: acoustic isolation of recording studios, thermal insulation) that purchase the biocomposites in rather large quantities. Secondly, retailers such as DIY stores, purchase the products to sell them to smaller target groups like e.g. private persons and households that focus on environmentally friendly solutions (third group).

Channels

To reach the costumers, different channels can be used. Information can be spread through newsletters and magazines which address sectors that are receptive for innovative and sustainable technologies like the construction industry and plant cultivation. Further online channels such as blogs, social media, the company's website as well as online shops are important in terms of information transfer and sale. Since Spawnfoam is a spin-off company from CITAB, the university and involved research institutes are important channels regarding technological exchange with external experts (e.g. from biotechnology and -engineering, product design, etc.) for product design and property improvement. Finally, partners, investors and funders can increase the company's reach via their word-of-mouth. By receiving funding from the European Union's Horizon 2020 research and innovation programme, the company profits from the big reach the EU already has which affects the popularity of Spawnfoam. In addition to that, online shops, hardware and DIY stores are distribution points that help to reach the customer and find the products for sale. For the collection of raw material and distribution of the products, logistics companies are needed.

Customer Relationship

As already mentioned for the start-up company Bio-Lutions, online content on the business, provided by the channels above, is updated continuously for the customers. Ongoing information sharing is essential to foster customer relationships, but also to attract new ones that are interested in operating their business more sustainably and in purchasing renewable products. Deals are initiated by the customer since they commission the quantity of products that is needed for their businesses. To maintain this relationship and to bin customers, the personal contact with the demanding site is fostered continuously. Furthermore, the products can be purchased directly via online shops and DIY stores.

Key partners

Start-ups such as Spawnfoam strongly benefit from various key partners. In this case, it is important to have an environment which serves as a good breeding ground for entrepreneurs. Here, the environment consists of business incubators, universities as well as research institutes that focus on the development of green businesses and sustainable resource management⁶. Thus, knowledge and physical infrastructure such as laboratories are available for developing the technology and a suitable business model. When it comes to establishing the business, technology and biomass suppliers (e.g. contractual bound vineries) as well as logistic companies become crucial to produce the developed biocomposite. Retailers, online shops and social media providers take over key roles in promoting and

⁶ Partners of Spawnfoam are listed here: <https://www.spawnfoam.pt/en/>

selling the products. Further key partners that enabled the business development of Spawnfoam, are investors and funders. In this special case policy-driven funding programs such as Norte 2020 and Horizon 2020 were elementary keys for success. Thus, there are several key partners that participate in today's business and also contributed significantly to the development and establishment of Spawnfoam's business model.

Key activities

Spawnfoam aims to offer a cost-effective product that can compete with its alternatives. This is of major importance when it comes to price pressure created by the market. What distinguishes the biocomposite from other competing materials is its environmental and social value which is generated by extending the life cycle of untapped agroforestry residues and thus valorising them. Here, Spawnfoam focusses on biomass resources from surrounding areas e.g. from vineries. These resources need to be chipped in order to use them in the actual manufacturing process. The promotion and sale of the product are key activities, too, that are essential for generating revenues in the end. Therefore, different channels and customer segments are used. The product and its advantages need to be communicated through different channels continuously. Thus, the relationship to customers is fostered. The maintenance of relationships with key partners (biomass and technology suppliers, pre-processors, research institutes, funders, etc.) must be considered a key activity as well.

Key resources

Since Spawnfoam developed an innovative technology, skilled labour force for the product development and marketing are as crucial as appropriate research infrastructure such as equipped laboratories. Therefore, a creative and stimulating environment is beneficial for a start-up development and establishment. This can be generated by the partners mentioned above. The financial support from the innovation fostering programs was essential for Spawnfoam's business development. For running the business, biomass resources from the surrounding areas are highly important, since they are, together with the used fungus, key resources for the final biocomposites. Finally, the different compounds are set together and processed in the production unit that manufactures the final product.

Cost structure

Spawnfoam's cost arise from key partnerships, activities and resources. Thus, skilled labour (product development and marketing) and the required biomass are two continuous cost factors. Since the biomass and the final product need to be collected and distributed, costs result from logistics. Moreover, business incubator spaces and laboratories must be rented (at least in the beginning of the business), which implies additional costs at this point, too, besides running and maintaining the production facility.

Revenue Streams

The main revenue of Spawnfoam is generated by selling the biocomposites to its various customer segments. Major awards and prizes support Spawnfoam in promoting products and thus generate additional revenues.

4.4 Business model analysis of the Hédinn protein plant

Hédinn is an engineering company that offers a transportable plant for protein production from fish waste. The company offers three different size configurations and thus, it is also suitable for small-scale production of fish protein from smaller feedstocks. By using this protein plant, small-scale fisheries as well as fish processing companies can valorise untapped or disposed fish processing residues and bycatches and thus stimulate economic growth, save disposal costs and strengthen the regional bioeconomy. Such a plant can be operated by fisheries, fish farms as well as co-operatives⁷.

⁷ Hédinn Protein Plant, <http://bibbico.com/Documents/HPP300Brochure.pdf> (accessed 19.11.2019)

The Hédinn business model for small-scale protein production is summarized in the business model canvas in Table 4⁸.

Table 4: Business model canvas for a protein plant from Hédinn

Key partners Feedstock suppliers (fisheries, fish farms, fish processing industries, fishing vessels, seafood restaurants) Logistics partner for the collection of raw material Technology supplier Hédinn Investors for the business	Key Activities Fast transport for high-quality products Production process and product optimization Maintenance of relationships with partners, customers and biomass suppliers Procurement of the feedstock Location identification for processing	Value Proposition Creation of natural and sustainable products for the customers Income creation Saving of fish waste disposal costs Valorising untapped and disposed feedstocks Extending life cycle of fish processing waste and bycatch	Customer Relationship Personal (on-site) contact On-site sales	Customer Segments Food and feed producers Cosmetics manufactures Pharmaceutical manufacturers
	Key Resources Financial resources (seed capital) Hédinn’s protein plant Fish waste and residues Local willingness for implementing new innovative technologies		Channels Associations like fishery, healthcare and cosmetic associations (word-of-mouth) Logistics for procurement of feedstock and distribution of the product	
Cost Structure Investment costs, feedstock, labour force, logistics, operation and maintenance of the production plant			Revenue Streams Selling of fish protein products	

⁸ Although Hédinn's protein plant was not presented in D2.1, it is suitable for analyzing the business model in the fishery sector on a small scale. Sintef's mobile sealab appeared to be less suitable, since it deals more with the product development and process optimization which are key actions that take place way before the development and establishment of a business.

Value proposition

The value created by Hédinn is versatile. By exploiting underused resources, their life cycles are extended which leads to economic value generation from normally untapped resources. Thus, the use of the feedstock gains an added-value as a bio-product and saves disposal costs which often accompany with environmental issues. This sort of value generation can be realised on local level which stimulates local development (income creation for biomass suppliers and operators). Moreover, a natural and sustainable product is created that may replace less sustainable alternatives in the food and feed, cosmetics and pharma industry.

Customer segments

The customer segments of Hédinn consist of food and feed producers, cosmetic and pharmaceutical manufactures which attach importance to sustainable resource use. This also includes a high potential for acquisition of end users (of pharma and cosmetic products, feed, etc.) that focus on sustainably produced products.

Channels

Since the proper flow of feedstock is related to the quality of the product, logistics for the feedstock transportation as well as the distribution are of major importance (e.g. focus on reliable logistics companies). Local trade as well as sector or industry-specific associations (fishery, healthcare and cosmetic associations) are important in terms of raising awareness of local products and its further applications. Like this, the establishment of business contacts can be facilitated.

Customer Relationship

Since the Hédinn business is primarily suitable for the value generation on local level, the direct selling of the product for surrounding companies is important. Thus, on-site sales are beneficial for the quick acceptance of goods by the customer. Since the facility is highly mobile, products can be processed at the feedstock source or at the customer's site. Personal contacts are essential for a proper customer relationship management in order to foster business contacts.

Key partners

In order to run a Hédinn protein plant, the interplay of several key partners is crucial. First, the production facility needs to be supplied. To run it properly, raw material suppliers (fisheries, fish farms, fish processing industries, fishing vessels, seafood restaurants), which provide high-quality feedstocks, need to be identified. The quality of the fish meal and oil strongly depends on the freshness and type of raw material. Moreover, reliable logistics partners need to be chosen in order to guarantee a gentle mechanical handling during the transport⁹. Finally, investors for the business need to be acquired. The investment structure may distinguish significantly depending on the property situation. As mentioned before, such production plants are suitable for fisheries, fish farms and co-operations etc. Provided that the facility is operated by several parties (e.g. associations of fisheries), the financial effort can be reduced by sharing the investment costs. Besides sharing the investment costs, the access to such a business is shared, too, which would not have been possible normally (Fogarassy et al. 2017). This may foster local communities and raise social and environmental awareness.

Key activities

Key activities of the business include a fast and safe transport of the raw material and the cost-effective processing of it. Before, suitable feedstocks pools are identified in order to procure high-quality feedstocks. The production process can be controlled on-site and remotely which makes the operator more flexible. The identification of a proper processing site is crucial to keep transportation costs as low as possible. The maintenance of the relationship with key partners, such as customers and biomass suppliers, and of the production facility is crucial for running the business profitably.

⁹ Hédinn 2019, Advantages of the HPP Process, <https://hedinn.com/fishmeal-processing/the-hpp-process/> (accessed 19.11.2019)

Key resources

Since Hédinn developed a technology which is supposed to be run locally, local willingness within the fishery sector for implementing and running new innovative technologies is an important resource in terms of establishing a new business. To run the plant, fish waste and residues are necessary because they pose the base of the business. Financial resources for the purchase of Hédinn's protein plant, the establishment of the business and its operation are crucial.

Cost structure

One of the major cost drivers is the investment of the production facility at the beginning of the business. In addition to that, fish raw material costs and wages are fixed costs during the whole lifetime of the business as well as the maintenance of the facility. Since the logistics play a major role for the quality of the final product, higher costs are expected here.

Revenue Streams

The revenue of Hédinn is mainly generated by selling the fish-based protein products. Usually, these revenues are additional ones, since the Hédinn protein plant can be run by fisheries or fish processing companies.

4.5 Business models – local suitability and impacts

The application of the business model canvas on different business models showed how the coverage of the OIP business opportunities can differ between the different businesses analysed. The degree of coverage depends on the considered feedstock but also on the general framework in the regions (e.g. educational infrastructure, company landscape, policies).

Important influencing factors behind each of the business models are the technology which stands in the core of the business as well as the traditional backgrounds, biomass availability and investment opportunities within the regions. That became obvious by investigating the business model for small-scale pellet production. Since all the addressed OIP regions (except the Polish Lagoons, which focus only on cyprinid fish resources as feedstock) have appropriate feedstocks for pelletizing, the required infrastructure and personnel to run such a business can be applied in every single OIP region. These ready-to-use technologies can be financed in different ways, either by single persons, associations or by shared investments. For such business, it is crucial that the rather easily produced product can compete with its alternatives such as fossil fuels. This applies notably to the required ovens in households and to CHP plants, which are target customers of a pellet business. Therefore, an important role is attached to policy makers in the regions, since they can steer the market addressed (e.g. subsidies, tax rebates, etc.). The investment costs for small-scale pellet units vary depending on the production capacity. For a pellet plant with a production capacity of 150 t/a, the investment costs are 30.000 € (production capacity 7000 t/a: 290.000 €) and the payback time is normally three years. During the operation of such facilities, the origin of the raw material and labour and production costs affect the margins¹⁰ (the larger the plant, the more profits from economies of scale). In case the raw material does not come from the pellet producer, surrounding foresters and farmers benefit from selling their raw material, which was normally untapped, disposed or burnt and thus they generate an additional income. In that way, added value is generated along the value chain which poses a positive socioeconomic impact. Moreover, local pellet production reduces the dependence from fossil fuels, replaces them in e.g. households and CHP plants and reduces overall logistics costs and emissions from fossil fuels. Thus, there is a remarkable positive environmental impact from pellet businesses, too.

The Hédinn business is mainly relevant for the Polish OIP regions, since they focus on the valorisation of cyprinid fishes. The raw material, consisting of fish processing residues and bycatches, exists in the region and is rather untapped so far. The infrastructural and financial conditions are suitable for a business like that, since the relevant stakeholders exist. A main challenge here will be the setting of priorities regarding the twofold approach of the region. That includes the valorisation of the untapped

¹⁰ EUBIONET 2, https://www.fh-eberswalde.de/_obj/B95369BC-D770-47BE-BD26-53FB7A3AFAC2/outline/ (accessed 26.11.2019)

fish resources by using them to produce bio-based products, as it is done in the Hédinn business, on the one hand. On the other hand, marketing strategies are aimed in order “to get the fish back on the plates”. Economic, social and environmental impacts can be expected for both approaches, but especially regarding the economic impacts one must consider the competition of both approaches and their specific expected economic values.

The Hédinn process requires less water and energy, than comparable technologies and thus it is economically and environmentally beneficial at the same time. In addition to that, new revenue streams are created. Firstly, minimum staff is needed (which may become highly relevant for fisheries and fish-processing enterprises with limited resources)¹¹ for operating the processing unit and secondly, fisheries and fish processing industries create new incomes by selling their untapped fish feedstocks and processing wastes and residues. Simultaneously disposal pressures are reduced. Additional to that, more aimed fishing of cyprinids may help to reduce eutrophication which may have positive environmental impacts and subsequently benefits for the local economy. All impacts considered rural development can be stimulated while protecting the environment.

The business model from the start-up company Spawnfoam showed clearly how different influencing factors must be arranged in order to develop a technology and the appropriate business. Therefore, many different stakeholders from industry and R&D need to be considered in order to develop and establish such a business. Nevertheless, good financing options are required as well as luck and chance. The successful development of Spawnfoam was positively influenced by funding programs, business incubators and R&D institutes. Today, the impact of Spawnfoam appears in various dimensions. The used raw material comes from the northern parts of Portugal which is highly beneficial for the socioeconomic development of the region. Since agricultural by-products and forest residues present the main resource pool, local economic agents from the agricultural and forestry sectors profit from the company because they become part of the raw material supply chain. Besides the additional income generation in the rural areas, multiple jobs will be created during the upscaling of the production. In addition to that, Spawnfoam has significant positive impacts on the environment. By creating sustainable and biodegradable products, fossil-based products are substituted. Therefore, Spawnfoam facilitates decarbonisation for a range of products, reduces GHG emissions and prevents the deposit of waste in landfills or in the seas. Moreover, their plant pots are even beneficial for plant growth (e.g. in nurseries), which becomes important with regard to a growing market for forest preservation¹². Even though the required raw material exists in all of the addressed OIP regions (except in the Polish OIP), the OIPs Vidzeme and Kurzeme and Covasna offer more suitable prerequisites for the development and establishment of such a business, since they profit from a beneficial environment consisting of educational and research institutions, financing and research & innovation programmes and opportunities, comprehensive networks and strong SME landscapes. Nevertheless, the Covasna region still needs to overcome the heavy under-investment within the region in order to develop such a business.

The business from Bio-Lutions may be attractive to all the targeted OIP regions (except the Polish OIP), since only basic infrastructure and raw materials, which are abundant in every OIP region, are required for running the business. The company has a major interest in using local resources to produce their biodegradable products. Thus, local biomass suppliers benefit from additional income by being involved in Bio-Lutions local supply chain. At the same time, transport costs and emissions for the biomass collection are kept low. In addition to that, the company strongly focusses on employing local production staff in the production facility, since they can be trained easily in order to work within the business. The decentralised production and the local value creation have a high replication potential for rural areas which stimulates rural development. The utilized raw material is outside of the human food chain and other value chains. Thus, there is no competition but even an environmental benefit since the raw material is saved from being burnt, disposed or not collected at all. Moreover, Bio-Lutions offer a biodegradable substitute for fossil-based products in the tableware and disposable sector. By doing so, the company counteracts the waste problem, mainly coming from fossil-based

¹¹ Hédinn Protein Plant, <https://hedinn.com/fishmeal-processing/the-hpp-process/> (accessed 26.11.2019)

¹² Government Europa, <https://www.governmenteuropa.eu/sustainable-plastic-substitutes/90574/> (accessed 26.11.2019)

plastics and thus facilitates decarbonisation¹³. This is highly important for regions with weak waste management.

5 Conclusions

The analysis of the business models showed how they varied in terms of the technology used and its market integration, the target groups addressed, and the key partners, resources and activities encompassed. The business model canvas appears to be a good tool to analyse a business model and its specific elements in order to align it with the potentials of the OIP regions. Of course, there are some elements in the canvases that were consistent along the four conducted analyses, but there are also key elements that varied and thus affects the suitability of a business model directly. In case there appeared large gaps in the elements, stakeholders in the OIP regions are now sensitised in order to adjust or further develop certain prerequisites and tackle (current) barriers in order to establish specific businesses. Thus, missing elements can be identified in order to develop a breeding ground for future bioeconomy strategies and businesses.

Even though the businesses could not be analysed in every detail, a tool for business analysis was presented that will be relevant again during the project activities, namely when it comes to the development of business models in Task 5.3 of BE-Rural.

¹³ Bio-Lutions, <https://www.bio-lutions.com/re-sourcing/> (accessed 26.11.2019)

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