

A collage of 12 images arranged in two rows of six. The top row shows: 1) A woman in a white shirt and dark pants bending over in a field of tall grass or wheat. 2) A close-up of a hand holding a large, round, brown, textured object, possibly a piece of bread or a seed pod. 3) A pile of small, red and green apples. 4) Hands holding a bunch of fresh green herbs. 5) Four small white bowls containing different types of food items, likely seeds or small grains. 6) A close-up of a corked bottle of olive oil next to several yellow sticky notes with handwritten text. The bottom row shows: 7) A scenic view of a river flowing through a lush green valley with mountains in the background. 8) A man in a white tank top standing in a field of purple flowers, holding a basket. 9) A close-up of a corked bottle of olive oil next to several yellow sticky notes with handwritten text. 10) A person sitting on a rocky ledge overlooking a vast mountain landscape under a cloudy sky. 11) A group of about 15 people standing together for a group photo in front of a wooden building. 12) Several glass jars filled with different colored spreads or dips, including yellow, green, orange, and purple.

TABLE OF CONTENTS

1.	Introduction	3
2.	Apple value chain	8
	a) Analysis of the apple value chain	8
	b) “Discovered” potentials of the value chain.....	10
	c) Ideas for eco-innovative products and business model development.....	11
	d) Business models selection and test phase.....	13
	i) Gluten-free apple flour	14
	ii) Disposable tableware and biodegradable packaging.....	16
	e) Development of policy and transfer guidelines	17
3.	Walnut value chain.....	21
	a) Analysis of the walnut value chain.....	22
	b) “Discovered” potentials of the value chain.....	22
	c) Ideas for eco-innovative products and business model development.....	25
	d) Business models selection and test phase.....	27
	i) Walnut spreads	27
	ii) Walnut flips.....	28
	e) Development of policy and transfer guidelines	30
4.	Herbs value chain	33
	a) Analysis of the herbs value chain.....	34
	b) “Discovered” potentials of the value chain.....	36
	c) Ideas for eco-innovative products and business model development.....	36
	d) Business models selection and test phase.....	38
	i) Herbal pacifier	38
	ii) Alpine hay seeds	41
	e) Development of policy and transfer guidelines	43
5.	Overarching business model for apples, walnuts and herbs.....	45
	a) The digital service platform business model – a special case.....	45
	b) Search for existing platforms to learn from.....	47
	c) Approach, feasibility and testing of good practice platform model.....	48
	d) Help to further develop the existing approach/platform and “lessons learned”	49
	e) Summary, outlook and recommendations	50
6.	Transfer of results	52
7.	Conclusion.....	57

Dear reader,

This report summarises and presents the project activities and results of the AlpBioEco project, a three-year research innovation project, focusing on bioeconomy. AlpBioEco addresses the bioeconomy potentials in six Alpine regions of the European Union, using innovative methods to foster sustainable development through bioeconomy. The project raises awareness regarding the economic potential in bioeconomy and actively supports interdisciplinary and supra-regional cooperation for the development of eco-innovative business concepts. The AlpBioEco team hopes you enjoy reading!

The AlpBioEco team

1. INTRODUCTION

The Alpine space with its rich variety of locations, resources and people contains huge potentials for the development of the bioeconomy, which can in turn promote eco-innovation and so-called “green growth”. While definitions of bioeconomy vary, they all share a common idea: the use of renewable, biological bio-based resources for goods and services. In the 2012 European Union Bioeconomy Strategy, bioeconomy is defined as the production of renewable biological resources and their conversion into vital products and bioenergy. A 2018 update of the strategy emphasises rapid creation of local bioeconomies across Europe¹ – the notion of bioeconomy has taken on a new political orientation, focused on a structural change of the current economy towards a more sustainable economic system. This includes not only resource preservation and climate protection but also resource efficiency, which the European Commission has set as a goal by way of the development of its agenda for the so-called circular economy. In particular, the value gained from already used resources as well as side-streams should be increased. Using natural substances and residual organic materials paves the way to creating new, alternative products, consequently fostering not only the development of a circular economy but also encouraging biodiversity, sustainability and economic growth. Furthermore, bioeconomy moves beyond the mere production of biological products – it also encourages new methods in product development and processing by means of technology. Unlocking the potentials of bioeconomy is one of the key challenges of the new century: expanding bioeconomy, particularly in rural areas, represents a major development opportunity, especially in terms of creating new jobs and fostering sustainable and lasting economic growth.

BIOECONOMY AS A DRIVER OF ECO-INNOVATION

Eco-innovation is the cornerstone for achieving a sustainable bioeconomy. Innovation means successfully putting in place novel solutions and ideas in order to achieve higher competitive advantage (Hauschildt & Salomo, 2010; Weis, 2012). In the face of increasing demands for sustainable and eco-friendly products, services and processes, eco-innovation is assumed to lead to reduced costs, helps to capture new growth opportunities, and strengthens a company’s image in the eyes of its customers (O’Brien et al., 2018; Fussler & James, 1996). Because of these factors, eco-innovation represents a crucial strategic opportunity for businesses. Small and medium-sized companies can especially benefit from eco-innovation by ascending the value chain (for example, by transforming themselves from suppliers to producers of end products), by entering new markets and thereby unlocking fresh potential for value creation. By supporting eco-innovation, the EU strengthens its economy and addresses common global and local challenges such as climate change, resource scarcity and dwindling biodiversity.

¹EU bioeconomy policy available at: <https://ec.europa.eu/research/bioeconomy/index.cfm?pg=policy&lib=strategy>

ECO-INNOVATIVE BUSINESS MODELS

A business model explains why, for whom, and how a company creates value and in return earns money (Gassmann & Sutter, 2016). The conceptual framework of a business model centers around the idea of satisfying the perceived needs of the market, asking the question: Which pain point(s) of our customers do we address? It includes, for instance, information about the core activities, needed investments and partners, and the market and competitor situation. Through the strategic alignment of these elements, business models become difficult to imitate and allow for the exploitation of business opportunities and economic growth. While a business model describes the rationale of how companies “create, deliver, and capture value” (Osterwalder & Pigneur, 2010, p. 14), an eco-innovative business model aims to do the same whilst achieving higher levels of ecological sustainability. Sustainability includes improvements in resource efficiency, or reducing negative environmental impacts in various ways, for instance by minimising input, throughput, and output streams, by reducing risks to health, safety and the environment, exploiting by- or side-products, and by re-using apparently waste energy in the process of value creation (Hellström, 2007).

Consequently, integrating eco-innovation in business model designs entails successfully putting in place new or significant changes towards more sustainability in the value proposition (e.g. new features, added services), the target markets or customer groups addressed, the value creation architecture (e.g. new supply chain solutions), and the revenue streams (like “freemium” or pay-per-use) of a company. An enterprise developing an eco-innovative business model can in this way create a unique chance to achieve new environmental and economic benefits, which are the main outcomes of eco-innovation as defined by the Eco-Innovation Observatory² of the European Commission.



Bringing the AlpBioEco project to life: Dr. Christin Wohlrath

Behind every European project is an initiator who built it and brought it to life. For the AlpBioEco project, this was due to the commitment of Dr. Christin Wohlrath, former director of the Innovation and Technology Centre at the InnoCamp in Sigmaringen, Germany. As head of AlpBioEco, Dr. Wohlrath managed its initial year before the first project coordinator was hired. Many thanks to her for her constant help and advice in the management and communication of the project! *“Circular Economy is the key – working together along our value chains!”* Dr. Christin Wohlrath



Dr. Christin Wohlrath, former director of the InnoCamp (left) and Gloria Kraus, first manager of the AlpBioEco project (right)

The European project management and the City of Sigmaringen



The City of Sigmaringen supports its local entrepreneurs by involving them in AlpBioEco's research work (left: Anna Bäuerle, middle: Andrés Negreros Abril, owner of the fruit shop “Andy's Früchte”, right: Gloria Kraus).

Wondering how collaboration in an international project with many partners works? One project partner coordinates the collaboration, takes care of administrative issues and leads the project consortium so they can jointly achieve the project's goals. For AlpBioEco, the [lead partner and overall coordinator is the City of Sigmaringen](#), which employed two project coordinators: Gloria Kraus until the end of 2019 and Anna Bäuerle from 2020 until the end of the project. Strongly committed to raising awareness of the bioeconomy, they have also represented AlpBioEco at [numerous regional](#), national and [international events](#) and have been extensively involved in value chain research.

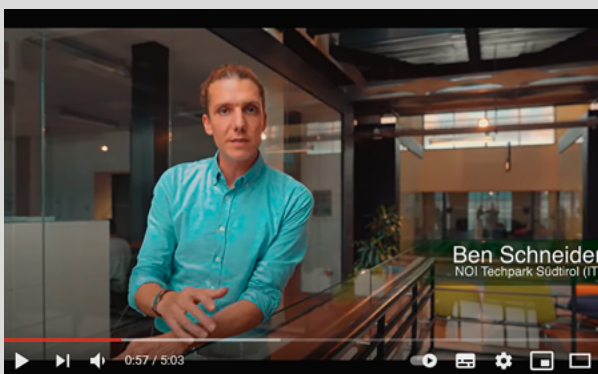
ECO-INNOVATION GOES FAR BEYOND NEW PRODUCTS

Multiple pathways exist for the uptake of eco-innovation, such as repair, re-use, valorisation of by-products or waste products, remanufacturing, or recycling. In particular, the way that products are designed and manufactured (considering aspects such as modularity, multi-functionality, reparability, longevity, and durability) has a significant impact on the options available to both consumers and companies after the products' initial use phase. However, eco-innovation not only refers to new products but also to processes and services. Likewise, new manufacturing processes can help save resources (e.g. raw material, energy), enable the use of renewable raw materials along with new manufacturing technologies (e.g. wood, apple pomace, walnut press cake, Alpine hay), or the re-use of processed energy and side-outputs (e.g. heat, steam, waste water). Moreover, non-technological innovations also open up novel options for eco-innovative business models. New supply chain architectures can reduce CO₂ emissions and streamline logistics, and new product-related services (like sharing, repairing, and upgrading) can create opportunities for value creation and increased sustainability. Furthermore, by establishing new opportunities for interaction and exchange between local and regional stakeholders, service-platforms create new environments in which the stakeholders can create eco-innovative value together.

The involvement of customers and end users is a crucial component of eco-innovation. In eco-innovative business models, consumers are no mere passive receivers of goods and services but are instead empowered by becoming participants and key drivers for more sustainable products, for instance by co-creating new products, processes and services, by taking an active part in the production process or by identifying new opportunities for the re-use of waste materials. New opportunities, for example the setting up of repair cafés or collaborative production and consumption schemes, can enable sustainability-conscious citizens to become active eco-innovators. Along these lines, eco-innovative business models can also change the ways in which profit is generated (for instance, by means of leasing or pay-per-use models), consequently unlocking fresh and emerging markets.



NOI AG and the official video of AlpBioEco on Youtube



In September 2019, a video presentation of the project came out on the brand new AlpBioEco YouTube channel. This was made possible thanks to the close cooperation with the Italian project partner [NOI AG](https://www.noi.it/). NOI is a strategic network of established firms, start-ups, investors, universities and development institutions. In the AlpBioEco project, the work of NOI centred mostly on the value chain of apples, as apples are an important economic resource in South Tyrol. Towards the end of the project, NOI also supported the herbal pacifier business model

and later focused on the herbs value chain as well. In the picture is Ben Schneider, Head of Tech Transfer Food at the NOI Techpark in Bolzano, and in the background is the “incubator”, where innovative start-ups are mentored.

²The Eco-Innovation Observatory is a platform that provides a wide range of information on eco-innovation gathered from across the European Union (<https://www.eco-innovation.eu/>). More details can be found at: <https://www.eco-innovation.eu/index.php/reports/eco-innovation-briefs?download=1:eio-brief-01>

ECO-INNOVATION AS A DRIVER OF SOCIETAL CHANGE

Eco-innovation should not be considered only at the company level. Technological eco-innovation must be supported by a corresponding evolution of social arrangements and institutional support structures (Freeman, 1996). Successful eco-innovation not only builds upon relevant social structures, but can sometimes even influence those structures (by new forms of collaborative value creation or grassroots initiatives by civil society actors). Eco-innovations can thereby encourage social and cultural acceptance of sustainability as a way of life. This aspect adds a social dimension to eco-innovation, which shows that it generates more than “just” a novel type of commodity or a new economic sector. Viewed through this lens, eco-innovation is then considered more in terms of usage and its process of value creation, rather than merely in terms of a new product or service on the supply side. The societal context associated with eco-innovation also introduces a governance aspect to making eco-innovation a more integrated tool for sustainable development (James, 1997; Rennings, 2000).

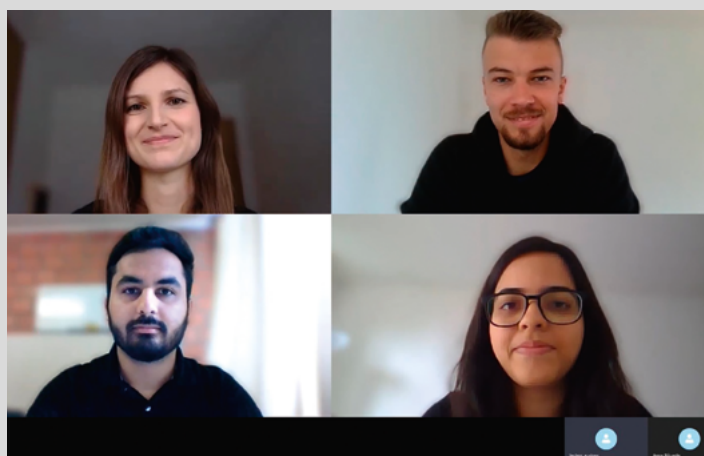
ALPBIOECO – A BIOECONOMY AND ECO-INNOVATION PROJECT

AlpBioEco is a three-year research project that addresses the potentials of bioeconomy in six Alpine regions within the European Union. AlpBioEco was co-financed through the Interreg Alpine Space Programme and by the “Federal Transnational Cooperation Programme” of the German Federal Ministry of the Interior, Building, and Community. The interdisciplinary project group consisted of thirteen partners from five different countries sharing the Alpine area (Austria, France, Germany, Italy, and Slovenia), uniting research bodies, businesses, innovation centres, academia, local entities, NGOs, industry associations, and chambers of commerce.



Collaboration with the University of Hohenheim

In 2019 and 2020, [AlpBioEco collaborated with the University of Hohenheim](#), Germany, which specialises in research on the bioeconomy. Within the module “Projects in Bioeconomy Research” of the international Master’s degree course in Bioeconomy, AlpBioEco spent two years working closely with students. The first group of students focused on selecting a suitable business model for the bioeconomic potentials of the walnut value chain in Alpine areas using information gathered in a review of the relevant literature. They evaluated two promising business models: walnut press cake as a replacement for traditional wheat meal, and walnut shells for use as microbeads in the cosmetics sector. The second group of students researched and analysed the EU’s overall bioeconomy strategy and the national bioeconomy strategies of Austria, France, Germany, Italy, and Slovenia, countries where AlpBioEco operated. These students evaluated food value chains, stakeholder collaboration, and the promoting of eco-innovatory practices. The research took place under the supervision of AlpBioEco’s lead partner city of Sigmaringen and, in 2020, its project partner Business Upper Austria.



In 2020, four students researched and analysed the EU bioeconomy strategy and the national bioeconomy strategies of the five AlpBioEco countries.

By using innovative methods to foster sustainable development in the Alps, AlpBioEco raises awareness regarding the economic potential of bioeconomy in the Alpine space, and actively supports interdisciplinary and supra-regional cooperation for the development of innovative business concepts. In particular, AlpBioEco aims at unlocking the potentials of bioeconomy along the value chains of regional vegetable extracts and foods as well as their side-streams. By choosing the value chains of apples, walnuts, and herbs, AlpBioEco focuses on important regional value chains of the respective Alpine regions. In this way, the project contributes to more sustainable regional development and to the promotion of green growth in the Alpine space.

In the course of the project, the AlpBioEco consortium analysed bioeconomic value chains in the Alpine space (work package T1); ideated and developed seven eco-innovative business models from the value chains of apples, walnuts, and herbs (work package T2); validated and tested them in pilot projects and business practices with local companies (work package T3); and, lastly, developed economic and political guidelines for the transregional adaptability of the results (work package T4). Hence, one of the major project goals was to develop and validate eco-innovative business model blueprints in the three selected value chains to unlock new competitive advantages for small and medium-sized enterprises operating in the context of Alpine food value chains.

AIM AND STRUCTURE OF THIS REPORT

This report informs interested stakeholders about the potentials of bioeconomy in the Alpine regions within the value chains of apples, walnuts, and herbs. As well as revisiting the four work packages of the project and describing their design and implementation, the report also highlights key findings relating to the eco-innovative business models that were developed and tested.

After this introduction to the AlpBioEco project, chapters 2 to 4 present the findings of the respective value chains. Chapter 2 focuses on the analysis of the apple value chain, examines selected eco-innovative business models, and provides insights into the development of policy and transfer guidelines. Chapter 3 explores the walnut value chain along a similar structure and chapter 4 concentrates on the value chain of herbs. Chapter 5 introduces an overarching business model for apples, walnuts, and herbs, while chapter 6 outlines the transfer of the project results, and chapter 7 concludes with a summary of key findings and highlights the need for further action.



AlpBioEco receives an award in Baden-Württemberg



AlpBioEco has been awarded [“HeldeNI-Tat” of the month July 2019](#) by the Sustainability Strategy Office of the Ministry of the Environment, Climate Protection and the Energy Sector based in Baden-Württemberg, Germany. “Helden der Tat” (heroes of action) is an honorary title given to those who engage in tangible activities that contribute to sustainable development. AlpBioEco has also been praised for its workshop “Bioeconomy local – creation of new, local value chains based on renewable raw materials” organised by the city of Sigma-

ringen, lead partner of AlpBioEco with the ICLEI European Secretariat (a global network of local governments with an emphasis on sustainability) that was held at the Innovation and Technology Centre in Sigmaringen on 3 July 2019.

2. APPLE VALUE CHAIN

According to estimates published in February 2020 by the Fruit Logistica exposition, Europe's leading fruit and vegetable fair, apples are by far the most commonly grown fruit in the European Union (followed at some distance by oranges and easy peelers).³ Apple production is particularly important in the Alpine region: South Tyrol, for example, is the largest apple-growing region in Europe, with every tenth apple sold in Europe grown there. France and Germany are also major apple producers.⁴

Apple production has a long and rich tradition in all Alpine regions, reflected in the wide range of traditional apple varieties that can still be found throughout the Alpine area, both in traditional farm orchards and in modern plantations, where production is based on scientific methods and new technological procedures. Apples, and traditional derived products such as apple juice, dried apples or apple vinegar, are viewed by consumers as products with high added value.

Preliminary research conducted by the AlpBioEco team in the early stages of the project showed that the apple market is already quite saturated. Dessert apples are currently the most profitable product, as they are thrice as profitable as other products like vinegar, animal feed or fertiliser.⁵ This

is why most producers focus on growing as many apples as possible, which they then sell as dessert apples. However, many other parts of the apple value chain have promising bioeconomic potential because there are several by-products, such as apple pomace (the solid residue of apples after they have been pressed to make apple juice) or apple peel, that could be used to develop eco-innovative products in various fields such as cosmetics (e.g. seed oil, body cream), food products (pectin, food supplements), packaging and other goods (apple paper, tableware, or apple wax). It is these unexplored possibilities that the AlpBioEco project examined more deeply in order to identify innovative ways for creating regional value. The marketing of such innovative bio-based products could bring a double benefit to farmers. On the one hand, the products could be as profitable as (or perhaps even more profitable than) dessert apples. On the other, it would add value to products formerly considered waste, which would otherwise be thrown away. The research carried out by AlpBioEco also showed that the possibilities for processing and marketing products made from side-streams of the apple value chain are rarely taken into account by apple producers in the Alpine region, which is also why the AlpBioEco team selected apples as one of the value chains to focus on during the project.⁶

A) ANALYSIS OF THE APPLE VALUE CHAIN

In order to explore new possibilities in the apple value chain, the AlpBioEco team started by analysing all links in the value chain across the whole Alpine territory, asking: What are the strengths and weaknesses of the apple value chain? What are the threats but also opportunities in the selected apple production areas we have analysed? And what are the threats but also opportunities we can identify? The potentials of the host of possible products within the apple value chain were explored in a two-stage process: first, the market potential was assessed, and second, laboratory analyses were conducted. This process was the main focus of the first work package "T1 – Value chain analysis" of the AlpBioEco project.⁷

Firstly, the Eurac Research Institute for Regional Development conducted the "Market potential analysis for regional products in the Alpine space" concerning the apple value chain on behalf of the project study. This survey, commissioned by the Italian AlpBioEco project partner NOI AG, evaluated the value chain of apple cultivation (production, processing, marketing, distribution, and consumption) and the corresponding bioeconomic potentials in the Alpine territory. The institute's findings underline that the bioeconomic potential of apples and their derivatives is still under-exploited in the Alpine regions.

³https://www.fruitlogistica.com/media/fl/fl_dl_all/auf_einen_blick/European_Statistics_Handbook_2020.pdf

⁴https://www.fruitlogistica.com/media/fl/fl_dl_all/auf_einen_blick/European_Statistics_Handbook_2020.pdf

⁵ AlpBioEco Results and replicable roadmap, p. 5.

⁶ AlpBioEco Results and replicable roadmap, p. 5; Eurostat (2018): Herbal products in EU standard humidity content (accessed 17 December 2018).

⁷ For more information on the results of this analysis and the [AlpBioEco work package "T1 - Value chain analysis"](#), please visit our website.





Dr. Schwarzingner and the analysis of apple pomace

Dr. Bettina Schwarzingner works at the University of Applied Sciences Upper Austria in Wels, specialising in food technology and nutrition, and she [participated in AlpBioEco's work package T1](#) for the apple value chain. Contact was established via AlpBioEco's project partner Business Upper Austria and its Food Cluster in Linz (a regional network of companies in the food industry from Upper Austria). Dr. Schwarzingner used various methods to examine apple pomace samples for their potentially still usable components.

"The analysis of apple pomace with the Food Cluster fit in very well with the topic, because that is an area in which I already had experience [...]. I got the samples with apple pomace from the Food Cluster and then we started. The aim was to check the ingredients for their bioeconomic potential." Dr. Bettina Schwarzingner



Ms Feichtinger, a colleague of Dr. Schwarzingner, analyses the apple pomace samples in the laboratory in Wels, Austria.

In addition, Eurac Research pointed to a lack of entrepreneurial interest in innovations in the apple sector. However, this is mainly due to factors relating to economic efficiency, as some raw materials from other agricultural production processes or other sectors of the food industry are cheaper. The study also raises the issue of costly storage and logistics issues when it comes to apple by-products. The uncertainty of predicting probable success or the demand for innovative products that are capital-intensive and time-consuming to produce is also an obstacle, as some innovative entrepreneurs will avoid engaging in such risky projects. Before creative entrepreneurs get involved, experts agree that it is necessary to examine the cost-effectiveness of an innovative use of apples and apple by-products and to determine the added value in addition to the currently applied cultivation and processing systems.

Secondly, laboratory analyses were carried out by the AlpBioEco project partner MCI, the Management Center Innsbruck, the Entrepreneurial School® from Austria. MCI first undertook basic research to provide a technical overview of already investigated fields regarding the re-using of apple waste material and by-products.⁸ Based on pre-defined target materials and areas of focus such as cosmetics, food additives, and high-tech methods like 3D-printing, the following thirteen ideas were selected as particularly promising areas to begin exploring:

- Wood-like pellets (source of energy)
- Leather/paper
- Disposable cutlery
- Removal of dyes by biosorption
- Cat litter
- Straws
- Smoothies
- 3D-printed snacks
- Yoghurt fermentation
- Dietary fibre enrichment
- Wax wrap
- Ski wax/floor treating wax
- Phenol extract as a food additive

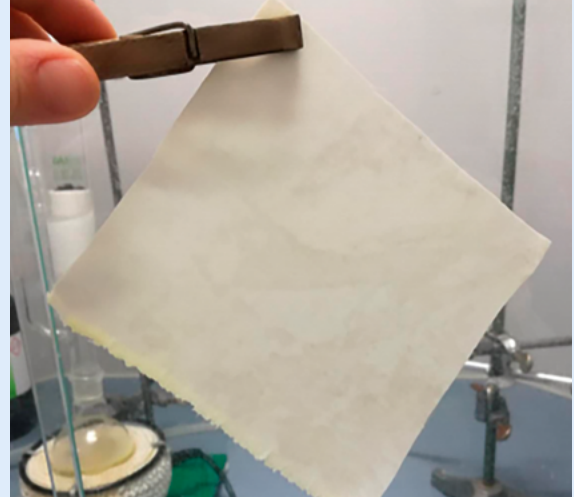
⁸You can find the laboratory analysis report on the AlpBioEco website.





The MCI – Management Center Innsbruck and apple wax

As part of AlpBioEco's work package T1, the AlpBioEco project partner [Management Center Innsbruck](#), the Entrepreneurial School® from Austria (MCI), tested the apple wax. Wax wraps are a promising and ideal alternative to plastic wraps for preserving food. They are usually made from expensive beeswax, which can be replaced with wax extracted from apple pomace.



Exemplarily apple wax wrap model

[The MCI](#) is a private business school located in Innsbruck, Austria. In AlpBioEco's work package T1, the MCI focused on exploring the potential of apple pomace, apple wax extract, and polyphenol extract from apple pomace in the laboratory. As AlpBioEco's lead partner for the work package T2, the MCI coordinated 22 AlpBioEco Open Innovation workshops to develop eco-innovative business models for value chains identified in work package T1. The MCI also presented the method of Open Innovation workshops at the [International Society for Professional Innovation Management Conference](#) in June 2020. The ISPIM is a community of members from research, industry, consulting, and the public sector interested in innovation management.

Based on criteria like the level of innovation, several product ideas, which are not yet on the market, were chosen next to be investigated in a laboratory. Comprehensive assessments were carried out with regard to the following aspects:

- Raw material characterisation
- Feasibility analysis for apple wax extraction
- Phenol extract as a food additive
- Yoghurt fermentation with apple pomace for a dietary fibre enrichment
- Smoothies
- 3D-printed snacks

B) “DISCOVERED” POTENTIALS WITHIN THE APPLE VALUE CHAIN

The research and analyses indicated a large potential in the apple value chain. There are many different side-streams with untapped bioeconomic potentials that eco-innovative products could make use of: for example, apple wax or apple polyphenol could be extracted from the fruit. Particularly interesting is the potential of apple pomace, the solid residue of apples after they have been pressed to make apple juice, to be used in another way instead of being simply disposed of. From the by-products suggested, a broad range of possible product or service ideas was developed within AlpBioEco's first work package T1. This included, for instance, potential uses in the medical sector (for example, by using apple polyphenol extract as a healthy flavour for lozenges), the food sector (by using apple pomace as a food supplement, for food colouring, or for making products like new spices or pasta), or in the packaging sector (by producing edible and/or biodegradable packaging made from apple pomace, for instance with 3D-printing).

As a result of the analysis of market potential and the laboratory evaluation, apple pomace was found to be the most promising target material for the development of new eco-innovative product ideas:



apple pomace is available in large quantities as a waste product of the juice industry, which is sometimes disposed of in a cost-intensive way. Traditionally, large amounts of apple pomace are further processed into animal feed or simply composted (Feichtinger, 2020), thus creating low value. In addition, due to its generally low level of protein yet high level of sugar, this is not the best choice for animal food. However, depending on the pre-treatment, many valuable ingredients like polyphenols or vitamins can be found in apple pomace, which would make it an option for food designers as an ingredient (Kruczek et al., 2017). Hence using apple pomace for new products would not only increase resource efficiency by adding value to the value chain of apples, but would also increase cost efficiency. Apple pomace therefore seems to be a promising avenue for the production of eco-innovative products (especially when processed with other ingredients) for the food industry as well as for the cosmetics sector.

However, all laboratory experiments⁹ showed that significant added value can only be achieved by using the entire by-product and by solving the challenges inherent in production on a larger scale.

C) IDEAS FOR ECO-INNOVATIVE PRODUCTS AND BUSINESS MODEL DEVELOPMENT

Building on the research and the initial product ideas, the AlpBioEco team then focused on further ideas for eco-innovative products and business models in the work package “T2 – Business innovation modelling” of the AlpBioEco project.¹⁰ As ideas for innovative products are the foundation of every novel business model, the aim was to develop a large number of such innovative ideas. Hence, the AlpBioEco team conducted six Open Innovation workshops with apple farmers, entrepreneurs, scientists, retailers, and other interested citizens between May and July 2019.

The workshops focused on the ideation (the sequence of thinking from initial concept to implementation) of innovative “value propositions” (value promised by the company to the buyers of the product) and new “target markets and/or customers”. The ideation process started from a future-oriented and user- as well as value-centred perspective by discussing and deriving emerging demands and customer needs from future trends in the food industry. The roots of the discussion were the results of the technological experimentation and prototyping achieved in the first work package of AlpBioEco.

In the next step, the workshop participants were asked to translate the identified demands into new product and service ideas and to identify potential target customer groups. The first workshop sequences resulted in 440 ideas for all three value chains, which were then summarised to avoid repetition. In the following, these ideas were prioritised by experts in the AlpBioEco project consortium and the participating food technologists in terms of economic (e.g. market potential, novelty, “wow” factor) and technical (e.g. feasibility, market maturity) criteria.

On 15 May 2019, AlpBioEco’s project partner from Austria and leader of the project’s work package T2, MCI, launched the first apple value chain workshop in Innsbruck, Austria, followed by a workshop in June in Strahinj, Slovenia, and another in July in Bolzano, Italy. These workshops generated more than 60 ideas for enhancing the apple value chain.

The resulting condensed shortlist of new product and service ideas for the three value chains was the starting point for the second workshop sequence that focused on the question of how to translate the selected and further refined ideas into reasonable value creation architectures and profit models that meet the criteria of eco-innovation. In the second sequence, more than eight workshops about the apple value chain took place in the five AlpBioEco countries between July and November 2019. From Ljubljana in Slovenia to Sigmaringen in Germany and Avignon in France, experts from all over Europe worked on the apple value chain for the AlpBioEco project, also using results generated in other workshops. The workshops not only showed which of the already developed ideas are the most feasible and which are the most interesting for companies, but also provided a first opportunity to network.

⁹For more information on the results of the analyses and the [AlpBioEco work package “T1 – Value chain analysis”](#), please visit our website.

¹⁰For more information on the results of the business model development and the [AlpBioEco work package “T2 – Business innovation modelling”](#), please visit our website.



2. Apple value chain

Through the workshops, for example, the AlpBioEco team got in touch with several local businesses, with which later collaborations were set up. Many questions were raised in the workshops, for instance regarding practical implementation (relating, for instance, to potential new partners or to the costs of specific machinery). These issues were later addressed in work package “T3 – Concept validation”. Figure 1 below depicts a selection of the ideas, clustered into thematic groups, and showcases the broad variety of potential innovation fields regarding the value chain of apples.

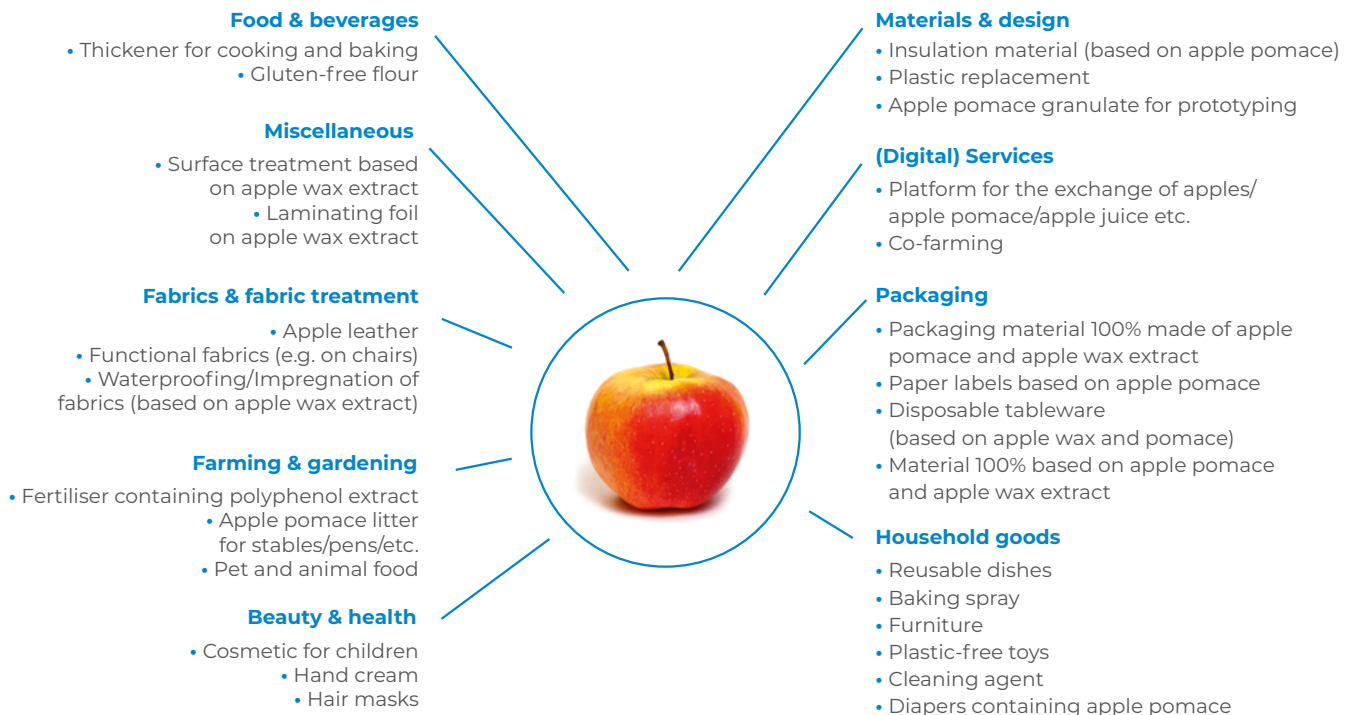


Figure 1: Overview of selected innovation ideas based on apple pomace, apple wax extract and polyphenol

As a result of the workshops and the other activities of the work package T2, seven eco-innovative business models for the apple value chain were developed:

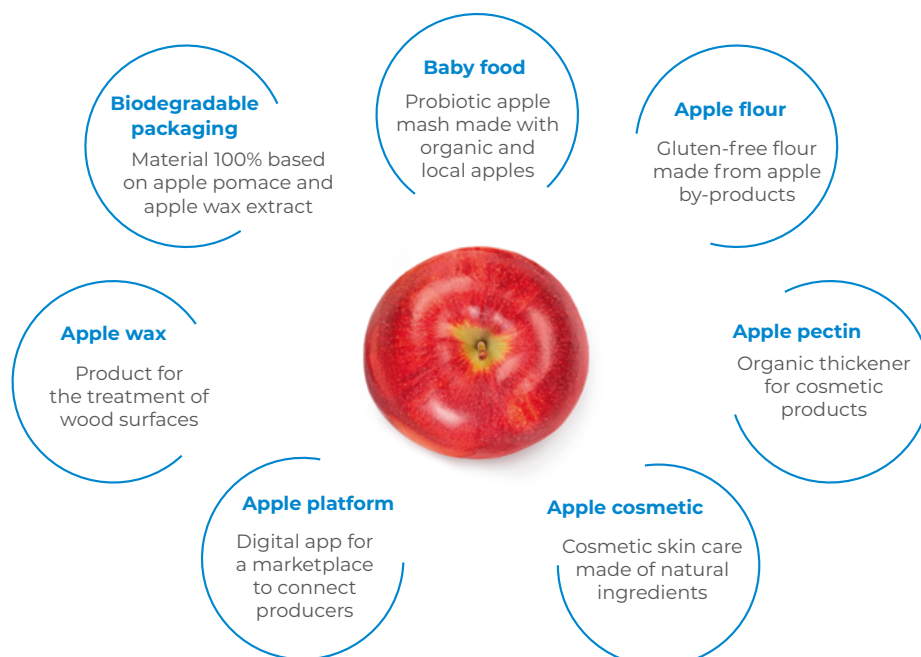


Figure 2: Selection of six eco-innovative business models for the apple value chain

These business models represent the mid-term results and form the basis for the further work of the AlpBioEco team within the apple value chain.



D) BUSINESS MODELS SELECTION AND TEST PHASE

At the AlpBioEco consortium meeting held in December 2019 in Avignon, France, two business models for the value chain of apples needed to be picked for further development and validation in the next AlpBioEco work package “T3 – Concept validation”.¹¹ The project partners of the AlpBioEco project selected gluten-free apple flour and disposable tableware and biodegradable packaging. These were chosen according to several criteria such as degree of novelty, market attractiveness, feasibility, sustainability, eco-innovative character, and the potential to stimulate the emergence of new social and transnational links between value-creating partners. The two business models selected were then validated and their feasibility evaluated by the AlpBioEco team and several experts in focus group workshops as well as through business visits to local companies and organisations.



Innov'Alliance and AlpBioEco's mid-term meeting in Avignon

In December 2019, the [AlpBioEco mid-term meeting](#) was hosted by the French AlpBioEco project partner [Innov'Alliance](#) and took place in Avignon, France. About 20 representatives of the different project partner organisations from the Alpine countries Austria, France, Italy, Germany, and Slovenia participated in the three-day meeting. Its aim was to present and finalise the selection of the previously developed business models, as well as to prepare the pilot-testing phase that would take place over the following months. This picture shows the AlpBioEco team during the Avignon meeting



Innov'Alliance is an agricultural and agri-food competitiveness cluster located in south-eastern France that brings together a network of companies, research and training organisations. In the work package T1, Innov'Alliance focused on laboratory and market analysis of the herbs value chain. Then in the work package T2, a workshop was held to develop new business models by cross-fertilising ideas between two value chains of apples and herbs. Towards the end of the project, Innov'Alliance gathered contacts in the area of Grenoble, noted for its extensive walnut production, and worked on the business model for walnut flips.

¹¹For more information on the results of the pilot testing of the business models developed and the [AlpBioEco work package “T3 – Concept validation”](#), please visit our website.



Cooperating with SMEs*: Entrepreneur Lorenzo Picco and the apple flour

AlpBioEco success story: this is the tale of Lorenzo Picco, a 25-year-old [Italian agricultural entrepreneur](#) who took over his grandfather's farm that had been abandoned for 20 years. Lorenzo was an organic farmer who had also set up a holiday farm. In November 2019, he took part in a workshop organised by the AlpBioEco project partner Envipark in Turin, Italy, where he started work on creating a gluten-free apple flour from pomace, a waste product from apple juice production. *"After developing the theory, we tested the process in laboratories and then we obtained this new material called apple flour. We figured out that we have to improve the process in the second step, because this apple flour was not soluble. Finally, we obtained a totally new material, which could be called 'apple paste'. And then we asked ourselves, how can we use this new material?"* [Finally, he decided to enter the cosmetics branch by creating his start-up at the beginning of 2021.](#) His range of cosmetics based on apple paste contains many antioxidants and can therefore be used in anti-ageing products, a valuable asset in the cosmetics sector.



i) GLUTEN-FREE APPLE FLOUR

The first selected business model is that of gluten-free apple flour, which can be produced either by processing apples directly into apple flour or by processing finely milled, dried apple pomace. Although apple pomace is generally considered a waste product, it still contains a high proportion of nutrients, which makes apple pomace a potentially valuable product for both the food industry and the cosmetics sector. For instance, apple flour could be used in the production of basic and nutraceutical foods or for skin care due to its rich content of different types of antioxidant. Apple flour even serves as a major ingredient for various cosmetic formulas. The market potential of these products is high, since producing them would involve less waste and would favour practices of the circular economy. A product such as apple flour, based primarily on leftover materials and offering a gluten-free alternative to traditional flour, offers excellent opportunities for successful market positioning.

The business model gluten-free apple flour was further developed and validated by the AlpBioEco project partners Environment Park SpA (Envipark) from Italy, the Italian Chamber of Commerce for Germany (ITKAM) and the Biotechnical Centre Naklo (BC Naklo) from Slovenia.

Envipark organised an initial technical workshop that concentrated on the business model development for apple flour, where selected experts from universities and small and medium-sized companies investigated the possible uses of apple flour. The expert team focused their analysis on the food industry and the cosmetics sector, taking into account potential technical difficulties in the production process, explored potential uses of apple flour and identified market opportunities. Participants also made suggestions for possible local collaborations. In the development and validation process, Envipark collaborated with a young entrepreneur from a small farm in the Piedmont region, Lorenzo Picco, who worked on the implementation of the business model of apple flour. In a first step, a large amount of apple flour (100kg) was produced from apple pomace. This was done by a local tool-making company that had suitable facilities for an apple juice production plant, namely a dehydrator and a flour blade mill. In a second step, the flour was evaluated for nutritional values and chemical

*Small and medium-sized enterprises



characteristics, with promising results: apple flour contains high levels of insoluble fibres and pectin, and it is a gluten-free product yet contains antioxidant compounds, making it interesting for both the food industry and the cosmetics sector. After this, pilot activities¹² were carried out in collaboration with local experts and stakeholders. For instance, Envipark ran a series of experiments looking at possible bakery products with apple flour as an ingredient in collaboration with a local pastry chef – resulting in tasty products like sponge cakes, biscuits and cereal bars. Alongside their excellent taste and scent, products like these are particularly valuable for the food sector because they are gluten-free. As the gluten-free market is growing, apple bakery products could cater for this increasing demand.

However, in terms of revenue generated, the cosmetics sector seemed a more fertile avenue for apple flour. The idea was to use apple flour as a functional ingredient together with natural excipients to realise different types of product – a cosmetics line that featured this would be certified as comprising organic and natural cosmetics products. A local cosmetics company was selected for a preliminary study formulation and an ensuing market study. During these activities, a technical problem arose relating to the physical characteristics of the apple flour: it is not soluble in water (hydrosoluble), which could limit the feasibility of cosmetic products. For this reason, a new approach to producing an apple paste was studied and put in place, with the help of experts and a regional juice producer for the paste. In this process, apple powder was rehydrated with water and homogenised, resulting in a water-soluble product that could be more suitable for the cosmetics sector. With this water-soluble apple paste, the AlpBioEco team and the collaborating business produced three prototypes: face cream, tonic and micellar water. These were tested and a list of ingredients drawn up. The positive feedback on the feasibility of the business model has led Envipark's collaborating partner to launch a start-up that aims to develop regional and organic cosmetic products made from, among other ingredients, apple pomace. In this example, the start-up is following a clearly defined path towards more sustainability.

In order to gain more insights into the cosmetics sector and the opportunities of this business model, another workshop took place, where marketing and media experts, together with business angels and a mentor, developed the business idea with the start-up, paying particular attention to brand identity, market approach, identifying target groups, assessing the value proposition and overall financial sustainability. The entrepreneur also participated in an online course on marketing and branding organised by a leading Italian consultancy company in the field of corporate communications.



Figure 3: Two possible applications for the business model gluten-free apple flour in Italy

¹²Pilot activities are implementation-related activities dedicated to testing a new product, process or approach.



Apple production is the main fruit-growing activity in Slovenia. In recent years, many apple-growing orchards and farms have also begun to process their fruit on-site as an additional activity. BC Naklo organised an online workshop for the gluten-free apple flour business model. The workshop results concluded that in Slovenia, the conditions are not yet in place for mass production of apple flour and penetration into international markets. It is necessary to develop a product intended for consumers who identify with the values a company conveys to them by means of the product. Apple flour from Slovenian pomace would emphasise the following values: sustainability (raw material for the product, which is a by-product of apple processing), short supply chain, and supporting local farms and producers. The exchanges showed that apple flour could be a valued alternative for consumers who need or prefer gluten-free products. With this in mind, BC Naklo organised a baking workshop where apple pomace flour was tested in gluten-free pastries. With the help of a professional baker, BC Naklo created three gluten-free pastries, gluten-free tea biscuits, a delicious granny apple pie, and apple muffins with cranberries and walnuts. Recipes for these pastries are included in the project's apple flour recipe book (learn more about the recipes on page 20).

ii) DISPOSABLE TABLEWARE AND BIODEGRADABLE PACKAGING

The second selected business model concentrates on disposable tableware and biodegradable packaging, by means of processed apple pomace. Apple pomace contains a high ratio of fibres, making it an interesting resource for the production of packaging materials (Feichtinger, 2020). Bio-based and biodegradable packaging are promising alternatives to existing conventional plastic products and can help to reduce environmental pollution caused by plastic waste. Its relevance will become even greater when single-use plastic products are outlawed by European Union legislation in summer 2021. Disposable tableware and bio-degradable packaging made from apple pomace is likely to be accepted by consumers due to their growing awareness of this topic and their increasing need for more effective and sustainable alternatives to conventional plastic. Thus, disposable tableware and biodegradable packaging became the second business model within the apple value chain, which was validated by the AlpBioEco project partner Business Upper Austria, the body in charge of work package T2.

After deciding on the idea of disposable tableware and biodegradable packaging made from apple pomace as a business model, the next steps aimed to pilot-test the business model and discuss it with stakeholders. For this purpose, an initial survey of relevant stakeholders in Upper Austria was conducted to identify appropriate partners for the pilot testing. Once partners had been identified and contacted, a date for a focus group workshop was arranged. The objective of this workshop was to present the business model and discuss it with participants from various sectors. For instance, the business model developed in work package T2 was evaluated and the participants also discussed future steps necessary to implement the business model. The online workshop was hosted by the Food Cluster of Business Upper Austria in April 2020.

As this business model is still very much in its infancy, preliminary research was undertaken in concert with the Upper Austrian University of Applied Sciences. The university assessed the raw material of apple pomace so as to test its suitability for packaging and tableware. During these analyses, bilateral talks were regularly held with stakeholders in order to push development of the business model further. In addition, several (online) business visits were held with the university to monitor the progress of the analyses. In particular, challenges uncovered by the evaluations as well as the university's recommendations for how to implement the business model were discussed. After a three-month research phase, the results were presented to Business Upper Austria by the university in an online session.

1. Gluten-free apple flour – ITKAM and Envipark, Italy

- conducting of technical focus group workshop for the implementation of apple flour
- development and production of apple flour prototypes
- analysis of apple flour
- production of food products with apple flour
- production of cosmetic products with apple flour



2. Gluten-free apple flour – BC Naklo, Slovenia

- focus group workshop with experts from Slovenia on the topic of apple production and food processing
- online business visits with apple producers
- focus group workshop for experimenting with gluten-free pastry recipes and carrying out of the evaluation

3. Disposable tableware and biodegradable packaging – Business Upper Austria, Austria

- focus group workshop with German-speaking experts
- start of raw material analysis
- bilateral exchanges with experts
- conducting of several business visits
- analysis of raw material
- presentation of results of raw material analysis

Figure 4: AlpBioEco's activities for the gluten-free apple flour and the disposable tableware and biodegradable packaging business model development

For more information on AlpBioEco's work package T3 and on how the project carried out the pilot testing of the selected eco-innovative business models, please see the [Best Practice Brochure](#) available on the AlpBioEco website.

E) DEVELOPMENT OF POLICY AND TRANSFER GUIDELINES

The final part of the AlpBioEco project, the work package “T4 – Policy transfer preparation”,¹³ focused on preparing the project results for the transfer to policy-making as well as on drawing up guidelines to promote the regional implementation. To achieve this, a regional advisory board was set up for each project region. These boards included regional representatives from business, science, politics and civil society, who brought their expertise in the field of the respective business model. Subsequently, for each of the two business models a regional advisory board was established to support the AlpBioEco project partners in developing regional policy guidelines. The business model disposable tableware and biodegradable packaging had been validated by two regions, so two advisory boards were established.

PROJECT PARTNER	BUSINESS MODEL	REGION
Envipark	Gluten-free apple flour	Piedmont, Italy
Business Upper Austria	Disposable tableware and biodegradable packaging	Upper Austria, Austria
NOI AG	Disposable tableware and biodegradable packaging	Autonomous Province of Bolzano, Italy

¹³For more information on the [AlpBioEco work package “T4 – Policy transfer preparation”](#), please visit our website.



First, every project partner organised an online workshop with their regional advisory board to explain the business model and to gather initial ideas for guidelines. In the workshops, participants discussed the current state of the art – or status quo – of the national and regional bioeconomy strategy, the available raw material, the research undertaken and its possible development, and the funding and legal frameworks covering their specific region.

Secondly, it was planned to use a design thinking tool, the Lego® Serious Play® workshops, to collaborate with regional advisory boards on improving the business models. Lego® Serious Play® workshops are agile approaches to solving challenges by using people's collective insights and by addressing challenges dynamically. For working on the AlpBioEco project, every member of each regional advisory board built (from toy bricks, as the name implies) the current situation and status quo of the business model from his or her own point of view. Thereby, a 360° view of the status quo of the region was creatively generated by experts from various policy areas and industry sectors (for instance, politics, economy, regional development, agriculture, food production and supply, advocacy). For the value chain of apples, a Lego® Serious Play® workshop was held by NOI AG for the business model disposable tableware and biodegradable packaging. However, the situation due to Covid-19 obliged some project partners to use other interactive methods. Envipark, for example, used the Lightning Decision Jam (LDJ) process with MURAL, an online collaboration tool, while Business Upper Austria used the PESTEL analysis. LDJ is an exercise created by AJ&Smart that helps teams to make faster decisions and to quickly find a common direction. PESTEL stands for the political, economic, socio-cultural, technological, environmental, and legal factors that influence a company when it comes to opening up or developing (new) markets. With the help of this analysis it is possible to describe the business environment (the macro environment) with regard to specific market conditions, (probable) developments and their effects, and to build a basis for well-founded decisions. The aim of these workshops organised by the three AlpBioEco project partners committed to the apple value chain was to develop guidelines for regional implementation, which include information about the status quo of the business model in the respective region and recommendations for stakeholders and interested companies regarding how to develop the business model further.

In the regional guideline for Upper Austria, for example, it was noted that the regional advisory board was clearly in favour of further promoting this business model, as biodegradable packaging is urgently needed. In addition, the region is ideal for this, as Upper Austria is a renowned apple-growing region and thus has access to a lot of the relevant raw materials. Upper Austria could therefore play a pioneering role in this field. In its recommendations, the regional advisory board drew attention to the need for unbureaucratic approval procedures for this type of sustainable packaging in order for it to be brought to the market quickly and efficiently. Equally, professional training must be available in order to have enough skilled workers in this field.

In the regional guideline for Piedmont regarding apple flour, Piedmont is said to be one of the Italian regions with the highest apple production. In the Piedmont region, some big companies produce apple juice on a large scale and there are also smaller producers. To support the development of bioeconomy at the local level, the regional advisory board recommends that those institutions that provide legislative and financial support should take up and promote local initiatives that are able to scale up effectively.

Regarding the business model disposable tableware and biodegradable packaging in the Autonomous Province of Bolzano, Italy, the regional implementation guidelines state that in South Tyrol there is a strong cultural connection to apples, which are much loved by the inhabitants. So ecological packaging, consisting of by-products of the value chain of regional apples, would be very well suited to the area's consumers and businesses as its use would be deeply embedded in the local culture. But it is recommended to establish key partnerships for contributing expertise about the raw material of the apple as well as the production of packaging, because specific know-how would contribute positively to the development of the business model.

Having gathered together the results from the regional advisory boards, the AlpBioEco team then worked on developing a transregional and transnational transfer guideline. For more information on the continuation of this work, please see chapter 6 of this report, which addresses AlpBioEco's transfer of results.



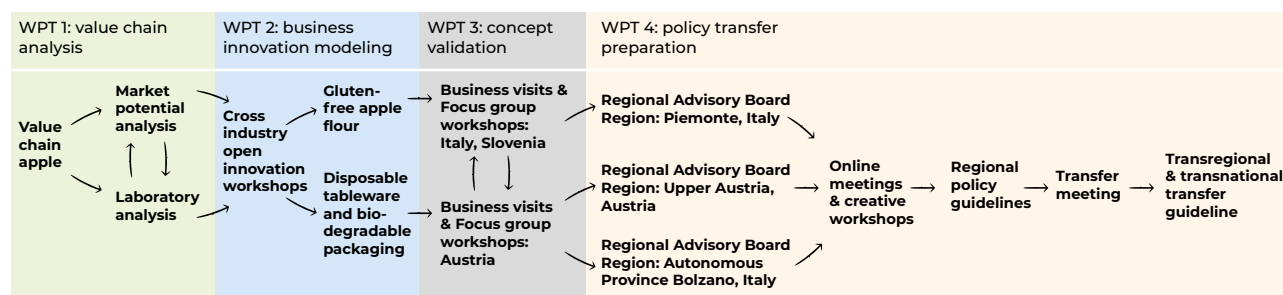


Figure 5: Overview of activities carried out for the apple value chain

To summarise, the AlpBioEco team worked on many different activities concerning the apple value chain and the two connected business models, as can be seen in the figure 5 overview. Apples are very important for many of the project regions of AlpBioEco in the Alpine area, and offer great potential for developing bioeconomy further. In particular apple pomace, which is still often viewed as waste, shows promising potential for use in a variety of ways. While some notions like biodegradable packaging are promising but remain relatively undeveloped, other ideas like the use of apple pomace in the cosmetics sector have already been put into practice. Having completed its final task of drawing up regional implementation guidelines, the AlpBioEco project is promoting the regional valorisation of the apple value chain and is thus making a significant contribution to sustainable and long-term economic development in the Alpine world.

Business Upper Austria and first impressions of the Upper Austria advisory board

The AlpBioEco project partner, [Business Upper Austria \(Biz-Up\)](#), is the business agency of the Upper Austrian government. It is an innovation driver and partner for location development and settlement of companies, as well as providing cooperation and advisory services for public funding. For AlpBioEco, Biz-Up focused on the development of the “disposable tableware and biodegradable packaging” business model but was also the lead project partner for the work package T4, which deals with preparations for eventual policy transfer and the setting up of guidelines. [Biz-Up supervised the creation and implementation of regional advisory boards](#), which worked on each business model in different regions. Below are some thoughts from the Upper Austria regional advisory board:



“Meadow orchards are currently not used in Upper Austria – there’s potential here!”

“The pressure from the market is getting bigger and the end consumers are getting more and more critical. The packaging industry has to come up with something.”

“Those packaging producers who are the first to rely on ecological packaging will be at the forefront.”



Envipark

The AlpBioEco project partner, [Envipark](#), a private company based in Turin, Italy, has been committed to the development of the gluten-free apple flour business model in Italy but has also contributed for example with a laboratory analysis of ingredients and the evaluation of the potential use of floral waters for the analysis of the herbs value chain. Envipark plays an active role for AlpBioEco in providing links among companies, research centres, local authorities and decision-makers. Envipark has promoted AlpBioEco at major trade events like the [Ecomondo Fair in Rimini](#), Italy. Ecomondo is the leading green and circular economy expo for the European Mediterranean area, which brings together all sectors of the circular economy, from material and energy recovery to sustainable development.



Barbara La Licata, Envipark's AlpBioEco liaison, presenting the project at the Ecomondo Fair in 2018

“Crazy about apples” and apple flour recipes publications

As a key part of its research, the AlpBioEco team have gathered a wealth of information and ideas, including recipes. In 2019, the Slovenian Ministry of Agriculture, Forestry and Food in collaboration with AlpBioEco published “[Crazy About Apples](#)”, a collection of recipes to promote the consumption of regional apple varieties. The publication was based on the work of the AlpBioEco project partner, the Chamber of Commerce and Industry of Slovenia, which in January 2019 carried out the [sensory research initiative “Crazy about apples” with students from various Slovenian faculties](#). In 2021, AlpBioEco, together with its two Slovenian project partners, the Chamber of Commerce and Industry of Slovenia and BC Naklo, published a [collection of recipes based on apple flour](#).



3. WALNUT VALUE CHAIN

Few plants can be used in such a diverse way as the walnut tree. In the Alpine regions, many different walnut varieties exist. Alongside large areas for commercial cultivation, there are also many isolated walnut trees, owned by private individuals and small farmers. For instance, there are around 300,000 walnut trees in the German state of Baden-Württemberg, from which around 10,000 tons of walnuts¹⁴ could be used for regional processing and marketing. Thus, the potential of regional walnuts is far from being exhausted.

However, a large share of these walnuts is not used at all. Just a small part is sold directly at farm stores or local markets. Some of the walnuts are also processed to make walnut oil, most commonly by contraction pressing, as a service for the self-marketing of the oil. The walnut press “cake”, one of the residues from pressing, is sometimes further processed as flour, but mostly not used in any other way.

This is one reason why Europe is currently the largest walnut import market in the world, and the imports continue to grow, in particular driven by the trend towards healthier diets.¹⁵ Walnuts contain, for instance, many healthy proteins and omega-3 fatty acids. Even though competition with cheaper suppliers from abroad is tough, the potential for increasing the walnut cultivation and processing in the Alpine region is great, also because regional walnut products are appreciated by consumers.

Walnuts also have great bioeconomic potential, which could be enhanced by increasing the added value in the oil production through better marketing of the walnut press cake (which constitutes at least 40% of the nut kernels) and the shell. The other by-products of the walnut tree, like the green leaves, the green walnuts, the green shell, or the nutshell, can also be used in a variety of sectors like cosmetics, food, organic pesticides, and textiles. Processing of these by-products would benefit producers as this would increase the added value of their walnuts. Since the walnut value chain represents an untapped potential in the Alpine area, the AlpBioEco team selected it as one of the three value chains for the project.



Cooperating with SMEs: Vivian Böllersen, a walnut pioneer from Germany

“Walnuts are in high demand and are consumed in large quantities, but in the retail trade they come 100 percent from abroad. I see this economic discrepancy as a challenge and I would like to contribute to ensuring that more walnuts in supermarkets come from Germany in the future.”

Vivian Böllersen, Germany.

Vivian Böllersen runs the agricultural business called “Walnussmeisterei” at Herzberg in the North-West of Germany. Her company is specialised in the cultivation and sale of walnuts, and is also part of the “Interessengemeinschaft Nuss”, a Germany-wide network for cooperation between walnut farmers, refining tree nurseries, processing companies and trade. Founder of the fruits section of the network, Vivian Böllersen helped the AlpBioEco team to expand its network and better understand the walnut value chain in Germany. She took part in an AlpBioEco Open Innovation Workshop in Sigmaringen, Germany, in 2019 and organised the 6th national meeting of walnut producers in 2019 in Ludwigsburg, Germany, where AlpBioEco was officially presented.



¹⁴Estimate of Friends of the Earth Germany, Regional Association Bodensee-Oberschwaben (BUND) based on a count of all orchard trees in the region undertaken by the University of Hohenheim and on interviews with 120 walnut tree owners (LEADER project).

¹⁵CBI (Centre for the Promotion of Imports from developing countries, an agency of the Ministry of Foreign Affairs of the Netherlands (CBI) (2019): Exporting walnuts to Europe. <https://www.cbi.eu/market-information/processedfruit-vegetables-edible-nuts/walnuts> (accessed 17 November 2020).



A) ANALYSIS OF THE WALNUT VALUE CHAIN

To explore new ways of developing the walnut value chain, the AlpBioEco team initially carried out a market study and laboratory analyses. The strengths, weaknesses, threats and opportunities of the value chain were studied by the experts within the AlpBioEco team. This was the focus of the work package “T1 – Value chain analysis” of the AlpBioEco project.¹⁶

First, a study of the market potential of walnut-based products in the Alpine region was conducted by three AlpBioEco project partners from Germany: KErn, the Bavarian Competence Centre for Nutrition, the University of Applied Science Albstadt-Sigmaringen (HSAS) and the BUND Ravensburg-Oberschwaben (Friends of the Earth Germany, Regional Association Lake of Constance-Upper Swabia). They assessed the walnut value chain through all its stages: production, processing, marketing, distribution, retail, and consumption. With the results of these investigations, the project partners examined the market situation, with a particular focus on nutrition, wood processing, cosmetics, and medicines. Walnut by-products such as tree leaves, green peel, walnut shell and the walnut press cake show some potential for processing. In a short, the walnut market in the Alpine area can be described as a small-scale market consisting mainly of small producers but with a few larger processing companies – as the laboratory analysis suggests, a small market but a big potential. Also, the fact that the nuts are grown in the Alpine region is itself a powerful sales argument as this location is well-known and so products with an origin here represent a mark of quality.

The Alpine walnut market is currently regional. At the moment, this regional market is not presenting the same trends as are walnut markets in general. For instance, normally prices rise as consumer demand grows. That is not yet the case for walnuts in the Alpine territories, or at least not to the same degree. In addition, regional walnut farmers in the Alpine space are in serious competition with larger and cheaper international walnut producers (from China, Iran, Latin America, and the US). Therefore, to be able to sell walnuts from the Alpine region, walnut producers need to find compelling arguments for their products and in particular to promote regional aspects and traditions.

As mentioned previously, AlpBioEco project partners were focusing on laboratory assessment, starting with a so-called sensory analysis showing there is no consistent raw material. Chemical analyses then underlined the potential of kernels as a valuable food source due to their high proportions of oil and protein. The remaining oil press cakes, mostly used for animal feed and occasionally as a foodstuff for people, are full of proteins and fibres.

Processing walnuts requires stringent measures. When developing food products, further tests need to be done for improving marketability, durability, storage capability, scalability and processability. The major issue concerns the consistency of walnut press cake. The raw material is highly variable and too unstable to ensure the same quality every time. Therefore, using walnut press cake for food industries would necessitate a reliable raw material supplier and strict processing steps to ensure consistency.

B) “DISCOVERED” POTENTIALS WITHIN THE WALNUT VALUE CHAIN

During the project, AlpBioEco examined the opportunities provided by possible walnut components or by-products of notable interest. Walnut press cake is particularly relevant, especially when used for processing in combination with other ingredients for the food industry. Many interesting ideas based on different parts of the walnut tree show bioeconomic potential. AlpBioEco's German project partners HSAS, BUND and KErn identified more than 80 possible eco-innovative products for this value chain. Within the AlpBioEco project, the emphasis was put on further processing of by-products of the oil processing as well as on the processing of other parts of the plant. The range of applicable uses can go beyond the food sector – for example, new ideas for using walnut components particularly in cosmetics were developed within the first work package T1 (peeling cream with ground walnut shells, aftershave lotion with oil and extract, shower oil, tea or tincture, and paper production, to name just a few possibilities). Processing other parts of the walnut is especially interesting in the case of walnut trees with nuts which are difficult to process, either because they are too hard or small for commercial use.

¹⁶For more information on the results of this analysis and the [AlpBioEco work package “T1 – Value chain analysis”](#), please visit our website.





Figure 6: Components of the walnut tree and their uses

During the exploratory phase, the project team examined different products made from walnut press cake, like walnut flour or walnut milk. Selected product ideas, such as walnut pasta made from the press cake, were produced and tested in the laboratory. Products made from other parts of the walnut tree were also looked at. Investigating the walnut shell revealed that it could potentially be used as a detergent, as a blasting abrasive, or as a peeling supplement in cosmetic products (e.g. skin cream). Walnut leaves could be used to produce insecticides or pesticides due to the high amount of tannic acid contained in the leaves. Green nuts are a possible natural dye and can also be processed into walnut gin.

Thus, the walnut and its by-products offer a wealth of options for further processing. These options can increase the added value in the walnut value chain and thus open up novel, profitable and sustainable opportunities for local producers and farmers.





The University of Applied Science Albstadt-Sigmaringen and the walnut laboratory analyses



In the University of Applied Sciences Albstadt-Sigmaringen, first around 30 kg of walnut press cake was ground. From the resulting different walnut flours, the scientists then produced prototypes, such as walnut pasta.

In the first work package of the project, AlpBioEco's project partner the [University of Applied Science Albstadt-Sigmaringen](#) from Germany (HSAS) carried out several laboratory analyses with walnuts. As there are considerable gaps in knowledge regarding the ingredients of walnuts, both sensory and chemical analyses, as well as application tests, were conducted. [The HSAS worked particularly with walnut press cake, one of the residues from walnut oil pressing.](#) AlpBioEco's research has even inspired [HSAS students](#) to develop [innovative cosmetic products with walnuts!](#) The HSAS was also responsible for the overall communication of the AlpBioEco project.

Collaboration with the University of Wuppertal



Veronika Kowolik (second from the left) participated in various AlpBioEco events including the walnuts workshop on 22 May 2019 at the InnoCamp in Sigmaringen, Germany.

Veronika Kowolik from the University of Wuppertal collaborated with AlpBioEco and wrote her [Master's thesis on innovative bio-based business models using the example of the walnut value chain](#). Her research focused on making action recommendations for the development of business models taking into account the bioeconomic potentials of the walnut value chain, and identifying the most promising product ideas. Looking at the potentials and advantages of the walnut for the Alpine region, she highlights the fact that traditionally no pesticides are used in walnut cultivation in the Alpine region and that there is a high diversity in walnut species, adding to a greater biodiversity.

C) IDEAS FOR ECO-INNOVATIVE PRODUCTS AND BUSINESS MODEL DEVELOPMENT

AlpBioEco developed the eco-innovative business models in several steps, including workshops, business visits, and expert interviews. In the context of the work package “T2 – Business innovation modelling” of the AlpBioEco project,¹⁷ four Open Innovation workshops on the walnut value chain were held between May and November 2019, jointly with entrepreneurs, farmers, retailers, scientists, and citizens.

On the basis of the technological and laboratory analyses as well as experiments conducted as part of the work package T1 of the AlpBioEco project, participants were asked during the first workshop sequence to develop new product and service ideas, taking into account emerging demands and customer needs on the basis of perceived future trends. Potential target customer groups were also identified. The first workshop sequences on the walnut value chain resulted in 41 ideas for potential business models, which were then prioritised by the project consortium and the relevant experts. For this sequence, two workshops on the walnut value chain took place in May and July 2019 in Sigmaringen and Waldburg, Germany.

The resulting condensed shortlist of eco-innovative business models formed the starting point for the second workshop sequence that focused on translating the selected and further refined ideas into realistic models of value creation and profit that would meet the criteria of eco-innovation. For this second workshop sequence, two workshops on the walnut value chain took place in October and November 2019, again in Waldburg and Sigmaringen, Germany. Figure 7 shows a selection of the ideas gathered during the workshops and illustrates how many potential innovations can be made in the walnut value chain.



Figure 7: Overview of a selection of innovative ideas based on the walnut value chain

¹⁷For more information on the results of the business model development and the [AlpBioEco work package “T2 – Business innovation modelling”](#), please visit our website.

3. Walnut value chain

The AlpBioEco project partners and external experts evaluated and prioritised all the eco-innovative business model ideas collected along the walnut value chain in the four workshops held in Germany according to different criteria, like novelty, market potential, “wow” factor, technical feasibility or market maturity. For the walnut value chain, six business models were selected for further analysis:



Figure 8: Selection of six eco-innovative business models for the walnut value chain

D) BUSINESS MODELS SELECTION AND TEST PHASE

At the AlpBioEco consortium meeting held in December 2019 in Avignon, France, all project partners involved in the walnut value chain work presented their results and discussed next steps. During this meeting, the results of the Open Innovation workshops were evaluated in groups. Based on crucial points such as degree of novelty, market attractiveness and feasibility, products' sustainability and eco-innovative character or the potential to stimulate the emergence of new social and transnational links between value-creating partners, two of the six selected business models were chosen: walnut flips and walnut spreads.

With the walnut spreads and walnut flips business models, three AlpBioEco project partners (BUND and the city of Sigmaringen for Germany, and Innov'Alliance for France) continued the next project phase: the AlpBioEco work package "T3 – Concept validation",¹⁸ which consisted of validating and testing the feasibility of the selected business models. To carry out pilot testing of the business model and discuss it with stakeholders, an initial survey of relevant stakeholders in Germany (Bodnegg/Ravensburg, Tübingen) and in France (Auvergne-Rhône-Alpes region) was conducted in order to identify the appropriate partners for the pilot tests.

i) WALNUT SPREADS

Walnut spread is a high-quality vegetarian spread with healthy and regionally sourced ingredients. The spread is made with walnut press cake from regional oil mills that process Alpine walnuts. Therefore, it contributes to the cultivation of walnut trees in the region and to regional consumption. The flavours vary and can range from sweet to savoury. In the project, several walnut spreads were produced with up to a 20% share of walnut press cake. The flavours were tomato-walnut, paprika-walnut, mint-walnut and chocolate-walnut-cinnamon, with varying shelf-lives. Some of the spreads were produced as fresh products with a comparably short shelf-life of a maximum of two weeks, and some spreads were conserved by means of pasteurisation.



The international trade fair "Fruchtwelt Bodensee" and the RegioTV Bodensee interview

Throughout the project, the AlpBioEco team participated in events promoting the value chains chosen within the project. For example, [from 14-16 February 2020 in Friedrichshafen, Germany, AlpBioEco's German partners, BUND and the city of Sigmaringen, presented the business models "walnut spread" and "walnut flips" at the international trade fair "Fruchtwelt Bodensee", a trade fair for commercial fruit growing, distillation and agricultural technology. AlpBioEco project coordinator, Anna Bäuerle, was interviewed by RegioTV Bodensee, a regional television channel from Baden-Württemberg, Germany.](#)



¹⁸For more information on the results of the pilot testing of the business models developed and the [AlpBioEco work package "T3 – Concept validation"](#), please visit our website.



3. Walnut value chain

To pursue work on this business model, AlpBioEco project partners BUND and the city of Sigmaringen conducted business experiments with walnut press cake. To learn more about practicalities and the implementation process, some business visits via phone calls (due to the Covid-19 situation) were carried out. Following this, a product prototyping was done to directly test all characteristics of the product. BUND and the city of Sigmaringen also presented the walnut spreads business model at the international exposition “Fruchtwelt Bodensee”, a trade fair for commercial fruit growing, distillation and agricultural technology.

ii) WALNUT FLIPS

Walnut flips are puffed snacks or puffed additives for cereals or energy bars mostly based on starch from potatoes, wheat, oat or corn, and walnut press cake. The flips can vary in size and form: as small pellets, they can be part of breakfast cereals. As larger flips, similar to the well-known peanut flips, the walnut flips could be a snack served as an appetiser at hospitality events or at home as a healthier, more local alternative to potato crisps. Walnut flips can be produced in two ways. One option is to use already made starch extrudates that are subsequently coated with oil, spices, and walnut press cake. The second option is to include walnut press cake in the extrudate mass and then process the mass into puffed extrudates, so that the starch extrudate also contains walnut press cake.

In the project, AlpBioEco project partners BUND and the city of Sigmaringen in cooperation with some regional companies produced several types of walnut flips with different starches, oils and flavours: as a base, they used extrudates made from oats (pellets and pillows) and millet. By coating these three extrudate types with different spices, oils and amounts of walnut press cake, they produced at least twelve varieties in two stages, such as walnut-chili, walnut-paprika, walnut-herbs or walnut-vanilla-cinnamon. In order to achieve this variety of products, the project partners of AlpBioEco started by organising a focus group workshop with selected stakeholders and experts. The Bavarian company Sinne & Sensorik (headed by Cornelia Ptach), a partner company of the AlpBioEco project, then carried out the product prototyping. This was followed by testing of twelve different coatings and discussing them with coating companies, in particular with respect to the possibilities of producing extrudates.

AlpBioEco's French project partner, Innov'Alliance, also contributed to developing this business model, for instance by conducting a business visit with an experimental centre (SENURA, Rhône-Alpes nuciculture experimentation station) dedicated to walnuts that grow in the area around Grenoble, France. Two main concerns emerged from the discussions: biocontrol for walnuts (in relation to the glyphosate issue) and alternatives to conventional pesticides. Interviews with experts were conducted and networking with all relevant stakeholders was carried out in order to better understand the problems faced by French protagonists in the walnut sector. The key issues that emerged from the exchanges were the questions of how to add value to by-products such as walnut press cake and how to find new ways of valorisation such as ingredients for human consumption. Innov'Alliance also hosted a focus group workshop on the business model walnut flips which highlighted difficulties relating to how to guarantee consistent quality of the walnut press cake. The raw material varies a lot and is not stable enough to guarantee consistent quality.



AlpBioEco business visits

To develop and improve the business models in the walnut value chain, the lead partner of AlpBioEco, the city of Sigmaringen, and the project partner BUND Ravensburg-Oberschwaben from Germany, visited an array of businesses throughout the region. Some companies even produced prototypes for AlpBioEco. The company “Fruchtbares von lebendigen Böden” (Fertile from Living Soils) produced walnut spreads with varieties like paprika, chili or tomato for the project.



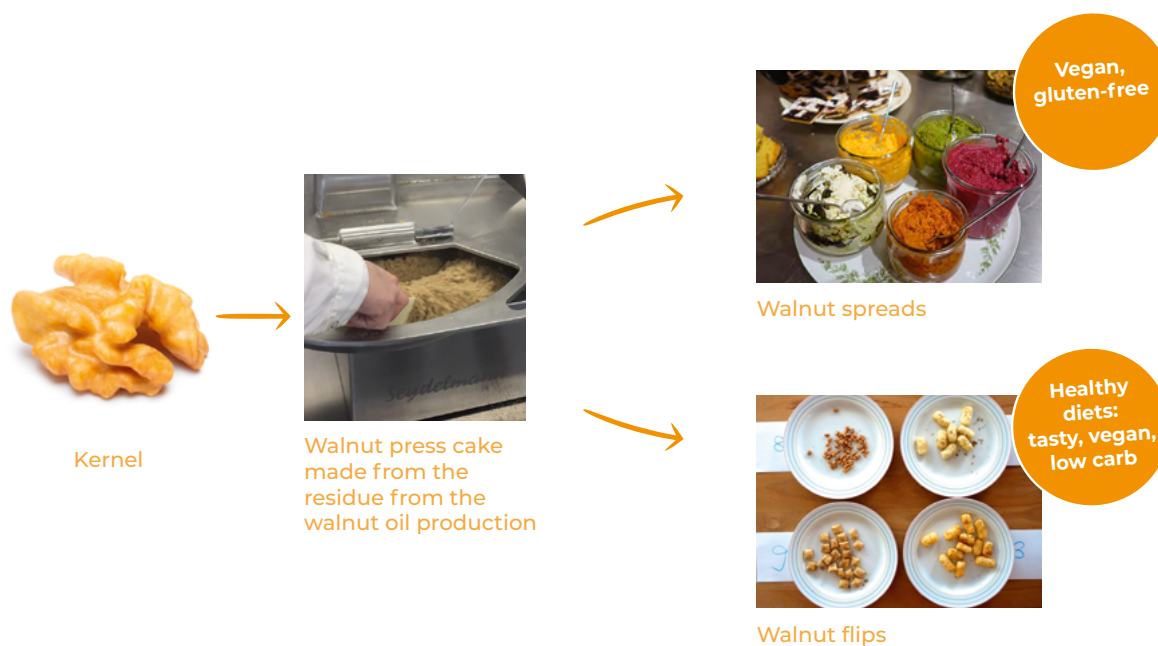


Figure 9: Walnut spreads and flips produced with the walnut press cake

1. Walnut flips – City of Sigmaringen and BUND, Germany

- Focus group workshop with selected stakeholders and experts
- Product prototyping from a partner company of the AlpBioEco project
- Production and tasting of twelve varieties of walnut flips

2. Walnut flips – Innov’Alliance, France

- Focus group workshop with selected stakeholders and experts
- Business visit to the Rhône-Alpes nuciculture experimentation station
- Expert interviews and networking

3. Walnut spreads – City of Sigmaringen and BUND, Germany

- Focus group workshop with selected stakeholders and experts
- Business experiments with walnut press cake
- Business visits via phone calls
- Product prototyping with walnut press cake, paprika and tomatoes from a partner company of the AlpBioEco project

Figure 10: AlpBioEco's activities for the development of the business models of walnut spreads and walnut flips

For more information on the business models, please consult the [AlpBioEco Best Practice Brochure](#) available on the AlpBioEco website.

E) DEVELOPMENT OF POLICY AND TRANSFER GUIDELINES

In the fourth and final work package “T4 – Policy transfer preparation”,¹⁹ the AlpBioEco project focused on preparing the project results for transfer to policy-making and for regional implementation guidelines for the business models of walnut flips and walnut spreads. For this purpose, regional advisory boards were set up. For the walnut value chain, regional advisory boards for both walnut flips and walnut spreads were set up for the area of Tübingen, Germany, and one more regional advisory board for walnut flips was set up in the area of Auvergne-Rhône-Alpes, France. They included, for instance, members from business, science, civil society, and politics, who brought expertise from the field of the walnut business. The regional advisory board for the walnut flips business model in France included experimental and technical centres, producers, farmers, processing services (mills), and nutritional experts. In a first round of online meetings in September and October 2020, the members of the advisory boards discussed the status quo of walnut cultivation, processing, and marketing in the different regions. Important aspects considered were the various national and regional bioeconomy strategies, available raw material, research and development, funding, and the legal frameworks in the different regions.

PROJECT PARTNER	BUSINESS MODEL	REGION
City of Sigmaringen and BUND	Walnut flips	Tübingen, Germany
City of Sigmaringen and BUND	Walnut spreads	Tübingen, Germany
Innov'Alliance	Walnut flips	Auvergne-Rhône-Alpes, France

In a second round of meetings in October and November 2020, two Lego® Serious Play® workshops (in Sigmaringen, Germany) and one Speed Boat method workshop (online, France) for the walnut value chain were held, where the business models were developed further, tested in different scenarios, and connected. The use of the creative design thinking tool Lego® Serious Play® and the innovation game known as the Speed Boat method encouraged the participants to solve challenges by using people's collective insights and by addressing the challenges dynamically. For improving the AlpBioEco project with the Lego® Serious Play® method for instance, every member of the regional advisory board built (from Lego® bricks) the current situation and status quo of the business model from his or her own point of view. Thereby, an overview of the status quo of the walnut sector in the region was formed by experts from various areas and sectors in a creative way.

Over the course of the exchanges during the workshops in Germany, the AlpBioEco project partners were able to establish new contacts and strengthen links with individuals from the political sphere, in particular from regional ministries, as well as from trade, which was essential for transferring the results of the AlpBioEco project. The exchanges were also an opportunity to reaffirm the need to have oil mills throughout the whole territory with a distance between farmer and oil mill of no more than 50 kilometres. The idea of mobile oil mills was also suggested. In order to make progress on the business models developed for the walnut value chain, the people who collaborated with AlpBioEco agree that more services need to be made available. Different tasks such as collecting walnuts, washing, drying, cracking, pressing kernels, or producing spreads, should be offered by service providers. The development of oil mills as a service or in cooperation with social enterprises, food designers, bloggers, and caterers could benefit the development of walnut spreads and flips.

¹⁹For more information on the [AlpBioEco work package “T4 – Policy transfer preparation”](#), please visit our website.

Compared to the rest of Germany, Bavaria and Baden-Württemberg have an above-average number of marketing contacts with organically grown goods and, at the same time, an above-average purchasing power of German households, which is positive for the outlets of the developed products. However, the workshop exchanges showed the need for quality standards and especially more biocertification for proper market access. Improved trade also requires secure conditions for the supply of raw materials, stable product qualities and clear and authentic origins and producers.

Finally, it was shown that the business models of walnut flips and walnut spreads are promising and all those involved in the workshops agreed that there is a need to reach and inform market partners with both the stories and the qualitative aspects of the business models.

With all these results, AlpBioEco worked on the development of a transregional and transnational transfer guideline. For the success of the AlpBioEco project, these interdisciplinary and transregional contacts were very important as there is also a lot of know-how outside the specific regions – in the case of walnuts in the region of Tübingen, for instance, expertise can also be found in the neighbouring regions of Bavaria, Vorarlberg or Thurgau. In the context of the project, visits and contacts to several places were set up, and the setting up of the regional advisory boards once more broadened the array of relevant contacts. For more information on the continuation of this work, please refer to part 6 of the report, which addresses AlpBioEco's transfer of results.

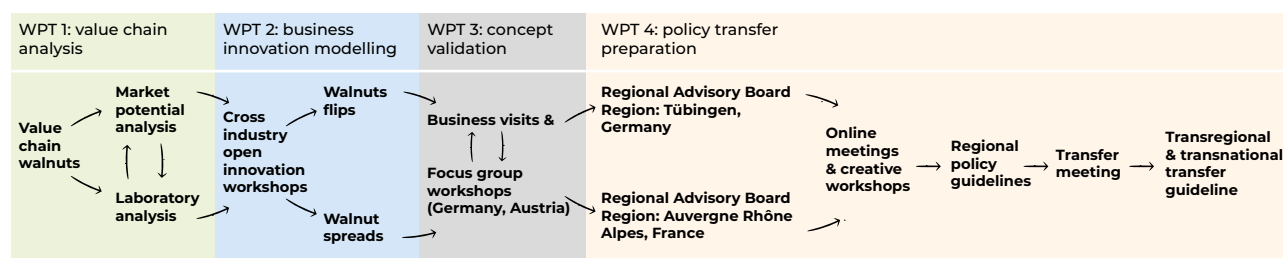


Figure 11: Overview of activities carried out for the walnut value chain

To conclude, the AlpBioEco project found a great deal of regional potential in further processing the available walnuts, but also suggests some necessary changes in the business landscape in order to realistically put into practice the walnut business models based on walnut press cake. Walnut press cake is a very interesting resource, because it contains many important and healthy nutrients such as proteins and fibres, which makes it ideal for food production. With its regional but also transnational focus, AlpBioEco has helped to create a huge network of people with knowledge about or interest in the walnut sector. This might soon trigger the implementation of one or more of the business models. AlpBioEco is thereby promoting regional valorisation of the walnut value chain, supporting in particular eco-innovative ideas, which could contribute to a more sustainable future.





BUND and AlpBioEco walnut excursion

In October 2020, [AlpBioEco's project partner BUND Ravensburg-Oberschwaben](#) (Friends of the Earth Germany, Regional Association Lake of Constance-Upper Swabia) organised a [walnut excursion](#) to Switzerland with two stops: first, the group went to the Walnut Competence Centre in Malans, and then to "Nussdorf Frümser" (the Frümser Nut Village). At both stops, the participants gathered information about the growing and processing of walnuts – in Frümser, 78 varieties of walnut trees can be found! Ulfried Miller, walnut tree owner and secretary of the BUND Ravensburg-Oberschwaben, led the excursion. He thinks that walnuts are fascinating: *"More than 100 varieties of walnuts are known, and hardly any other tree is so versatile"*. The BUND has primarily contributed to the work of AlpBioEco in the value chain of [walnuts](#) and apples, also due to the extensive regional networks the BUND has already built up, for instance with [walnut tree owners](#).



At the walnut excursion, the participants got to know many different walnut varieties.

KErn, the Competence Centre for Nutrition and the publication of recipes based on walnut press cake



What can you actually do with walnut press cake? This question was answered by AlpBioEco's project partner [KErn, the Competence Centre for Nutrition](#), which bundles knowledge about nutrition in Bavaria, Germany. KErn is part of the Department of the Bavarian State Ministry for Nutrition, Agriculture and Forestry. It was the lead partner for the work package T1 of the AlpBioEco project and contributed to the project with research such as laboratory analyses and market potential assessments, as well as a host of other activities. For example, KErn was involved in developing the "digital platform" business model. In June 2020, a [brochure of walnut press cake recipes](#) was published by KErn. From cabbage rolls with walnut-vegetable filling, to walnut patties, and even Walnutella – a range of delicious products that can all be produced with walnut press cake.

4. HERBS VALUE CHAIN

Another resource found in abundance in the Alpine area are herbs. This is also why the cultivation of herbs shows promising economic potential in the Alpine regions, as natural conditions in these locations are suitable for this activity. However, cultivating herbs – regardless of the form of cultivation – is a specialist niche because herbs require good soils and favourable climates. For example, herbs need mainly weed-free areas, because of the weak growth impetus of the seed and the slow development of young plant shoots. Another important factor is adequate irrigation, either from sufficient rainfall or by artificial irrigation. Medicinal and aromatic plants also cannot be grown in soils contaminated by slurry or sludge, heavy metals, residues of plant-protection products, or other non-naturally occurring chemicals.

There are several small-scale cultivation areas of herbs across the Alpine world, particularly in the mountain areas of Austria, France, Italy, Slovenia, and Switzerland. In Germany, Italy, and Switzerland, herb cultivation is dominated by outdoor and greenhouse cultivation. The latter is mostly operated by large producers. Herb cultivation under cloth is predominant in Austria, whereas in Slovenia outdoor herb cultivation is prevalent. Furthermore, the collection of wild herbs is currently practised in Italy (South Tyrol), Switzerland, Slovenia, and in certain mountain areas of Austria.

Based on experts' assessments,²⁰ the existence of the cultivation areas of herbs is largely based on Alpine climatic conditions, long-standing tradition and the associated know-how regarding herb cultivation. There are also synergies with tourism-based programmes that support herb cultivation. Thus, the growing of wild herbs has untapped potentials for cultivation, especially in dry and mountainous areas. The cultivation of "regional" herbs (like gentian, edelweiss, or everlasting flower) could also be seen as an unexplored potential, because substituting imported herbs and expanding biological cultivation is a realistic option.

However, the expansion of herb cultivation in the Alpine territories is currently limited due to several reasons, including increasing production costs (especially in the case of biological cultivation), the poor organisation of trade structures as well as insufficient logistic infrastructures (especially in the Veneto region, Italy, and Slovenia). In the case of the pharmacy and medicine sector, some experts have noted²¹ that pharmaceutical companies are forced to import raw materials for the production of remedies and medicines because the local harvesting volumes of herbs cannot meet their requirements. Moreover, small-scale herb cultivation – as is the case in most Alpine cultivation areas – cannot guarantee sufficiently standardised raw materials.

The bioeconomic potential of herbs and their waste residues lies particularly in the use of plant parts for biogas plants, or in the production of paper or textile material from plant fibres. The composting of raw material and their re-use as fertiliser also offers bioeconomic potential. Yet it is important to consider that, for example concerning the use of raw material for biogas production, the raw material is only available in small amounts and thus this type of use would comprise only a small contribution to replacing fossil energy with renewable raw materials. Moreover, the producers and processors are not interested in exploiting waste residues because it is not economically viable for them (due to transportation costs and personnel costs). Also, the producers and processors often re-use the small amounts of waste residues on their own farms (e.g. for composting), so waste residues are not available on the market. Besides, the producers of herbs are generally unaware of the possibilities of bioeconomic valorisation in herb production.

Nonetheless, there is a strong demand for herbs, as consumers look more and more towards healthier lifestyles. The production of regional herbs should therefore increase to meet these expectations. Because the herbs value chain represents many opportunities for the Alpine regions and the development of innovative products for this value chain occurs in a favourable context, the AlpBioEco team selected it as one of the three value chains of the project.

²²For more information on the results of this analysis and the [AlpBioEco work package "T1 – Value chain analysis"](#), please visit our website.



Focus on the Alpine hay

Throughout the work on the herbs value chain, AlpBioEco has focused intensively on Alpine hay. As a raw material in the Alpine area, Alpine hay is cultivated mainly in steep mountain meadows. It can be harvested from dry and sunny as well as from wet habitats like hanging moors and headwater marshes. The cultivation of these areas is important because of its value for the unique landscapes and a high degree of biodiversity with many rare and endangered species. Alongside this, the ecological value of the rough pastures and treeless mountainsides is of crucial importance for the landscape and contributes to the location's value for tourism and regional identity. However, the labour-intensive cultivation of less productive, hard to access, steep and hilly pastures does not suit today's large agricultural firms – therefore, initiatives that help to add value are vital for the region.



ALPINE HAY

A) ANALYSIS OF THE HERBS VALUE CHAIN

In order to begin working on the herbs value chain, the AlpBioEco team had to start by considering several questions, such as the strengths and weaknesses of the value chain, the threats it faces and the opportunities that could open up. To conduct this value chain analysis, market potential and laboratory analyses were carried out by the AlpBioEco project partners. The work package “T1 - Value chain analysis” of the project addressed this issue.²²

HERBS

The AlpBioEco team started with a market analysis. Herbs production is expected to grow to meet new market needs, also because new products based on herbs are arriving on the European market. New textile products from nettle or broom, and cosmetic products with antioxidants, nutraceuticals with active ingredients, fungicides, or herbicides with novel ingredients are typical examples of innovative products currently coming on the market. In addition, some new processes that exploit the bio-economic potential of herbs are emerging, such as the use of floral waters for seed tanning in organic agriculture, the use of essential oils as herbicides, antimicrobial applications, fungicides or food preservatives, or the composting of solid residues from by-products.

The demand for certified cosmetic ingredients is growing. It means new natural ingredients from plants will replace some synthetic molecules, which offers new bioeconomic possibilities for herbs and their residues. Biogas-producing plants are the most frequently used. For other co-products, recycling the residues is more challenging as it does not yet appear profitable due to transport costs. In addition, there are no structures for purchasing waste residues, and this raises the question of waste management between herbs producers. To do so, the bioeconomic potential of residues has to be identified by

²⁰Ozturk et al. Herbal from High Mountains in the East Mediterranean. 2017. (https://www.researchgate.net/publication/308947434_Herbal_from_High_Mountains_in_the_East_Mediterranean)

²¹Salgueiro et al. Raw materials: the importance of quality and safety. A review. 2010. (<https://onlinelibrary.wiley.com/doi/pdf/10.1002/ffj.1973>)



herbs producers. As long as herb residues are not seen as presenting high added value, no valorisation pathways among herbs producers will be opened up.

Currently, more and more consumers are adopting a healthy lifestyle – herbs can be part of the answer for achieving this. Therefore, the demand for spices and herbs will continue to grow. To meet this increasing demand, buyers are looking for new suppliers with certain criteria because, especially on the European market, raw materials have to comply with requirements for quality, food safety and traceability. To gain further insights on the herbs market, AlpBioEco's project partners prepared a preliminary questionnaire with the following information: typologies of herbs, distribution, types of cultivation, uses

Eventually, new possible scenarios in the herbs value chain were hypothesised as follows:

DEALING WITH NEW PRODUCTS :

- paper
- new textile products from nettle or broom
- cosmetic products with antioxidants
- nutraceutical products with active ingredients
- novel ingredients from fungicide or herbicide
- new edible plants for direct human consumption

DEALING WITH PROCESSES :

- floral waters for seed tanning in organic agriculture and on farms
- essential oils as herbicides, antimicrobials and fungicides
- essential oil as food preservatives
- composting of solid residues from by-products

The laboratory analysis was done by investigating the distillation process. Few evaluations have been done regarding possible biological activities within essential oils and one of their by-products, floral waters. Therefore a bibliographic study was done exploring scientific articles on hydrolates and essential oils from different types of Alpine plant. Hydrolates have some potential for innovative uses since they still have active molecules. For examples, please refer to the AlpBioEco results in the work package T1.²³ The main activities found within essential oils and floral waters are their food preservative properties, as well as their efficacy as herbicides or fungicides and their antioxidant effect.

ALPINE HAY

The project partners focused on aromatic, medicinal and perfume herbs. As the project took place in the Alpine area, it was deemed relevant to focus also on Alpine hay. The market study shows some sectors where Alpine hay can be valorised:

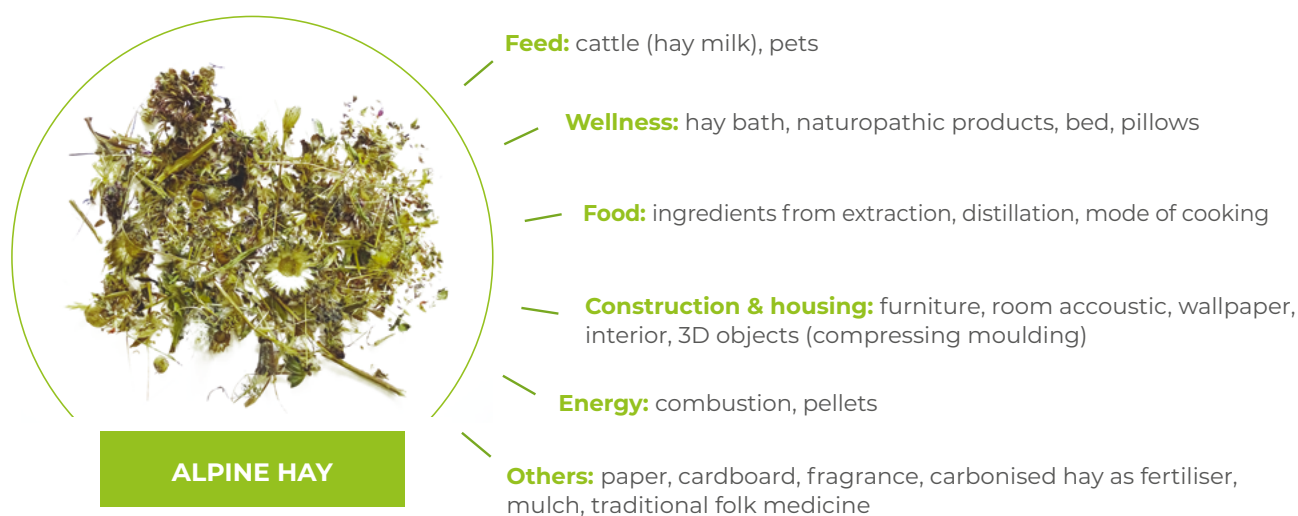


Figure 12: The various uses of Alpine hay

²³For more information on the results of this analysis and the [AlpBioEco work package "T1 – Value chain analysis"](#), please visit our website.

No laboratory analysis has been made for Alpine hay as the product is very diverse in its composition and very specific to a geographical area. Nowadays, Alpine hay producers do not exploit the full potential of the product as it requires more logistic structures and a more beneficial economic valorisation. There is still a need to show more effectively the added value of using Alpine hay for the market segments mentioned above.

B) “DISCOVERED” POTENTIALS WITHIN THE HERBS VALUE CHAIN

Herbs, in their different forms (fresh, dry, frozen, as essential oils or extracts), are in widespread use after transformation. The main destination of herbs is the medical sector, including related segments like phytotherapy, aromatherapy, food supplements, homeopathy, or allopathy. Moreover, herbs are used in the agri-food sector, and in the cosmetics and perfume sector.

Herbs cultivation in particular seems to be relevant for promising business opportunities, as there are many trends associated with a healthy lifestyle in favour of the herbs industry. One important part of the trend for a healthier lifestyle is the aim of avoiding unhealthy and synthetic ingredients. Herbs are not only natural spices that can serve as substitutes for unhealthy ingredients like salt or artificial additives, they also contain important nutrients and are hence used, for instance, in food supplements or protein products as alternatives to meat, where the herbs are used to season the “meat” and to imitate the taste of meat this way. The healthy properties of herbs are also highly valued in the medical sector, as it is assumed that herbs have a better tolerability compared to synthetic drugs. Moreover, the cosmetics sector is increasingly replacing synthetic products with herbs, especially with essential oils derived from herbs, which are used to perfume and even to disinfect.

Another general tendency connected to avoiding synthetic components is the trend towards an organic market for spices of herbs, which is already increasing and is expected to continue to expand in the future. Organic products are associated with a healthy lifestyle and also offer a valuable opportunity to distinguish products in a competitive market.

C) IDEAS FOR ECO-INNOVATIVE PRODUCTS AND BUSINESS MODEL DEVELOPMENT

Within the work package “T2 – Business innovation modelling” of the AlpBioEco project,²⁴ eight Open Innovation workshops on the herbs value chain were held with herb farmers, small and medium-sized enterprises, entrepreneurs, scientists, researchers, retailers, and citizens between June and November 2019. On the basis of the data collected and analysed as part of the work package T1 of the AlpBioEco project, participants were invited to develop new ideas for products and services, taking into account emerging demands and customer needs arising from future trends while targeting potential customers. The first workshop sequences generated 58 ideas for the herbs value chain. The AlpBioEco project consortium and the experts involved then ranked and prioritised the ideas. For this sequence, two herbs value chain workshops were held in June and July 2019 in Naklo, Slovenia and Bolzano, Italy.

The selection of new product and service ideas for the herbs value chain formed the basis for the second sequence of workshops which focused on translating selected and refined ideas into architectures for creating reasonable value and profit models that meet the criteria of eco-innovation. For this second series of workshops, six workshops on the herbs value chain took place between September and November 2019 in Austria, France, Italy, and Slovenia. It was at the workshop held in November in Nenzing, Austria, for example, that the idea emerged to use Alpine hay seeds in a different way. Now, the hay plants are dried and packaged for sale as seedlings in a small pilot project called “natürlich bunt

²⁴For more information on the results of the business model development and the [AlpBioEco work package “T2 – Business innovation modelling”](#), please visit our website.

& artenreich" (naturally colourful & biodiverse; for more information see page 41). But the longer the seeds are stored, the more the seeds' ability to germinate decreases. After three years at the latest, they can no longer be used for sowing. Therefore, the idea arose to use the stored seeds for herbal extracts in the second year. At the meeting, a comparison with experts showed the need to increase awareness of the bioeconomic potential of Alpine hay among all target groups: farmers, horticultural businesses, architects and environmental organisations. Since there are no regional seeds in Vorarlberg and they are mainly bought from abroad as non-local species, it is important to raise these new possibilities and to provide all the necessary information to potential buyers in order to reverse the trend.

Figure 13 exhibits a selection of the ideas, clustered into thematic groups, and showcases the broad variety of potential innovation fields regarding the value chain of herbs.

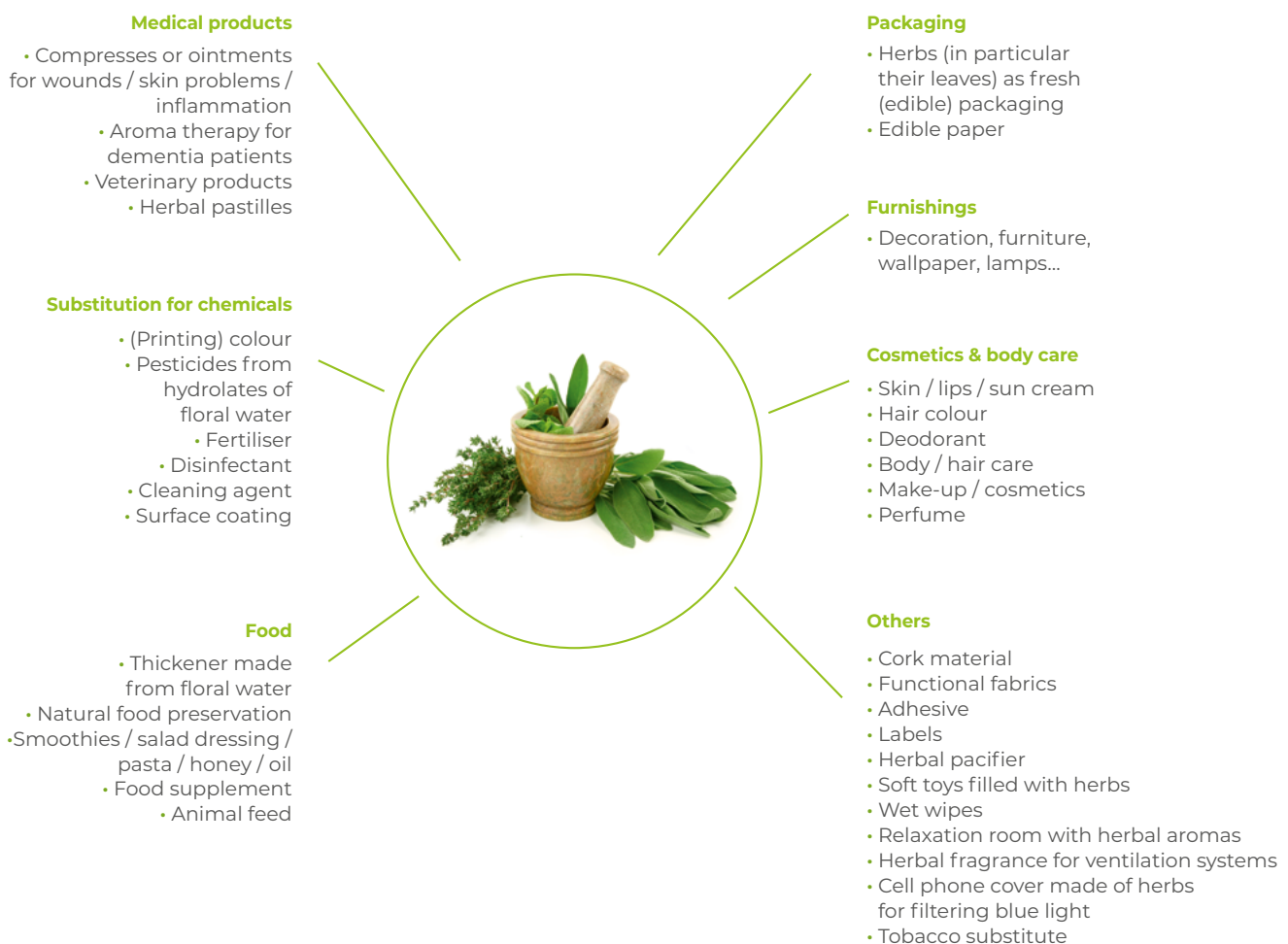


Figure 13: Overview of selected innovation ideas based on herbal products



At the end of the second round of workshops, six eco-innovative business models were identified for the herbs value chain:



Figure 14: Selection of six eco-innovative business models for the herbs value chain

D) BUSINESS MODELS SELECTION AND TEST PHASE

During the AlpBioEco consortium meeting held in December 2019 in Avignon, France, the AlpBioEco project partners selected herbal baby pacifier and Alpine hay seeds as the two business models to be validated in the AlpBioEco work package “T3 – Concept validation”.²⁵ This phase of the project consisted of validating and testing the feasibility of the business models. In selecting these two business models, the AlpBioEco project partners took into consideration several criteria, for example degree of innovation, benefit for local small and medium-sized companies active in this value chain, or the presence of local entrepreneurs interested in collaborating to put the business model into practice.

The two selected business models were validated in work package T3 by means of focus group workshops with experts, business visits and pilot activities. These activities allowed the AlpBioEco team to verify the feasibility of the business models, to outline the next steps necessary for their implementation and to highlight any obstacles to overcome.

i) HERBAL PACIFIER

The herbal pacifier business model was set up by two AlpBioEco project partners: the Italian Chamber of Commerce for Germany (ITKAM) and the Chamber of Commerce and Industry of Slovenia.

²⁵For more information on the results of the pilot testing of the business models developed and the [AlpBioEco work package “T3 – Concept validation”](#), please visit our website.



This business model foresees the development of a dummy made of organic material (for example, bio-rubber) that contains a vessel with Alpine herbal fluids used for therapeutic purposes. The development of such a product has several benefits for both Alpine herb growers and the target group. In fact, the fluids contained in the dummy can be used to treat a variety of early-childhood ailments such as stomach ache, toothache, or sore throat. The fluids can also be used for other therapeutic purposes, such as in treating skin impurities in adults. The development of this eco-innovative product represents a benefit for Alpine herb producers, who can thus diversify the use of the herbs they grow and generate added value. Both the dummy and herb therapy are produced entirely from local raw materials. Their production supports small economies of scale and gives the product a regional identity. This product is also scalable, can have different therapeutic applications and can also be produced with local herbs in other locations.

To establish the herbal pacifier in Italy, ITKAM collaborated with the South Tyrolean entrepreneur Christoph Kirchler, owner of the company Ecopassion and hemp grower. He has already developed various hemp products in the fields of green building, cosmetics and food, and is now looking for new sustainable products to include in his portfolio.

ITKAM first organised two focus group workshops in spring 2020, one with German experts and one with Italian experts. The workshop was attended by employees of local authorities for economic promotion, university professors, pharmacists and Alpine herb growers. The workshop participants helped to define the steps necessary for putting the business model into practice, and to highlight any strengths and possible obstacles to overcome. Their observations showed that the first step is to sound out the interests of the target group and to identify possible market gaps. Hence, ITKAM, in collaboration with a local marketing agency, carried out extensive market research involving parents, paediatricians, midwives and pharmacists. The target group was asked:

- to identify the most problematic early childhood disorders according to them;
- to declare their level of satisfaction with products currently on the market;
- to state whether they were hypothetically interested in the use of a herbal pacifier and what the necessary conditions would be for them to buy it (in the case of parents) or recommend its use (for paediatricians, midwives and pharmacists).

The survey responses show that the most difficult disorder to treat is stomach ache, also because the products presently on the market are unsatisfactory. Therefore, for a prototype, consideration could be given to developing herbal fluid therapy to counteract this discomfort. In general, both parents and early childhood experts interviewed expressed a potential interest in the purchase and use of such a product. However, important conditions are that the product has passed the necessary toxicological tests, has no side effects, tastes good and contains no added sugar.

The Slovenian AlpBioEco project partner, the Chamber of Commerce and Industry of Slovenia, followed a different approach. Due to the difficulty of clinical product trials which are expensive, time-consuming and involve a large number of people, the herbal pacifier was considered too complex for regional validation. For this reason, it was decided in Slovenia to focus on the validation activity on herbal fluids as an alternative medical therapy for skin impurities, such as psoriasis and dermatitis. In particular, research has focused on essential oils and hydrolates made of locally grown and indigenous plants called strawflower or everlasting flower (*Helichrysum italicum*) and lemon balm (*Melissa officinalis*). These products need to be manufactured with great care because their main customers are mothers and children.

As a first step, the Chamber of Commerce and Industry of Slovenia consulted stakeholders with extensive experience in bioeconomy, herb production and processing, to obtain initial impressions of the business model. In April 2020, a focus group workshop was organised to involve experts in the validation of the selected business model. The workshop, together with the preliminary consultation of experts, showed that such a product could have excellent market opportunities in Slovenia, a country



where the consumer is very attentive to the regional origins of products. Moreover, in the case of herbal products, consumer trust in them is higher when the effects of these products on human health are supported with reliable scientific research results. Eventually, selling such a product on foreign markets would also represent an excellent opportunity for Slovenian manufacturers to become more internationally oriented. Additionally, distillation plant residues can be re-used in producing pellets for heating or compost. In June 2020, a business visit was organised at the Bonistra company in Slovenian Istria, where the process of harvesting and distilling everlasting flowers was demonstrated and explained. During the business visit, the setting up of a small distillation centre with a small-scale laboratory and other educational content, such as demonstrations, interactive lectures and practical workshops – all related to herb production and herb processing – was discussed.



ITKAM and the herbal pacifier survey

The Italian Chamber of Commerce for Germany,

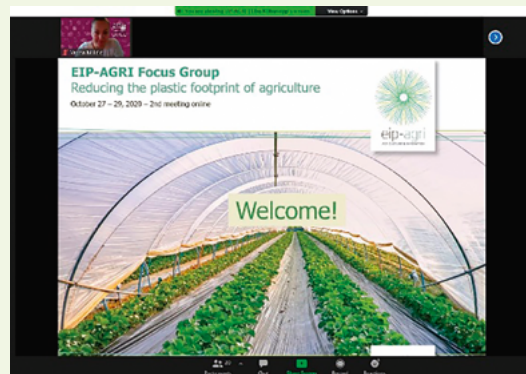
ITKAM, is a registered non-profit bilateral association with the main purpose of promoting economic relations in the EU with a focus on Italy and Germany. ITKAM comprises over 400 member companies and provides around 500 Italian and German firms every year with business support. In the framework of the AlpBioEco project, ITKAM is the Italian partner for the Lombardy region and is involved especially in validating the business model and in testing new products. ITKAM mainly dealt with the value chains of apples and herbs, but also partially supported the walnuts team. ITKAM has also presented AlpBioEco at many events such as the European Week of Regions and Cities. ITKAM contributed to the research on the herbs value chain with a survey about the business model of the herbal pacifier. The results of the survey lead to a very positive conclusion: three out of four parents surveyed stated that they could imagine buying a herbal pacifier!



ITKAM presented the AlpBioEco project jointly with the AlpBioEco lead partner, the city of Sigmaringen, in an online exhibition and two interactive online sessions in October 2020.

The Slovenian Chamber of Commerce and Industry

As well as being heavily involved in research for the apple value chain, AlpBioEco's project partner, the Slovenian Chamber of Commerce and Industry, has also worked intensively on the herbs value chain, both on the "herbal pacifier" and the "Alpine hay seeds" business models. The organisation brings together the interests of around 230 registered agricultural and food companies in Slovenia. As a leading partner in AlpBioEco work package T3, the chamber organised and supervised the testing and piloting of the business models, which resulted in the publication of the AlpBioEco Best Practice Brochure. The chamber has also promoted the AlpBioEco project at major trade events like the AGRA International Agriculture and Food Fair, and has presented the project at the Agricultural European Innovation Partnership, EIP-AGRI, a focus group made up of experts from the EU.



ii) ALPINE HAY SEEDS

The herbal pacifier business model was set up by two AlpBioEco project partners: the Italian Chamber of Commerce for Germany (ITKAM) and the Chamber of Commerce and Industry of Slovenia.

Alpine rough pastures are an environment particular to Alpine regions. The idea of the second business model in the AlpBioEco herbs value chain is to use the seeds of Alpine rough pastures for revegetation. Alpine hay flowers can be harvested every three years and, once dried, can serve as revegetation material. Using Alpine hay flowers is especially interesting because, on the one hand, they offer seeds perfectly adapted to the location and resistant to the climate, while, on the other, the Alpine rough pastures can be still mowed normally for animal fodder without any loss of volume. Such seeds are suitable for the replanting of building sites, road construction sites, embankments, roofs, or other renaturation projects. Furthermore, harvested flowers can also be used in the cosmetics industry, for example in the production of essences and distillates.

The business model revegetation with Alpine hay seeds was validated by AlpBioEco's project partner Regio Im Walgau (RIW) in the Austrian region of Vorarlberg. RIW has collaborated with a small horticultural business already producing revegetation seeds from Alpine hay in a test phase. As a first step, RIW organised a focus group workshop with farmers, biologists, small and medium-sized companies and local public authorities in March 2020. This initial meeting with experts was followed by business calls (by telephone) to the companies HELFE Ltd and Daniel Gartenbau, and a second workshop focused on how to gain more rough pastures to harvest. A third meeting was organised to concentrate on marketing and internal organisation. During the test phase, Alpine hay seeds were harvested and the business model presented to farmers and other stakeholders in the region. While a network committed to developing the business model has been set up, a flyer has been produced as well as a website to find donors of meadows for the harvesting of seeds with the aim of producing plant extracts for cosmetics and to bring together Austrian protagonists in the region. This led to the birth of the initiative "Hay Flowers – Meadow from the Bag" (you can learn more about the initiative below).

Alpine hay revegetation seeds are aimed in particular at architects, property developers and public institutions, who can use them for public green regeneration projects. Alpine hay farmers would benefit greatly from the increase in such a business because, by selling the top of the hay flower every three years, they can increase their profits. At the same time, those who process Alpine hay seeds are not obliged to own a field in order to have this type of raw material available. Furthermore, the flowers of Alpine hay can also be used in cosmetics, especially when they are "old" and can no longer be replanted.



Regio Im Walgau and the "natürlich bunt & artenreich" initiative

["Natürlich bunt & artenreich"](#) (naturally colourful & biodiverse) is an initiative that provides a network for municipalities in Vorarlberg, Austria and Liechtenstein to build up knowledge about diverse flowering meadows and roadsides. AlpBioEco's Austrian project partner, [Regio Im Walgau](#), is a member of the network and has been involved more specifically in the ["Meadow from the Bag"](#) project that supports collaboration with local farmers to make available various seeds and plant extracts from Vorarlberg.

Regio Im Walgau is an Austrian association of 14 local authorities working together to promote development of the Walgau region, to foster production of regional agricultural products and to encourage improvements to the Alpine landscape. Within AlpBioEco, Regio Im Walgau was involved in the herbs value chain and focused on the issue of Alpine hay. Its speciality is in revegetation and renaturing services using Alpine hay seeds.



1. Herbal pacifier – ITKAM, Italy

- Two online focus group workshops with Italian- and German-speaking experts
- Online business visit at the hemp company Ecopassion
- Market research to sound out the interests of the target group

2. Herbal pacifier – Chamber of Commerce and Industry of Slovenia

- One regional focus group workshop with experts
- Business visit at the company Bonistra
- Harvesting and distillation of everlasting flowers

3. Revegetation service with regional seeds – Regio Im Walgau, Austria

- Two focus group workshops with farmers, biologists, small and medium-sized enterprises and local public authorities
- Business visits via phone at the companies HELFE Ltd and Daniel Gartenbau
- Harvesting of Alpine hay seeds

Figure 15: AlpBioEco's activities for development of the herbal pacifier and revegetation service with regional seeds business models

For more information on the Alpine hay seeds and herbal pacifier business models, and in fact on all the business models selected and developed by AlpBioEco, please consult the AlpBioEco [Best Practice Brochure](#) available on the AlpBioEco website.



Cooperating with SMEs: Alexander Heller, how hay flowers become regional care products

"For us it was an ideal project to collaborate with: on the one hand, I am in direct contact with my suppliers and, on the other hand, I can directly influence the value chain. The project helps the farmers because they can earn a second income with their poor meadows, and it helps nature, for example by preserving biodiversity. It's just a great value circle." Alexander Heller

[Alexander Heller](#) is from Austria and runs the family company HELFE. The company has been producing natural body care products and bath salts since 1927. HELFE buys hay flowers and oat straw directly from farmers. The hay flowers come from natural meadows – that is, rough meadows. Alexander Heller has participated in several AlpBioEco workshops, focusing on the business model "Alpine hay seeds". For him, it is important to look to the future: the cooperation with AlpBioEco secures the raw material in the long term and enables companies to continue working with hay flowers.



A HELFE employee processes herbs in the company's production facility in Feldkirch, Austria.





Cooperating with SMEs: Jana Bergant, local herbs for cosmetic products

“Hydrolates have many advantages, for example, they are the most natural cosmetic product, they are gentle and have a therapeutic effect, there is no need to dilute them, and allergies are rare. Everyone can use them every day! [...] My work in the field of herbs coincides with the definition of the AlpBioEco project.” Jana Bergant



Jana Bergant lives in Istria, in Slovenia, and works with indigenous herbs. She grows and uses many local herbs for the cosmetic products of her company “Bonistra” and, in particular, focuses on hydrolates and essential oils. She is an expert in local herbs and contributed to the AlpBioEco project with AlpBioEco's project partner in the region, the Chamber of Commerce and Industry of Slovenia, in developing the “herbal pacifier” business model. The Chamber has also produced [a video of the business visit to the company](#). The video was submitted to the Global Bioeconomy Summit 2020.

E) BUSINESS MODELS SELECTION AND TEST PHASE

As part of the final work package “T4 – Policy transfer preparation” of the project,²⁶ to prepare the project results for transfer to policy-making and for regional implementation guidelines for the herbal pacifier and the Alpine hay seeds business models, regional advisory boards were established. These brought together members from business, science, civil society and politics and provided expertise on the two selected business models. For the herbs value chain, two regional advisory boards were set up in Italy and Slovenia for the herbal pacifier business model and another was set up in Austria for the Alpine hay seeds business model. In a first series of online meetings in October and November 2020, members of the Austrian advisory boards discussed, for instance, marketing issues, legal frameworks (including problems of certification) and quality control.

PROJECT PARTNER	BUSINESS MODEL	REGION
Chamber of Commerce and Industry of Slovenia and BC Naklo	Herbal pacifier	Slovenia
ITKAM	Herbal pacifier	Lombardy, Italy
Regio Im Walgau	Alpine hay seeds	Vorarlberg, Austria

²⁶For more information on the [AlpBioEco work package “T4 – Policy transfer preparation”](#), please visit our website.



4. Herbs value chain

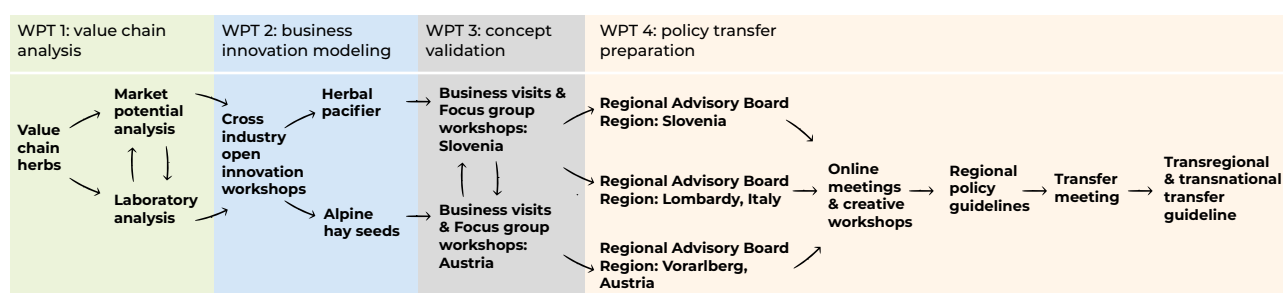
In a second series of meetings, the AlpBioEco team worked with several interactive methodologies and design-thinking tools. In November 2020, ITKAM, for instance, held an online workshop using the tool Mural and the interactive method Lightning Decision Jam. After a detailed presentation of the business model, the members of the Lombardy advisory board were asked to:

- point out things that are working in the business model
- capture and prioritise problems
- reframe problems as challenges
- ideate and prioritise solutions
- make solutions actionable

Thanks to this methodology, the regional advisory board was able to come up with recommendations for local institutions to help them create a more favourable environment for sustainable innovation. The regional implementation guidelines of the Lombardy region, on which the AlpBioEco project then based its transregional and transnational transfer guidelines, outlined major points such as:

- A vast majority of traditional small and medium-sized companies still see eco-transition as a hurdle and a risk: more awareness-raising activities about the potential of bioeconomy are needed.
- Entrepreneurs and company owners are not fully aware of all funding possibilities for eco-innovative projects – for example, local chambers of commerce provide free assistance to those interested in participating in public calls for tenders. Institutions have to spread information about funding possibilities and the role of the chamber system in promoting innovation.
- A network of innovation hubs for mature companies willing to start eco-transition should be established, in order to create a driving ecosystem to boost innovation.

With all these results, AlpBioEco worked on the development of a transregional and transnational transfer guideline. For more information on the continuation of this work, please refer to part 6 of the report, which addresses AlpBioEco's transfer of results.



Thus, even though the Alpine area currently has mostly small and local producers of herbs, a situation that cannot yet satisfy the increasing demand for (organically grown) regional herbs, potential for further development in this direction is promising. While the use of by-products is not an ideal option, there are in contrast many other ideas for using herbs in eco-innovative business models. Resulting from the innovation process of the AlpBioEco project, two very different possibilities for the use of Alpine herbs were developed: a herbal pacifier as well as herbal fluids as an alternative medical therapy for skin impurities, and a revegetation model with Alpine hay seeds. Both give local producers and processors the opportunity to increase the value gained with their products and thus promote green economic growth and a more sustainable future in the Alpine space.



5. OVERARCHING BUSINESS MODEL FOR APPLES, WALNUTS AND HERBS

Apple pomace and walnut press cake, for example, are products that offer numerous possibilities for economic exploitation and eco-innovative products and business models (see the report chapters above). In work package “T2 – Business innovation modelling”²⁷ the AlpBioEco project partners have been looking for new ideas for business models by conducting Open Innovation workshops. These ideas were rapidly enriched and many of the proposals concerned digital solutions. The idea of a business model did emerge: a digital tool to involve and connect farmers, manufactures, consumers and research and development organisations in a bioeconomic setting. The digital service platform is a general, overarching business model which can be implemented for each value chain or even across them.

The exchange of raw materials, especially unused or waste materials, that could be further processed and valorised can provide a basis for developing other eco-innovative products or services (among start-ups and small and medium-sized enterprises, for instance). A digital service platform would provide the necessary cross-regional and user-friendly infrastructure for stakeholders to communicate, network and trade materials. A tight network, which on the one hand makes raw materials/residues discoverable and on the other interlinks a start-up culture for the transformation of production processes, holds great potential for the region and its future viability.

Clearly, it was unrealistic to develop such a complex digital network platform with its multiplicity of requirements and challenges during the brief duration of the AlpBioEco project. This is why the project partners decided to look for good practice and basic work that had already been done and which should be further developed and disseminated. The following points show our approach and lessons learned with respect to the digital service platform idea and the good practice examples.

A) THE DIGITAL SERVICE PLATFORM BUSINESS MODEL – A SPECIAL CASE

The digital service platform creates a virtual marketplace for all kinds of bio-based products from small and medium-sized enterprises but also larger enterprises and even private individuals: raw materials, by-products from processing, end products and bio-based materials, which until now have often been considered waste.

The digital platform provides ideas, tips, requirements and opportunities to enhance trading of materials with bioeconomic potentials – it can be characterised as a virtual place to share, trade and exchange information and innovative concepts on raw materials and by-products with as yet unexplored or unused potential: on the one side a home base for a creative community corresponding about bioeconomy topics and, on the other, a great opportunity to cluster and trade (larger) volumes. Also included are interfaces to institutes of research and development, consultants, funding bodies and others.

This business model is characterised by its unparalleled capacity for bundling and networking. It differs from other (practical or tangibly applicable) business models on the three value chains of apples, walnuts, and herbs. It includes four sectors – consumer quadrant, producer, partner, and owner (or perhaps operator and developer). A successful networking platform in terms of capturing bioeconomic potential that goes beyond current approaches in the European Alpine region is not known to the authors at the time of writing.²⁸ Figure 17 portrays some idea of its complexity, as well as the interrelationships between producers, owners, consumers and partners in the circular economy.

²⁷For more information on the results of the business model development and the [AlpBioEco work package “T2 – Business innovation modelling”](#), please visit our website.

²⁸Status as of 25 January 2021: The AlpBioEco team’s digital platform business model.



5. Overarching business model for apples, walnuts and herbs

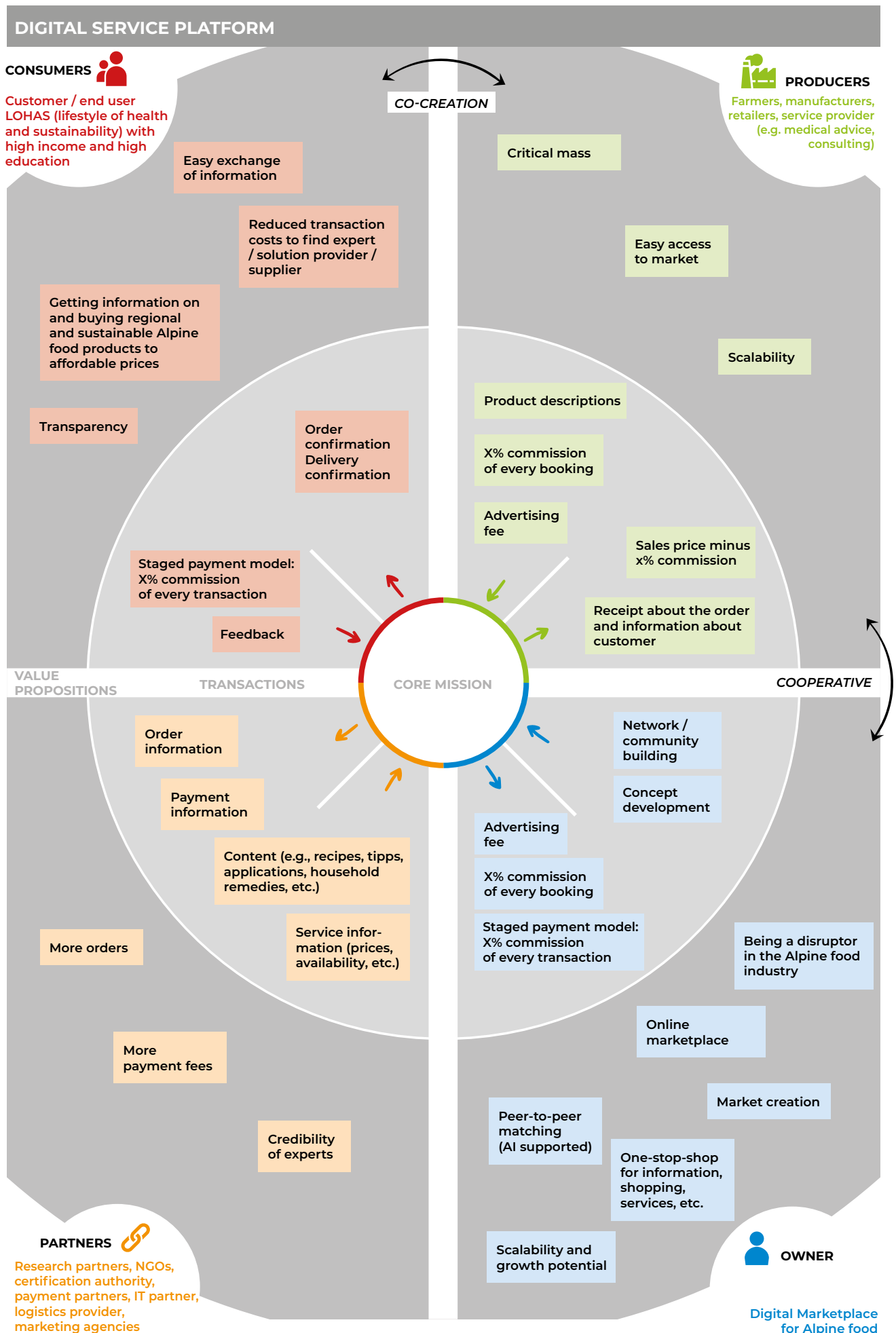


Figure 17: Digital service platform: main results of the work package T2

B) SEARCH FOR EXISTING PLATFORMS TO LEARN FROM

At the AlpBioEco consortium meeting held in December 2019 in Avignon, France, seven business models were selected, based on key aspects such as degree of novelty, market attractiveness and feasibility. The digital platform business model, as the only overarching model, was selected with the aim of further investigating, developing and testing it during the project period.

Two AlpBioEco project partners decided to work mainly on the business models, but with a focus on differing aspects. The Slovenian project partner BC Naklo decided to work on the digital platform business model because of the novel ways in which the model provided opportunities to exchange ideas, products and services. The German partner KERN chose this model because of their experience and working knowledge gained from developing online platforms in previous projects²⁹ and because colleagues are currently working on a similar project in Bavaria ("Digitale Rohstoffbörse", a digital exchange platform for raw materials).



"Digitale Rohstoffbörse" a digital platform for raw materials



The official video of the "Digitale Rohstoffbörse" explains how its digital platform works.

The "[Digitale Rohstoffbörse](#)" is a digital marketplace for buying and selling raw and processed materials, thereby creating bio-based economic cycles, ensuring short distances and lower transportation costs, and promoting regional trade in Bavaria, Germany. On 19 May 2020, AlpBioEco's team and the project team of the "Digitale Rohstoffbörse" held the [online workshop "AlpBioEco meets Digitale Rohstoffbörse"](#). The webinar served to test and evaluate the digital marketplace and to reflect on the concept of a digital, full-service platform.

BC Naklo

The Slovenian AlpBioEco project partner [BC Naklo](#) is an education, research and development oriented institution with a focus on nature preservation and a concern for production and processing of bio-based food. It has been involved in developing the business model of the digital service platform and in the business models of the value chains apples and herbs during the second and third work packages (T2 and T3) of the overall project. In work package T4, BC Naklo collaborated with the Chamber of Commerce and Industry of Slovenia and worked exclusively on the herbal business model.



In July 2020, BC Naklo tested apple flour made from apple pomace in gluten-free pastries during a [focus group workshop](#) on the apple flour business model in Naklo, Slovenia.

²⁹For example, www.wirt-sucht-bauer.de ("chef seeks farmer", a b2b platform for matching gastronomy and direct sellers from food production).



The following gives a short summary of “test objects” the teams took into consideration:

- Digital raw material exchange platform for sustainable resources (in German, from KErn and fortiss GmbH): <https://www.digitale-rohstoffboerse.de/>
- Marketplace of the EU MOVECO project (finished): <https://danube-goes-circular.eu/>
- Biomass-trade: The publisher is EPC, a non-profit organisation (Berlin, Germany; several European languages). The Biomass Trade Platform has received funding from the European Union’s Horizon 2020 research and innovation programme: <https://www.biomass-trade.eu/>
- Marketplace for agriculture and agricultural machinery (in German): <https://www.agrarboerse.eu/>
- Pack it eco, b2b platform (Munich, Germany): procurement platform and comprehensive services for b2b customers to switch to sustainability: <http://www.packiteco.com/de>
- Byprotex, b2b platform, private initiative/start-up from Bavaria, Germany. They first only focused on waste products from the abattoir branch and now are open to researching other value chains.

C) APPROACH, FEASIBILITY AND TESTING OF GOOD PRACTICE PLATFORM MODEL

To validate and test the feasibility of this model within work package “T3 – Concept validation”,³⁰ two online focus group workshops were organised in May 2020, first by KErn and then by BC Naklo. The KErn team found two approaches that can reach the goal of creating a digital full service platform: one private initiative with more industrial focus (byprotex), and one by a public body with more innovative focus on small and medium-sized producers (Digitale Rohstoffbörse für nachhaltige Rohstoffe, or Digital Exchange for Sustainable Raw Materials). The participants believe that this kind of “stock exchange” could be a good way to enhance the effectiveness of networking at the national level and to improve market transparency with regard to raw and residual materials in future. If the platform users know where to find raw and waste materials, then other product ideas can also be brought to life.

From all the exchanges a strong idea emerged: it is recommended not to create a completely new platform. Rather, it is best to continue developing a basic version such as the “Digitale Rohstoffbörse”. The scale and effort involved should not be underestimated.

The regional focus group workshop in Slovenia was attended by participants from the business sector, public administration and NGOs. In Slovenia there is no platform comparable to this business model. During a visit to the KGZ Sloga cooperative, a large cooperative of Slovenian farmers specialising in cattle breeding, ideas were collected on how to expand their platform, which is currently under construction, with the aid of the business model. They were thinking of adding AlpBioEco’s proposal of selling a “waste material” such as apple pomace as an additional feature on their platform

This platform should help to overcome some of the main hurdles and challenges also identified during the research on value chains of apples, walnuts, and herbs and during interviews with stakeholders:

³⁰For more information on the results of the pilot testing of the business models developed and the [AlpBioEco work package “T3 – Concept validation”](#), please visit our website.

- Connect (“acquire”) actors like producers, manufacturers, start-ups, sellers etc. to enhance density and functionality of the platform, with added value for supply and demand;
- Fragmented, non-transparent markets (many small or regional providers);
- A lack of critical mass/no scalability (limited regional scope);
- High market power of wholesalers and intermediaries;
- High transaction costs for customers to find suitable solutions/providers;
- No connections, or only loose ones, between stakeholders;
- The platform should facilitate exchanges by reducing costs and/or by enabling innovation.

D) HELP TO FURTHER DEVELOP THE EXISTING APPROACH/PLATFORM AND “LESSONS LEARNED”

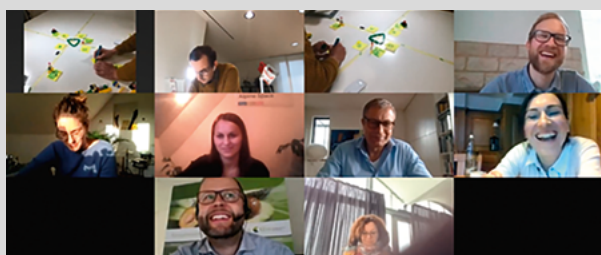
The final work package “T4 – Policy transfer preparation”³¹ of the project focused on preparing the project results for transfer to policy-making. With the beginning of the work package, the AlpBioEco team built up regional advisory boards to further develop ideas and basic ways of working. These boards were consortiums of regional representatives from the realms of business, science, society and politics, who brought their expertise in the context of the respective business models.

KErn organised two workshop rounds to bring the various stakeholders together to brainstorm about the “Digitale Rohstoffbörse”. During the first workshop the participants discussed the status quo of the regional bioeconomy strategy, the market situation for raw materials, as well as research and development, funding and legal frameworks covering the Bavarian region. In the second workshop, the regional advisory board continued to work on specific aspects regarding how to put in place the digital service platform business model.

In this case the training method of Lego® Serious Play®³² was used to illuminate the thoughts and opinions of the board in a playful way. Many aspects were discussed in this workshop, such as the fact that a change in the mentality both of consumers and of producers is needed. Building a community and network and overcoming the obstacles raised by a lack of transparency and openness were also discussed. The management of ideas and products as well as structural protection during implementation were important topics, especially with regard to appropriate financial frameworks.



KErn, the Competence Centre for Nutrition and digital service platform meetings



Despite the ongoing Covid-19 challenges, AlpBioEco project partner KErn organised two meetings for AlpBioEco online: there was a super working atmosphere for the regional advisory board meeting and the Lego® Serious Play® workshop!

³¹For more information on the [AlpBioEco work package “T4 – Policy transfer preparation”](#), please visit our website.

³²Lego® Serious Play® workshops: a creative design thinking tool, an agile approach to solving challenges by using people's collective insights, intuition and spontaneity.



E) SUMMARY, OUTLOOK AND RECOMMENDATIONS

i) LESSON 1 – FINANCING, MARKETING AND DISTRIBUTION ASPECTS

The financing of the platform depends on its future operator. If the platform is put in the hands of the state or an NGO – which we recommend – the platform could be free of charge for users.

If the platform is handed to the private sector, there would be a payment required for use – at least after start-up funding comes to an end. Profit for the operator can be generated by a service lump sum per month/year, which will lead to expectations or considerations on the user side. For this reason, the offered service should include technical support, data security guarantees, quality management and acquisition of a range of relevant stakeholders to quickly establish a close-knit network.

From the KErn perspective, the concept of the “Digitale Rohstoffbörse” is well suited as an innovative portal for enhancing networking between regions and improving market transparency with regard to raw and residual materials in future.

ii) LESSON 2 – PARTICIPATION IN THE PLATFORM

Consumers, producers, development, educational and research institutions, agricultural advisory services, customers, entrepreneurs, start-ups and other users should all be encouraged to participate in the platform. In addition to its developer and administrator, a marketing provider should also be appointed to systematically research and analyse the market, establish a register of potential customers and communicate with them. Among the potential customers, pioneers should be found who, according to their profiles, would be the most likely first participants on the platform. Those who share the common values of sustainable agriculture, the circular economy, the green economy, digitalisation, innovation, as well as local production, processing and cooperation should be selected.

iii) LESSON 3 – LEGAL FRAMEWORK

The exchange of new ideas for business or products on the platform must be based on a clear “share and protect” policy. It must be ensured that companies benefit from a fair and open exchange and that their unique ideas remain so. The Bavarian regional advisory board was almost unanimous in its opinion that establishing a platform for residual materials requires staying power, a good network and the right supporters. In order to support the transformation to bioeconomic production as a society and region, the board has recommended public support for the setting up and further developing of the platform. This should occur without any entity claiming profit or commission (at least initially, as in the case of government-operated platforms), to build up as large a network as possible and to ensure a critical mass of suppliers and customers is reached. Only in a second or third step could a full-service feature of the platform with logistics and invoice processing be offered as a “premium” variant. It would be advisable to start with a pilot phase in just one region.

iii) LESSON 4 – IMPLEMENTING THE DIGITAL SERVICE PLATFORM BUSINESS MODEL, POLICY AND TRANSFER GUIDELINES

The AlpBioEco team do not recommend setting up a new digital platform independently as a business idea for your own company. Instead, they recommend supporting the existing project mentioned and contributing to network building.

RECOMMENDATIONS FOR STAKEHOLDER REPRESENTATIVES

These guidelines are addressed to political decision-makers, representatives of interest groups (chambers) and clusters. It provides assistance and serves as a basis for strategic decisions, especially in the field of bioeconomy, which will play an increasingly important role in regional regulatory frameworks in future.

For the business model to attract companies, conditions must also be created by policy-makers to enable projects to be designed, implemented and assessed.

Various factors can influence whether a particular business model succeeds:

KEY POLITICAL FACTORS

- European Union regulations, such as the Green Deal and the Farm to Fork initiative.³³
- Commitment to regionalism: policy-makers must promote regions, regional products and sustainability aspects even more strongly than before through political measures and funding guidelines.

KEY ECONOMIC FACTORS

- Conflicting goals between economy and ecology, caused by scarcity of raw materials on the one hand, and competition for raw materials, price stability and security of supply on the other, require new economic approaches.
- Budget and resources are initially on the side of the operating state entity (cluster, authority, university or similar).

KEY SOCIAL FACTORS

- Promote fair production conditions, wages and trade through good governance.

KEY ECONOMIC FACTORS

- Interdisciplinary cooperation between research institutions and with other disciplines, as well as cooperation with companies are important prerequisites.
- The platform model as an innovation driver for environmentally friendly technologies, providing opportunities to reduce CO₂ emissions.
- Digitalisation has a strong influence on society, politics and the economy and also drives future innovation. Digitalisation enables new business models to emerge and opens up additional opportunities for companies in the expansion of business areas.

³³https://ec.europa.eu/food/farm2fork_en (accessed 4 December 2020).

6. ALPBIOECO TRANSFER OF RESULTS

To make a project genuinely sustainable, it is essential to ensure that significant and hard-earned results are still available after the end of the project, so that know-how and experience can be built on and developed further. To this end, the AlpBioEco team need to address three levels of scale (figure 18). First the project regions themselves must ensure that the developed business model is still supported or that ideas are put into practice in order to promote bioeconomy in their interests and to modernise regional food economies (figure 18, scale 1). However, the business models should not only be introduced in one location but should also be brought to other regions with the same or similar strengths in order to find interested companies there, which could also benefit from the idea (figure 18, scale 2). The third level refers not only to disseminating the business model beyond the project regions, but also to all results of the project, including the general transfer of knowledge between project partners, networks and different European Union projects (figure 18, scale 3).

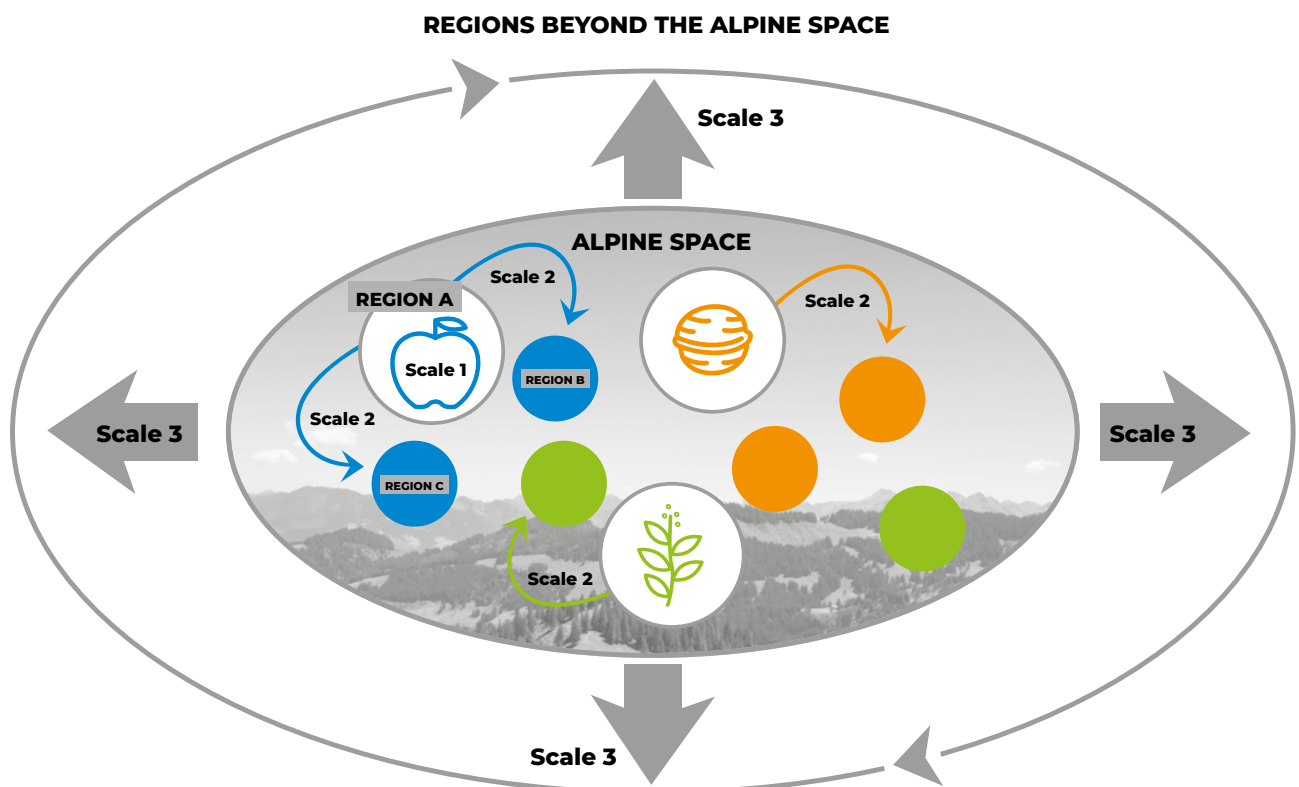


Figure 18: The three different levels of scale for knowledge transformation that AlpBioEco needs to consider – scale 1: within the project regions; scale 2: into other Alpine regions; scale 3: general knowledge transfer

The ideas and innovations developed in the regions have been advanced to different degrees. Some business models already have finished products that are available on the market, while others are still being tested and researched and require approval, patenting or product development. Figure 19 shows the different stages of development of the business models. While it is already possible to buy Alpine hay seeds in the local markets of some regions, disposable tableware and biodegradable packaging still need further research, cooperation and implementation partners before the business model is fully developed and ready for the market. To ensure further implementation, development or research activities, information about the business models should be presented and public interest maintained. For this purpose, the information needs to continue to be available, implementers must be found, or support for current implementers should continue. The project partners have made themselves responsible for this and will ensure, by means of an annual communication plan, that the project remains public and that new research, implementation and networking are intensified. Within this plan

every project partner notes which dissemination actions they will take and when. Examples of such actions will be, at the very least, social media postings, newsletter articles, visiting the business model and informing the stakeholders about the current status and development of the model, and publishing information and updates on progress for conferences, homepages and other forms of business and academic literature.

PROJECT PARTNER	BUSINESS MODEL	MORE RESEARCH IS NEEDED	FIND COOPERATION AND IMPLEMENTATION PARTNERS	PRODUCT DEVELOPMENT	MARKET LAUNCH	MARKET MATURITY
City of Sigmaringen	Walnut spreads		→			→
Innov' Alliance	Walnut flips / spreads			→		→
Biz-Up	Disposable tableware and biodegradable packaging	→				→
Regio im Walgau	Alpine hay seeds					✓
NOI AG	Disposable tableware and biodegradable packaging	→				→
KErn	Digital service platform		→			→ ✓
Envipark	Apple flour		→			→
Chamber of Commerce and Industry of Slovenia and BC Naklo	Herbal pacifier	→				→
ITKAM	Herbal pacifier		→			→
BUND	Walnut flips		→			→



However, to ensure the sustainable anchoring and dissemination of the business models in the region, partner institutions were found which are already in close contact with potential implementers of innovative ideas. On the one hand, these organisations can be chambers of commerce and agriculture and cluster organisations to which both farmers and companies turn if they want to restructure themselves and thus possibly take up the idea of a particular business model. On the other hand, there are also training institutions and universities that work a lot with young, innovative people. These training centres can include new business models as examples in their curricula (figure 20).

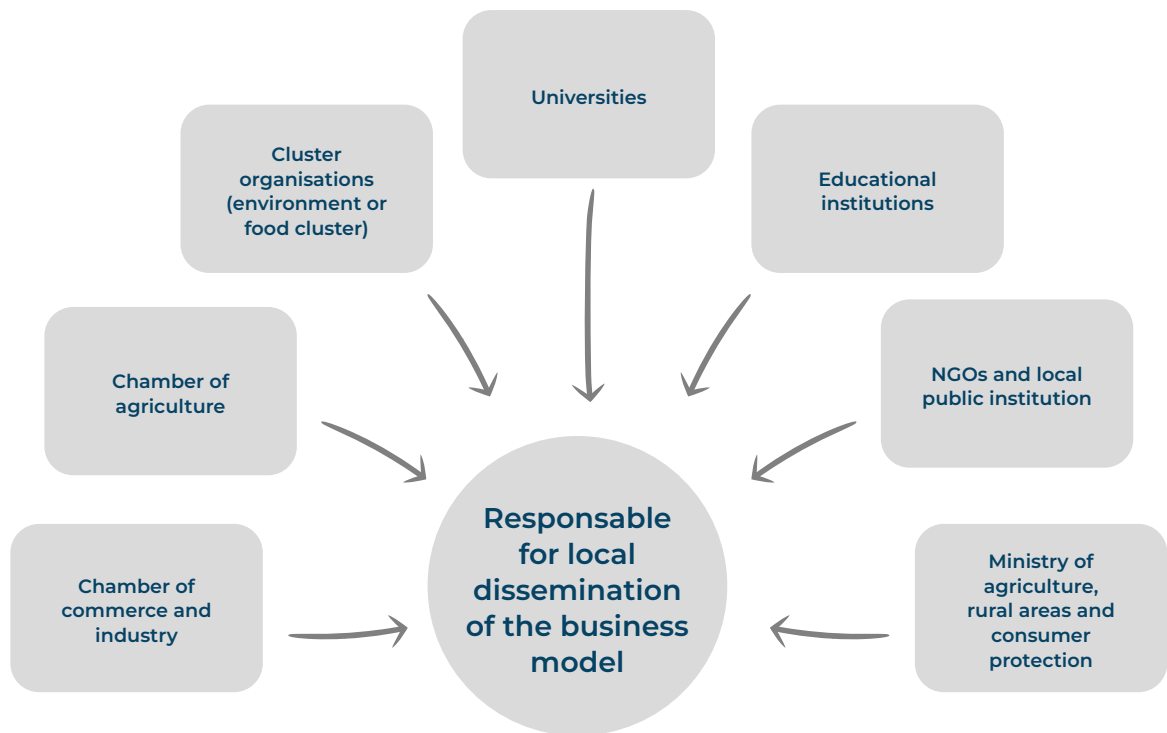


Figure 20: Regional organisations that keep the data of the business model and pass it on to interested parties



DISSEMINATION OF THE BUSINESS MODEL IN OTHER REGIONS AND KNOWLEDGE TRANSFER

Seven business models for ten regions were developed in AlpBioEco. However, these business models need not only be implemented in the regions developed for them or in other Alpine areas, but should also be used wherever similarly promising conditions exist for putting them into practice, especially where especially innovators adopt the idea of a particular business model, adapt it for a region and transform it into a market-ready product, which leads to added value in the region and generates additional jobs.

The AlpBioEco business models should serve as best practice examples beyond projects' original regions. To this end, the project results and findings have to be made known beyond the regions. The project homepage has become very well-known due to numerous social media posts and appearances during the project. In the past three years, a lot of information about the business models and the results of all work packages has been put out on this homepage. It is therefore important that the homepage continues to be available as a source of information. A translation of the content into the project languages will also ensure that the content of the homepage is easy to read and understand for the public.

Collaborations have emerged from the AlpBioEco project and the resulting value chains and business models. Similar business models or regions working on the same value chain have recognised the similarities of their regions and have started joint activities based on this. For example, based on the results of the AlpBioEco project, Business Upper Austria and Management Center Innsbruck, the Entrepreneurial School® from Austria have decided to continue working on the development of biodegradable packaging made from apple pomace. Research into this in Austria is still quite scant and should be pursued in a further project with partners from science and preferably also from relevant industry sectors. The strong cooperation between the city of Sigmaringen (lead partner and overall coordinator of the project) and BUND Ravensburg-Oberschwaben (Friends of the Earth Germany, Regional Association Lake of Constance-Upper Swabia) already during the project will continue and joint excursions and further networking in the area of nut cultivation are planned.

An effective way of making project results available in a sustainable manner and for the general public is to upload them to a platform that is accessible for users throughout Europe. Some project partners have already gained expertise in these networks and therefore urgently recommend that the experiences and results from the AlpBioEco project be saved on the platforms and thus made public to the many interested people.

Numerous Alpine-area or EU-wide platforms offer different levels of publishing results, networking interested people or forwarding information. These platforms are used to a large extent to ensure the project results are available for organisations and that future projects can be rolled out sustainably. They increase the radius of action and the level of awareness, and the results remain available even after projects are completed. The table below shows the selected platforms at the AlpBioEco transnational meeting where the AlpBioEco team were tasked with publishing project results.

The European Bioeconomy Network (EuBioNet) and the Alpine Space Project Library are platforms for EU-funded projects that deal with promoting, communicating and supporting bioeconomy. The main goal is to maximise efforts to improve knowledge sharing, networking, mutual learning and the coordination of joint activities and events. AlpBioEco is already a registered organisation and there is a lively exchange and networking between the projects and project partners.

Some platforms also enable networking among interested parties. For a defined period, EEN enables B2B matches and implementers of, for instance, walnut spreads in different regions of Europe to exchange and network their ideas, problems, solutions and best practice.



DISSEMINATION AND KNOWLEDGE TRANSFER IN OTHER REGIONS

Platform	Advantages	Disadvantages
ALPINE REGION		
Project homepage	<ul style="list-style-type: none"> • Well-known • All project results available • Different languages 	<ul style="list-style-type: none"> • Time limited till 2024 • No activities after project end
European Bioeconomy Network (EuBioNet)	<ul style="list-style-type: none"> • For networking • For knowledge transfer • Possibility to publish events 	<ul style="list-style-type: none"> • No upload possible • No specific information about the project • Only a homepage link
Alpine Space project library	<ul style="list-style-type: none"> • Possible to upload documents • Well-known • Large sphere of influence 	<ul style="list-style-type: none"> • Division into three categories: strategy, network, tools
INTERNATIONAL KNOWLEDGE DISSEMINATION		
EEN for a defined period of time (B2B match)	<ul style="list-style-type: none"> • B2B matches possible 	<ul style="list-style-type: none"> • Chargeable • Time limited
Networking platform Agri Food Scout	<ul style="list-style-type: none"> • Possible to upload documents (RIG of the different regions, Best Practice Brochure, TNG) • Very flexible • Divided into different areas • Specialising in agriculture and food • Includes a digital marketplace • Networking platform 	<ul style="list-style-type: none"> • Homepage is only in German • Relatively new homepage – not very well-known yet
EIT-Food - Europe's leading food innovation initiative	<ul style="list-style-type: none"> • Possible to upload documents (business models) • Support available for persons responsible for implementing the business model 	<ul style="list-style-type: none"> • Not well known – especially by farmers and very small companies

7. CONCLUSION

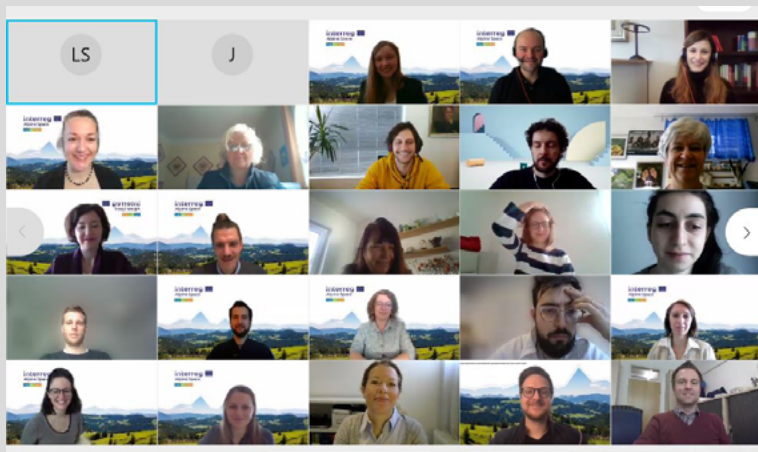
The AlpBioEco research project addressed the bioeconomy potentials in six Alpine regions of the European Union. The project aimed at unlocking the potentials of bioeconomy along the value chains of vegetable extracts and foods by strengthening regional value chains, contributing to the high-quality use of residual materials. By picking the value chains of apples, walnuts, and herbs, AlpBioEco focused on important regional value chains of the respective Alpine regions. Using innovative methods, AlpBioEco contributed to sustainable development in the Alps, raised awareness regarding economic potential in the bioeconomy, and actively supported interdisciplinary and supra-regional cooperation for the development of innovative business concepts.

Among other aims, one of the main project goals was to develop eco-innovative business model blueprints to unlock new competitive advantages by developing new products and services for small and medium-sized enterprises in the Alpine food value chains of apples, walnuts, and herbs. The AlpBioEco consortium analysed bioeconomic value chains in the Alpine space (work package T1), ideated and developed seven eco-innovative business models for the value chains of apples, walnuts, and herbs (work package T2), validated and tested them in pilot projects and business practices with local businesses (work package T3), and lastly developed economic and political guidelines for the transregional adaptability and transmissibility of results (work package T4).



Final public conference

The AlpBioEco final conference took place on 11 February 2021. Partners, stakeholders and others interested in supporting and promoting eco-innovation had the opportunity to learn about the activities and results of AlpBioEco and to discuss with the project partners current challenges, best practices and lessons learned. You can find out more on the [AlpBioEco website](https://www.alpine-space.eu/alpbioeco)!



ECONOMIC POTENTIAL OF THE ALPINE BIOECONOMY IN THE VALUE CHAINS OF APPLES, WALNUTS, AND HERBS

The research results obtained by the project consortium in the individual work packages clearly show the enormous potential of existing and future value chains in the Alpine bioeconomy for increasing sustainability and green growth.

The comprehensive analyses of apples indicated extremely useful bioeconomic potentials. The outcome of AlpBioEco's research was that the ideal target material for an innovation process is apple pomace, due to its availability in large quantities as a waste product in the juice industry. The technical potential depends on the already available possibilities for re-using and upcycling of apple pomace and also on particular untapped potentials. However, all performed experiments in the laboratory show that high efficiency can only be reached by using the entire by-product. Preceding processes like apple wax extraction can decrease efficiency through further costs and longer processing times. By coupling the identified strengths of the apple value chain with subsidies and extending the corresponding opportunities, weaknesses could turn into opportunities. Research and the relevant expertise in cultivation, processing, and marketing will serve as a basis for exploiting and implementing opportunities and for countering threats and risks throughout the value-added chain.

For walnuts, the laboratory and market evaluations reveal excellent potential in the bioeconomic context. Results point to a wide range of possibilities and ideas relating to all parts of the walnut. The beneficial characteristics of the nut can be used in the food, cosmetics, textiles, and paper industries, as well as in various other areas. Many applications of walnut kernels (oil, press cake), green nuts, and walnut leaves were pilot-tested in the kitchen lab. All end products containing these components preserved the typical taste of walnuts. Therefore, it is advisable to combine the walnut press cake with other starchy products in order to minimise the taste (mostly bitter, astringent, tart, and of course nutty) and to take advantage of the sticky properties of conventional flour. After adapting food recipes, they can be scaled up for industrial processing. However, the processing of walnuts comes with several difficulties. The tasting and sensory evaluations of food products indicated the need for further tests to improve marketability, durability, storage capability, scalability, and processability.

Herbs such as Alpine hay play an important role in the Alpine region. The analyses show that there is great potential in using these plants in various ways throughout many sectors. The market for herbs represents a niche in the agricultural sector, with small companies that can draw on strong traditions but which are lacking in innovation, and with many unexplored potentialities. The results reveal that herbs producers may benefit from cooperation structures that support market expansion on a supra-regional level by strengthening communication and knowledge exchange. There are some possible applications of herb residues, and of particular interest in this context is the use of residues as biomass in biogas plants as well as in the textile industries. By using the by-products in different markets, such as in the cosmetics or nutraceutical sectors, where raw material prices are higher, herbs producers could identify potential economic advantages and explore new profitable business opportunities.



WPT1 report and roadmap

Within AlpBioEco's first work package ("T1 – Value chain analysis") and in coordination with AlpBioEco's German project partner KERN, [the first AlpBioEcoreport was published](#). This report gives an initial overview of the three value chains of apples, walnuts and herbs/hay and builds a foundation for further work packages. A replicable roadmap for analysing bio-based value chains was also developed based on lessons learned in the project. The standardised guide for evaluating value chains with regard to their bioeconomic aspects and to the potentials in regions like the Alpine area was transformed into a [practical guide for analysing bio-based value chains according to their bioeconomic potential](#) in June 2020.



ECO-INNOVATIVE BUSINESS MODELS

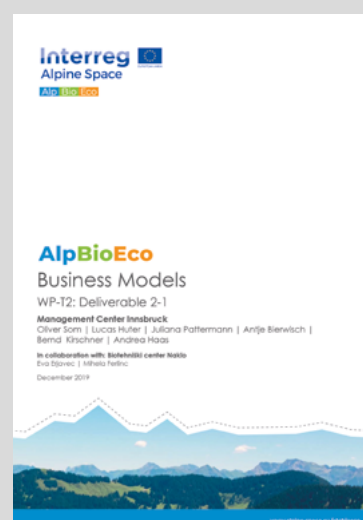
To exploit the economic potentials identified here, AlpBioEco has developed eco-innovative business model blueprints for new products, processes, and services in the value chains of apples, walnuts, and herbs to leverage future sustainable growth for Alpine farmers and companies. This was achieved through two series of Open Innovation workshops. They were conducted across five Alpine regions, including more than 180 stakeholders such as farmers, companies, biotechnological and bioeconomic experts, users, policy-makers, and intermediary organisations. During these workshops, more than 400 ideas for new products and services were developed. A selection of the most promising ideas was gradually transformed into six business model blueprints – two for each of the three value chains focused on by AlpBioEco – as well as one overarching business model idea.



On 15 May 2019, AlpBioEco's project partner from Austria and leader of the project's work package T2, Management Center Innsbruck, the Entrepreneurial School® from Austria (MCI), launched the first apple value chain workshop in Innsbruck, Austria.

WPT2 reports

Within the second AlpBioEco work package ("T2 – Business innovation modelling"), the AlpBioEco project partner Management Center Innsbruck, the Entrepreneurial School® from Austria (MCI), the lead partner for this phase of the project, published [four reports](#). The first report introduces the seven business models selected by AlpBioEco, the second report "Good and bad practices" presents a wide variety of business models with innovative components. Twelve business models are analysed and discussed in detail. The third report "Success factors" illustrates findings regarding the success factors identified and competencies required for putting into practice eco-innovatory business models in the Alpine region. The final report "Missing linkages" identifies and defines gaps in the Alpine bioeconomy's innovation system that could hamper the emergence and diffusion of eco-innovative business models in the value chains of apples, walnuts, and herbs.



ECO-INNOVATIVE BUSINESS MODEL BLUEPRINTS

TITLE OF BUSINESS MODEL BLUEPRINT	VALUE CHAIN
Gluten-free apple flour	Apples
Disposable tableware and biodegradable packaging	Apples
Walnut spreads	Walnuts
Walnut flips	Walnuts
Revegetation with Alpine hay seeds	Herbs
Herbal pacifier	Herbs
Digital service platform	Apples / Walnuts / Herbs

These business models were subsequently validated, modified, and pilot-tested in business practice during a series of 17 regional focus group workshops with potential consumers, producers, bioeconomy experts, intermediaries, and policy decision-makers in nine Alpine regions. Additionally, the AlpBioEco researchers and experts visited 16 companies in six different regions to explore possibilities and opportunities for implementation and to test the business models on site. Connecting various stakeholders to develop, discuss, and pilot-test these eco-innovative business models revealed both a high potential of and a demand for regional and sustainable bio-based (niche) products as well as various crucial success factors for the implementation.

Generally, the potential of the Alpine bioeconomy unfolds in two different perspectives. The first one is a short- to medium-term perspective and deals with the use of already existing products and manufacturing processes in terms of more efficient use of resources, raw materials, side- and waste-products as well as the lowering of negative environmental side effects. The products based on the business models of gluten-free apple flour, walnut spreads, walnut flips, and revegetation with Alpine hay seeds represent this perspective. Hence, one potential of the Alpine bioeconomy to foster sustainable and green growth lies in incremental improvements to the efficiency and sustainability of today's bioeconomic value chains. The second perspective of bioeconomic potentials in Alpine regions aims at a medium- to long-term perspective. This entails applying innovative technologies like 3D-printing, digital communication technologies, or innovative functional elements of apples, walnuts, and herbs to develop completely new and sustainable products, services, and processes. Business models built around products like disposable tableware and biodegradable packaging made from apple pomace, or a herbal pacifier that uses the natural healing properties of herbs, represent this perspective.

Similarly, the development of digital service and co-creation platforms marks an entirely new way of designing regional value chains. These solutions offer compelling strategic perspectives for today's farmers and food-supplying small and medium-sized companies in the Alpine regions to ascend the value chain(s) and to unlock new levels of economic and sustainable growth by becoming end producers of eco-innovative products and services.

Significant findings show that, depending on their degree of market maturity, eco-innovative business models still require considerable amounts of basic and applied research to achieve successful implementation in the market. Additionally, like the development of innovative products, processes, and services, putting in place eco-innovative business models is accompanied by risk and uncertainty. Small-scale firms and independent farmers in particular might feel discouraged to take on these risks and efforts. Consequently, such eco-innovative business models require novel linkages and newly created networks between stakeholders that have hardly interacted until now for the purpose of innovation. Furthermore, the interregional context showed marked differences in terms of natural resources, quantities of raw materials, financial possibilities, market differences, consumer behaviour, and policy regulations.



Best Practice Brochure

In the third work package (“T3 – Concept validation”), under the auspices of the AlpBioEco project partner, the Chamber of Commerce and Industry of Slovenia, the seven selected business model blueprints were validated and tested to check their feasibility. To achieve this, small-scale and intensive group interviews were conducted in focus group workshops to share ideas and know-how from a range of experts and stakeholders. The results of this practice-related work package are presented in a [Best Practice Brochure](#). This report includes methods for validating business models as well as highlighting existing best practices.



POLICY RECOMMENDATIONS

The results from AlpBioEco's work clearly show that existing efforts by the European Union to support the exploration and exploitation of Alpine bioeconomies' potential for sustainable growth should be maintained and further increased in future to meet the policy goals of the European Green Deal. While the potential of the European Alpine bioeconomy in the light of eco-innovative business models has undoubtedly been confirmed, the insights gained during the research project provide empirical evidence of the numerous barriers that stand in the way of effective and efficient development and implementation of eco-innovatory practices. These barriers as well as the possible fields of policy action were addressed and discussed in a series of six regional Lego® Serious Play® workshops with bioeconomy experts, companies, food engineers, intermediaries, and regional policy-makers.

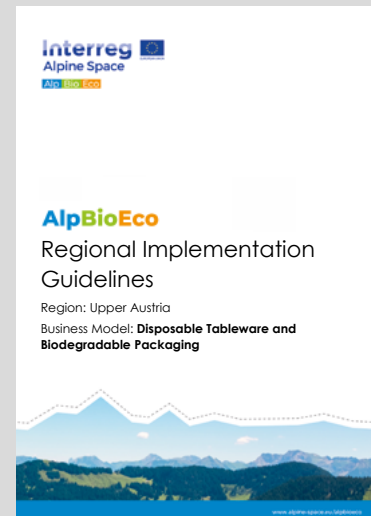
Despite the heterogeneity of the value chains and the geographical regions involved, however, three aspects emerged in the majority of business models and therefore seem to be universally applicable. The following section summarises and highlights the main barriers still extant and the policy recommendations derived from the workshops.





WPT4 reports

In the concluding AlpBioEco work package (“T4 – Policy transfer preparation”), AlpBioEco’s project partner Business Upper Austria was responsible for this phase of the project and coordinated [the establishment of regional advisory boards](#) dedicated to developing policy guidelines for each project partner region. Alongside the regional policy guidelines, Business Upper Austria has produced for AlpBioEco the transregional and transnational transfer guideline, which suggests how Alpine regions can support implementation of innovative business models in other regions, countries or projects.



AVAILABILITY OF RAW MATERIALS

Securing the availability of raw materials in the right quality and quantity is key to almost all the developed eco-innovative business models. Apples, walnuts, and herbs as well as their by-products (e.g. apple pomace, walnut press cakes, herbal extracts) are seasonal products with varying quality and quantity depending on nature. Additionally, the volumes cultivated in the Alpine regions, for instance in the case of walnuts and herbs, are still limited today. However, the development and manufacturing of products for the food, cosmetics, and healthcare sectors require a constant supply of raw materials that meet certain standards in terms of chemical characteristics, purity, taste, and texture. As many product ideas were based on the use of by- or waste-products, the remaining volumes of such ingredients represent just a fraction of the original raw material. Hence, the availability of raw materials with consistent qualities and characteristics often limits the scalability of the developed business models.

Policy support could thus, for example, focus on increasing the availability (e.g. expanding the areas of cultivation) of those raw materials like fruits and plants that offer promising potential for realistic and sustainable bioeconomy products, like walnuts or Alpine herbs. Another approach could be to offer incentives for developing new manufacturing technologies and processes, thereby allowing for more efficient use of existing raw materials in and across the European Alpine regions. This also includes setting up improved logistic processes and/or cross-regional collaborations between farmers and producers, because many raw materials are not equally distributed across Alpine regions. In many cases, regional farmers can only provide a fraction of the quantity of raw material needed. Hence, logistic processes need to be put in place to gather raw materials from various regions, taking into consideration not only time and cost factors but also ecological aspects like the carbon footprint produced by transportation and storage.

MISSING LINKAGES IN THE INNOVATION SYSTEM OF THE ALPINE BIOECONOMY

Many of the developed and pilot-tested eco-innovative business models require novel collaborative approaches of value creation between farmers, producers, customers, and end users to achieve the necessary economies of scale and scope. Hence, the key to success is to establish multidisciplinary networks across national and regional borders in order to find partners with the necessary competencies, that are willing to cooperate and at the same time fulfil the criteria of sustainability. Small and medium-sized companies and farmers especially face difficulties in identifying partners and building network relations with partners and stakeholders outside their regional domains due to limited resources and a lack of access to information.



The project results revealed several missing connections between the various stakeholders and actors in the Alpine bioeconomy innovation system. Firstly, when it comes to developing new eco-innovative products, processes, and services, farmers need links to research partners, such as universities and research organisations, so as to access the latest technological knowledge. While knowledge transfer between manufacturing companies and research organisations and universities has been a focus of innovation policy support for decades in most countries, farmers and research organisations usually do not collaborate with each other regularly. Secondly, farmers who serve as suppliers of raw materials for food producers frequently do not have established channels to end users of food products or bioeconomic solutions. Consequently, many farmers report a lack of knowledge about market trends and users' "pain points". Thirdly, when it comes to actually putting into practice eco-innovative business models and physically manufacturing eco-innovative products, farmers often lack information about potential collaboration partners from relevant industries in the bioeconomy. For instance, the lack of expertise, complex logistics, unfamiliar types of walnuts, and the vulnerability of the nut are significant obstacles to creating an effective strategy to take advantage of promising opportunities. A proper strategy, long-term relationships between farmers and producers through associations, and the development of well-defined value chains could overcome these problems. Finally, farmers in the Alpine space are often unaware of innovation-oriented funding programmes in the bioeconomy. Besides, even if they are aware, entry barriers to such funding schemes are often too strict, for instance by requiring that a certain amount of existing investment goes into research and development.

Based on these identified missing linkages, the following recommendations for innovation policy can be derived in order to address these gaps and to support a more effective functioning of the Alpine bioeconomy innovation system:

- Lowering of entry barriers for farmers to participate in research and development funding schemes that encourage innovatory collaborations between farmers and (especially regional) universities, laboratories, and research and development organisations.
- Supporting the development of tailor-made vocational training/qualification for farmers in the fields of basic business administration, market strategy, business model design, and marketing to enhance their ability to think and plan from the perspective of the market.
- Establishing closer links to other value-creating manufacturers and processing firms (e.g. oil mills, distilleries, producers of cosmetics) in terms of identifying and making use of synergies and exploiting available capacities more effectively.
- Adapting existing innovation funding schemes to farmers' needs, raising their awareness of such funding schemes, and supporting farmers during the application process.
- Connecting suppliers, producers, consumers, non-profit organisations, research and development partners, and universities as well as other relevant stakeholders (e.g. public authorities, intermediaries) through a digital service platform to improve information flows, enhance knowledge transfers, and act as a bridge between supply and demand.

LOWERING LEGAL BARRIERS

In order to get access to markets, many of the developed and pilot-tested business models require market approvals and certifications. Especially for small businesses and start-ups, such legal barriers can demotivate and impede the launch of technologically ready (niche) products. Hence, lowering legal barriers would allow small and medium-sized companies and start-ups easier access to markets and therefore pave the way for more bottom-up innovation in the bioeconomy sector in future. Whereas some recent amendments of legal regulations (such as EU Directive 2018/852 on packaging and packaging waste) already provide incentives for innovation in the bioeconomy, other national and supranational legal regulations (for instance, EU Directive 2008/98/EC on waste, the German and Austrian Waste Management Act, or registration requirements for the International Cosmetic Ingredient Nomenclature Committee) still constrain such innovation attempts.



CLOSING REMARKS

Overall, the AlpBioEco project improved the conditions for sustainable innovation, resulting in eco-innovative business ideas and concepts for small and medium-sized companies in Europe's Alpine regions. It increased the capabilities of small and medium-sized companies to develop bio-based products and to establish new connections and networks with relevant stakeholders. It furthermore intensified transnational cooperation for eco-innovations in the bio-based economy and thereby decreased the disparity of economies across the Alpine territory. In sum, AlpBioEco contributed to more cohesion and a more effective integration of territorial development since rural regions became better connected by means of new bio-based value chains. This lays the groundwork for the future creation of high-quality and sustainable jobs in the European bioeconomy. The output of the AlpBioEco project is relevant for local and regional public authorities, sectoral agencies, interest groups including NGOs, higher education and research institutions, start-ups, established enterprises and small and medium-sized companies, business support organisations, European Economic Interest Groupings, and European Groupings of Territorial Cooperation.



CONTACT PERSON

Anna Bäuerle

Project Coordinator "AlpBioEco"
City of Sigmaringen

Address: InnoCamp Sigmaringen
Marie-Curie-Str. 20 · D-72488 Sigmaringen

Tel: +49 75 71 / 9 27 92 72
Mobile: +49 174 / 3 47 03 38
Email: alpbioeco@sigmaringen.de



This report was produced as part of the AlpBioEco project, which is co-financed by the European Regional Development Fund through the Interreg Alpine Space programme.

DISCLAIMER

Neither the European Commission, nor any person acting on behalf of the Commission, nor the regions of the project partners are responsible for the way in which the following information is used. The opinions expressed in this publication are the sole responsibility of the authors and do not necessarily reflect those of the European Commission. Reproduction is authorised, provided that the source is acknowledged, unless otherwise specified. For the use/reproduction of third party documents specified as such, permission must be obtained from the copyright holder. © AlpBioEco, 2021

IMPRINT

Published by:
AlpBioEco project
InnoCamp Sigmaringen
Marie-Curie-Str. 20
D-72488 Sigmaringen
www.alpine-space.eu/projects/alpbioeco

Date: March 2021

Design: Rainer Görsch | visual communication

Photo Credits:

AlpBioEco plantable seed postcard and apple paste
© Barbara La Licata

Gluten-free pastries made with apple flour © BC Naklo

Mountain pictures © Marina Fischer

Biodegradable straws made of apple pomace © Miličić

Harvesting of the eternal flower during the business visit
in Krkavče, Slovenia @ DEMO studio

Apple flour bread © Barbara La Licata

Alpine hay © HELFE

Walnut flips © Ulfried Miller

Harvesting Alpine hay seed material for revegetation use
in Austria © Conrad Amber, www.conradamber.at

Walnut spreads © Ulfried Miller

AlpBioEco am InnoCamp Sigmaringen
© InnoCamp Sigmaringen

AlpBioEco kooperiert mit Andys Früchte
© Stadt Sigmaringen

Labor analyses © Feichtinger & Schwarzinger

Apple wax © MCI

Fresh red apple isolated on white. © irin-k

roter Apfel mit einer Hälfte einzeln © Nataly Studio

Apple flour tests © Lorenzo Picco

Apfelsaft auf Holztisch, Nahaufnahme © Drakonyashka

Apple flour © Barbara La Licata

Backery products © Barbara La Licata

AlpBioEco © Business Upper Austria

2018 Ecomondo Fair © Envipark

Vivian Böllersen © Vivian Böllersen

Old walnut tree on a white background © Zerbor

Satz köstlicher Walnüsse einzeln auf weißem Hintergrund
© Yeti studio

Pictures walnut press cake recipes © KERN

Timothy Hay © Von Anna Hoychuk

Saatgut_© Marina Fischer

Kollektion von frischen Kräutern einzeln auf weißem
Hintergrund © Elena Schweitzer

Processing of herbs © HELFE

Jana Bergant © DEMO Studio

Digitale Rohstoffbörse video © KERN

Gluten-free pastries tests at BC Naklo © BC Naklo

Pictures AlpBioEco WPT2 workshop in Innsbruck © MCI

Kollektion von frischen Kräutern einzeln © Elena Schweitzer

red apples isolated on the white background
© Iurii Kachkovskyi

Walnüsse mit Blättern einzeln auf Weiß © irin-k

For all other pictures © AlpBioEco



ABOUT US

You want to know more details about our project?



Please find more detailed documents on our homepage:
www.alpine-space.eu/alpbioeco



Interested in the latest news?
Subscribe to the newsletter on our website.

Follow us on:



AlpBioEco
#AlpBioEco



AlpBioEco



YouTube AlpBioEco

Please
contact us,
we will be
happy to
advise you!

CONTACT

Anna Bäuerle ||| Project coordination ||| EU Interreg Project AlpBioEco ||| alpbioeco@sigmaringen.de

PROJECT PARTNERS



PROJECT FUNDERS



EUROPEAN UNION

This project is co-financed by the European Regional Development Fund (ERDF) through the Interreg Alpine Space programme.
Support from the European Union:
1.820.666 €



Federal Ministry
of the Interior, Building
and Community

This project is funded by the "Federal Transnational Cooperation Programme" of the German Federal Ministry of the Interior, Building and Community