



NOVELBALTIC

Market driven authentic non-timber forest products from the Baltic Sea region

Project report

Research and development infrastructure and industry needs

Work Package 2

Activity 2.1

Output O2.1





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Annotation

A detailed survey of the infrastructural needs for research infrastructure of academia and SME to promote new non-timber forest products is carried out. A survey of R&D equipment available to NovelBaltic project partners has been conducted and availability of facilities in project partner laboratories (such as HPLC, GC in different laboratories as well as specialised equipment such as freeze dryers, CO₂ extractors, Raman and NIR spectrometers) has been evaluated to prepare the NovelBaltic service platform. The existing capacity of the R&D laboratories is satisfying needs of industries in the Baltic Sea Region. The laboratories of project partners are interested and ready to provide services to industry for quality characterisation and authenticity testing as well as for upscaling from R&D lab scale to pilot and industrial scale. Many laboratories are considering investments (e.g. pilot scale extraction, biomass characterisation) to enhance the non-timber forest products/natural products development opportunities. During this activity, in cooperation with other project partners, a questionnaire was elaborated and a survey was done with an aim to identify the needs in respect to research and development infrastructure in the Baltic Sea region countries and Norway at present and in future and to match the need of industry and emerging markets in SE Asia and China to support: a) creation of new products based on NTFP; b) support development of authenticity and quality control methods; c) develop standardization methods of NTFP; d) training at universities and research on NTFP. The survey includes needs of enterprises and R&D capacity analysis of project partner organisations. Results of the survey reveal current high capacity of academic institutions and interests of industry, but at the same time identify the bottlenecks and support identification of solutions to solve problems. Results of the survey thus help to develop research and development infrastructure platform and strengthen the cooperation between industry and academia supporting further integration of research institutions in solving of applied problems. The services can be adjusted to match the needs of market demand in Asia and to support the development of novel non-timber forest products including the development of novel test methods. The survey results are used to develop the NovelBaltic R&D platform and the platform will help for the development of novel authenticity and quality testing methods based on the need of industry partners.



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1. Non-timber forest products (NTFP) for development of bioeconomy

Europe is setting course for a resource-efficient and sustainable economy. The goal is an innovative and low-emissions economy, reconciling demands for sustainable agriculture and fisheries, food security, and the sustainable use of renewable biological resources for industrial purposes, while ensuring biodiversity and environmental protection¹. From perspective of development of bioeconomy it is important to consider all kinds of bioresources and thus largely neglected are non-timber forest products. Non-timber forest products include berries, mushrooms, herbs and special non wood forest products like bark, sap and resin or lichen. Use of NTFP's belong to the bioeconomy sector and is actively supported accordingly to EU sustainable development strategies in the Nordic, Baltic countries and elsewhere. The development of NTFP production and applications are largely oriented towards production of health promoting food and bio-based pharmaceuticals, cosmetics it creates job opportunities in rural areas, since manufacturing or refining of these products is economically most efficient close to place of origin, forests and farmlands. Actualities to develop NTFP production and applications is reflected in the national bioeconomy development strategies of countries of the Baltic Sea Region. For example, according to the Finnish bioeconomy strategy, the value of bioeconomy should grow from 60 billion € to 100 billion € by 2025². According to the latest Finnish NTFP sector report (5/2017), there are more than 750 enterprises in Finland and the business value is over 300 million €. There are political initiatives to promote development of bioeconomy in the northern areas based on bioresources. The focus is on integrated biorefinery; one raw material to several products, and there is a need to develop 1) access to raw materials 2) technology and 3) processing.

Food sector and agriculture are the largest share of Lithuanian bioeconomy and needs for food security ensures the priority of the food sector³. In Latvia the strategic goals of the bioeconomy development are divided into three main groups: 1) advancement and retention of employment in the bioeconomy sectors for 128 000 people, 2) increasing the value added of bioeconomy products to at least EUR 3,8 billion in 2030, 3) increasing the value of bioeconomy production exports to at least EUR 9 billion in 2030⁴. Estonian bioeconomy covers almost all industry sectors, mostly based agriculture and forestry covering e.g. food, feed, chemical, biotechnology⁵. In the case of berries more

¹ <https://ec.europa.eu/research/bioeconomy/index.cfm?pg=policy>

² <https://www.bioeconomy.fi/facts-and-contacts/finnish-bioeconomy-strategy/>

³ [https://eimin.lrv.lt/uploads/eimin/documents/files/Inovacijos/bioekonomikos%20studija/Lithuanian%20Bioeconomy%20Study_EN\(1\).pdf](https://eimin.lrv.lt/uploads/eimin/documents/files/Inovacijos/bioekonomikos%20studija/Lithuanian%20Bioeconomy%20Study_EN(1).pdf)

⁴ https://www.zm.gov.lv/public/files/CMS_Static_Page_Doc/00/00/01/46/58/E2758-LatvianBioeconomyStrategy2030.pdf

⁵ http://www.bioeconomyforum.llu.lv/images/llar_Lemetti_4_Governance.pdf



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than 90% is left in the forests annually. Global cultivated blueberry export between 2001 and 2010 has grown from over 53 000 tons to 113 000 tons and the, value has grown from 119 million \$ to over 300 million \$⁶. Annually, millions of kg of wild berries from Baltic countries are exported as frozen berries to Asia and Central Europe for further refining⁷. Berries are often imported back to the Baltic countries as refined products. In Finland annual crop of berries varies between 500 – 1000 million kg, and typically only 15 million kg is utilized by the industry. In 2014 the bilberry crop was 5,9 million kg and the next year the crop had increased to 7,6 million kg⁸. The world market for bilberry extract is estimated to be 180 tons. The market value in form of pills and capsules is more than 700 million € annually⁹. The value of NTFP's like berries could be a lot higher if biomass was refined to higher value products, which would create jobs in rural areas.

Globally the Nordic/Baltic NTFPs are valued highly because they are often organic and wild and they are regarded as authentic, safe and the concentrations of valuable components are higher than in plants grown in e.g. southern parts of Europe. The high quality has also been linked to the climate and genetics, which are involved in the branding of NTFP from this region¹⁰.

An example of NTFPs of importance for national economies are the different bog and forest berries – blueberries, cranberries, bilberries and others (Figure 1, 2). The situation in two countries (Latvia and Finland) demonstrate the importance of the “berry business” and the increasing trends of berry production and export.

⁶ <https://www.tridge.com/intelligences/bilberry/production>

⁷ <https://www.npr.org/sections/thesalt/2015/09/16/440643854/asian-countries-have-nordic-berry-fever-and-finland-cant-keep-up?t=1572683089685>

⁸ <https://www.internationalblueberry.org/2017/09/29/an-overview-of-global-blueberry-production-in-2016/>

⁹ <https://www.tecnologiahorticola.com/blueberry-europe-market-change/>

¹⁰ Foster, Steven, and Mark Blumenthal. "The adulteration of commercially bilberry extracts." *HerbalGram* 96 (2012): 64-73.



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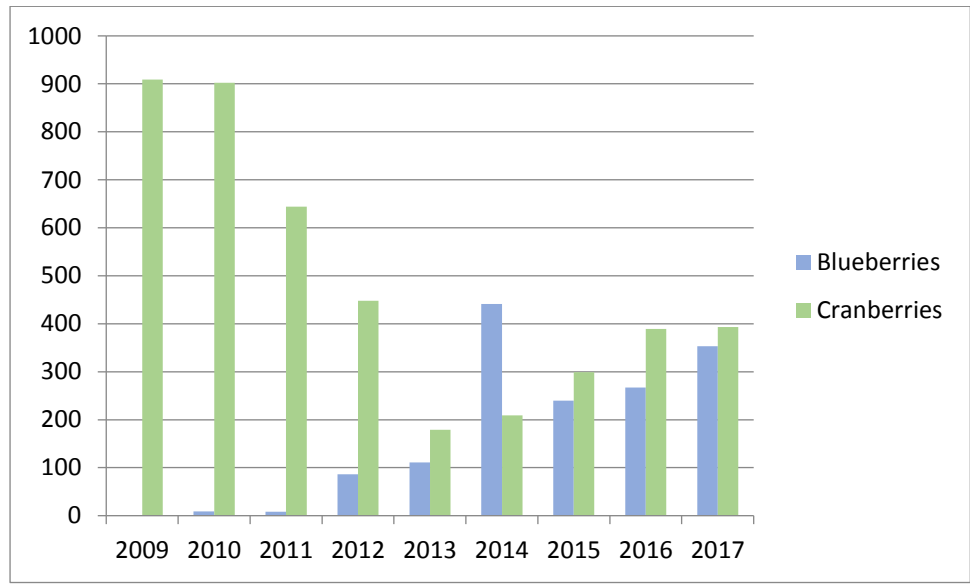


Figure 1. Production quantity of blueberries and cranberries (tonnes) in Latvia*

* According to FAOSTAT data

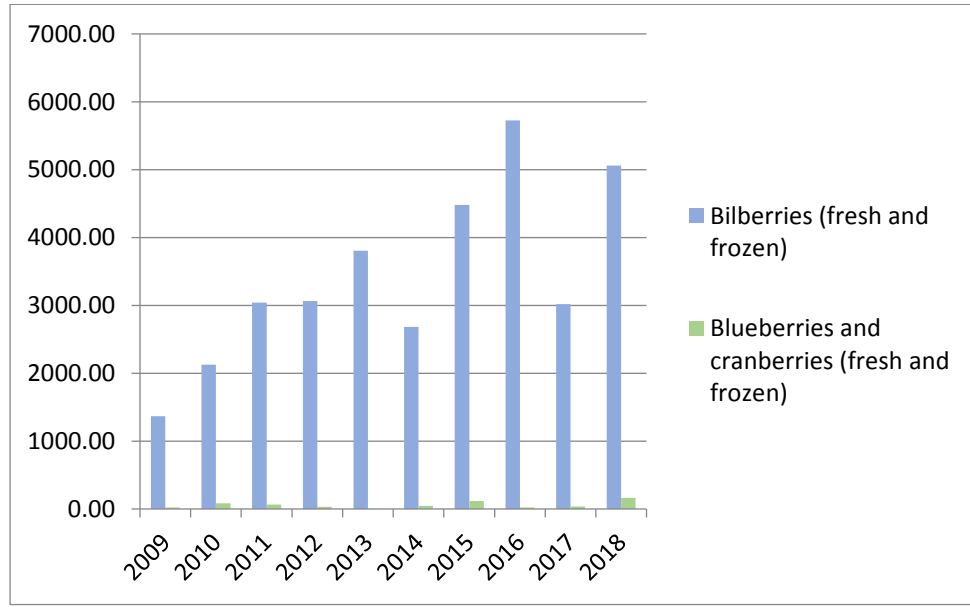


Figure 2. Export of blueberries (tonnes) and American cranberries from Latvia. Blueberries- *Vaccinium corymbosum* L., American cranberries- *Vaccinium macrocarpon* L.*



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* According to the data of the Ministry of Agriculture of the Republic of Latvia

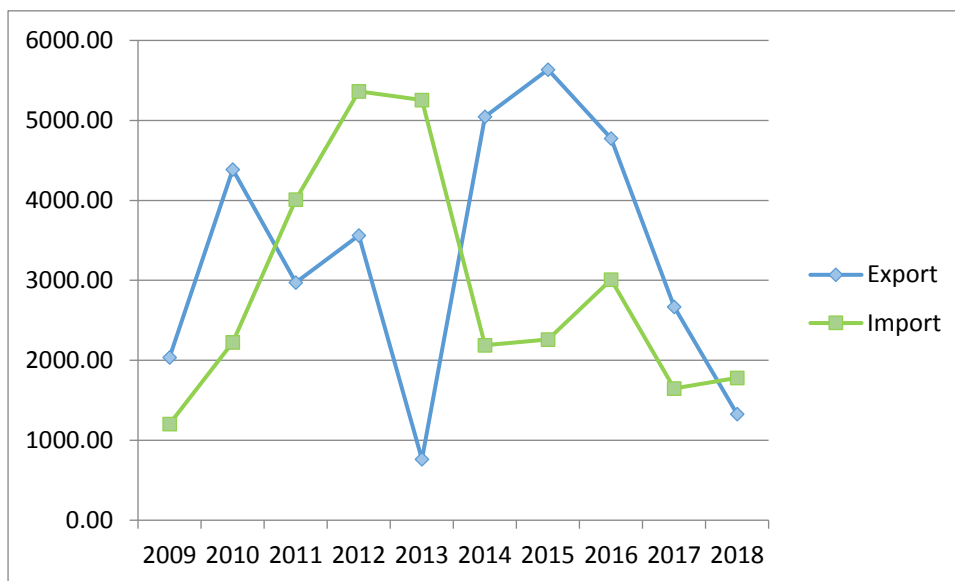


Figure 3. Export and import of bilberries, fresh and frozen (tonnes) in Finland*

* According to FAOSTAT data

Despite some fluctuations in berry production and export, the trend of their production/sampling is evidently increasing the Baltic Sea region countries. In Latvia the forest berries, bilberry and lingonberry are exported to Finland, China, Italy and imported from Belarus, Ukraine, however, these statistics are not gathered by government institutions, therefore the traceability of these products in Latvia is poor and very difficult in most cases.


Bog and forest berries are the most evident NTFPs of interest for further processing and development of new businesses. However, there are many other NTFPs, prospective for further processing and use. Just one example: *Sphagnum* mosses: probably the most abundant mosses in Northern Europe in wet ecosystems. Presently the *Sphagnum* mosses are relatively rarely used, however also their application could be wide, including medicine, food preservation, insulation materials and others¹¹.

¹¹ Klavina, Laura, Gunta Springe, Vizma Nikolajeva, Illia Martsinkevich, Ilva Nakurte, Diana Dzabijeva, and Iveta Steinberga. "Chemical composition analysis, antimicrobial activity and cytotoxicity screening of moss extracts (moss phytochemistry)." *Molecules* 20, no. 9 (2015): 17221-17243.



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Non-Timber Forest Products




<p>Lingonberry</p> <p><i>Vaccinium vitis-idaea</i></p> 	<p>Bilberry</p> <p><i>Vaccinium myrtillus</i></p> 	<p>Bog cranberry</p> <p><i>Vaccinium oxycoccos</i></p> 
<p>Chaga</p> <p><i>Inonotus obliquus</i></p> 	<p>Mushrooms</p> <p><i>Boletus edulis</i></p> 	<p>Moss</p> <p><i>Sphagnum species</i></p> 
CULTIVATED		
<p>American cranberry</p> <p><i>Vaccinium macrocarpon</i></p> 	<p>Blueberries</p> <p><i>Vaccinium corymbosum</i></p> 	

Figure 4. Non-timber forest products of potential interest for studies of properties, applications and development of new products



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2. Study on business needs related to NTFP processing in partner countries: science , testing, and R&D infrastructure



NTFPs provide a new kind of business potential and require new knowledge, development of new products, and their quality control. Thus, it is important to understand the needs of the enterprises interested in the development of products from NTFPs. So far, the needs of businesses interested in the NTFPs in the Baltic Sea Region have not been studied, and one of the aims of the project is to understand the needs of industry and to prepare suggestions on how to meet them in optimal way. The aim of the study is to identify the needs in respect to research and development infrastructure in partner countries, both at the present and in the future. The aim is to match the needs of industry and emerging markets in South East Asia and China and to support: a) the creation of new products based on NTFPs; b) the development of authenticity and quality control methods; c) the development of standardization methods for NTFPs. In addition, the aim is to support training at universities and also research on NTFPs. The priority target of the survey were the project partner countries, but potentially interested institutions in other countries have been considered. During the survey, special attention has been paid to the following aspects: a) availability of scale-up facilities and cooperation possibilities of their use; b) barriers and limitations in the research and development infrastructure. Another aim of the survey was to reveal the current capacity of academic institutions and industry, to identify bottlenecks and to support the identification of solutions in order to solve problems.

The analysis on the industry needs in new knowledge, in cooperation with academia, and needs in infrastructure of research was based on the results of the survey as well as the analysis of expert opinions. The survey included 30 questions which were related to the:

- 1) Profile of the enterprise (name, ownership of the enterprise, number of employees etc.),
- 2) Profile of production (main market of products, main profile of production, cultivated berries used in business, wild berries used in business, origin of berries used),
- 3) Profile of berry processing (interests and plans to expand berry cultivation, species interests and plans to expand berry gathering, interests and plans to expand berry processing),



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4) Knowledge needs profile (sources of existing experience in business, sources of information on NTFPs and their product markets, sources of information on plants used in the production - their nutrition value and other data, knowledge needed to advance in berry cultivation, knowledge needed to advance in berry processing, quality characterisation, and interest to develop express tests for berry quality- and authenticity characterisation, as well as their processing chain).

The interviews were done using an elaborated Internet tool as well as direct meetings with the enterprises. Altogether 39 answers depicting the situation in the project partner countries were obtained. Interpretation of the survey results the results of previous studies, contacts and discussions with industry representatives in the project partner countries, were considered.

2.1. NTFP processing - profile of businesses

The first level of analysis was related to the profile of the enterprises (name, ownership of enterprise, number of employees etc.) as well as the profile of production (main market of products, main profile of production, cultivated berries used in business, wild berries used in business, and origin of berries used). The aim of the analysis was to evaluate the existing size of the NTFP production in the Baltic Sea Region (BSR), as well as the potential of development. From the perspective of the evaluation related to the capacity of the NTFP industry, the most valuable resources were direct interviews as they provided the possibility to see the infrastructure of the enterprise, get an impression on the intents and motivation, and get an overall feeling on the prospects on the development of the enterprise.



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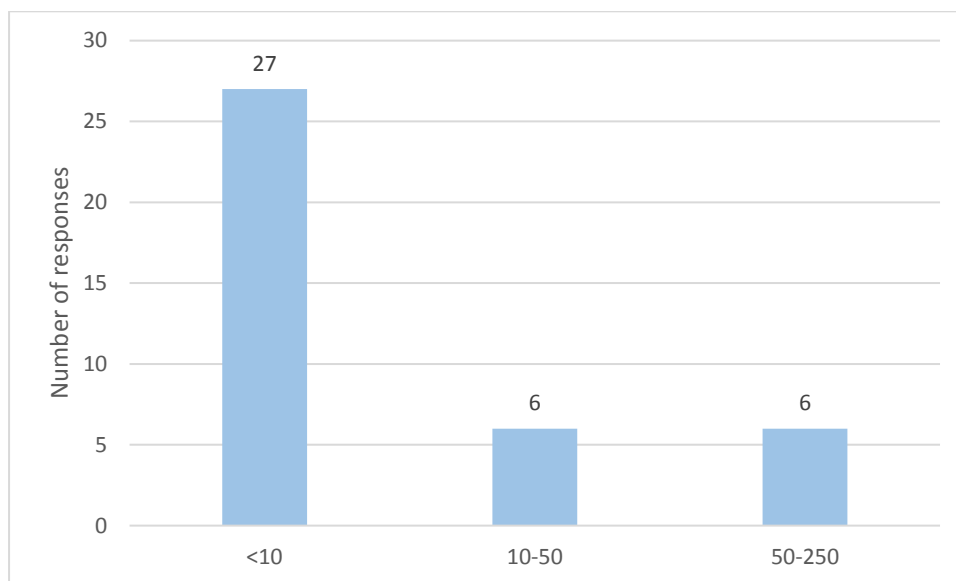


Figure 4. Size (number of the persons employed) of the enterprises involved in the NTFP processing in project partner countries

Most of the enterprises analysed during the survey were relatively small with a number of persons employed <10 (Figure. 4). The motivation to start the business were related to knowledge obtained during university education as well as considering traditions of the country, and the interviewed persons showed enthusiasm. Thus, it is evident that there are good prospects for the growth of NTFP industry. The “large players” can enter the business, but at the same time, considering the growth potential of the functioning enterprises. However, the survey did not cover large food processing enterprises, such as juice producers, and enterprises where jam and confectionary production are the profile. The processing of NTFPs such as forest berries is a part of side-stream of production. Traditional food processing businesses are working at significantly higher capacity in respect to their size.



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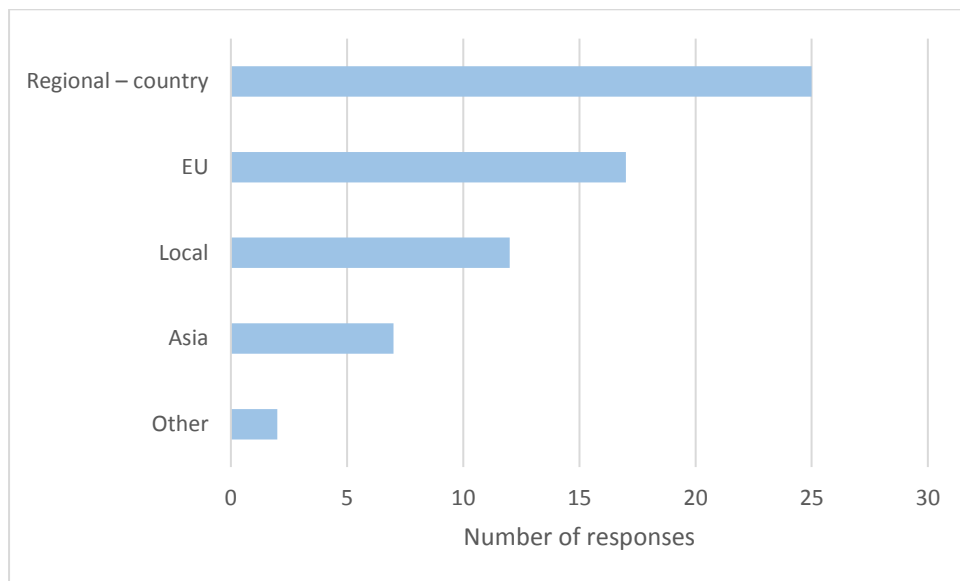


Figure 5. Main markets of the products of the enterprises involved in the processing of NTFPs in project partner countries

The direction of markets of the enterprises involved in the processing of NTFPs can partly be related to the size of the enterprises. The production is mostly covering domestic consumption as well as markets of neighboring countries. The businesses are mainly located in the bio-product (ecological, natural etc.) market niche. However, except for one businessman (from Norway, working on birch chaga), all the other enterprises contacted have expressed their interest to expand businesses especially in the Asian markets which were considered the most prospective ones.



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2.2 NTFP business profile in NovelBaltic partner countries

As discussed previously, NTFPs consist of a wide category of products. However, according to the results of the survey, industry mainly focuses on berry cultivation and processing. The other directions of activities include products, such as birch sap, birch and pine bark, bark of other forest trees, pine and spruce, juniper needles and berries. The results of the survey are indicative in respect of the need to study the properties, extraction possibilities and application potential for both food and biopharmaceuticals, as well as cosmetic products. The personal meetings with the enterprise representatives underlined the importance for the development of new applications from NTFPs and the market interests in such products.

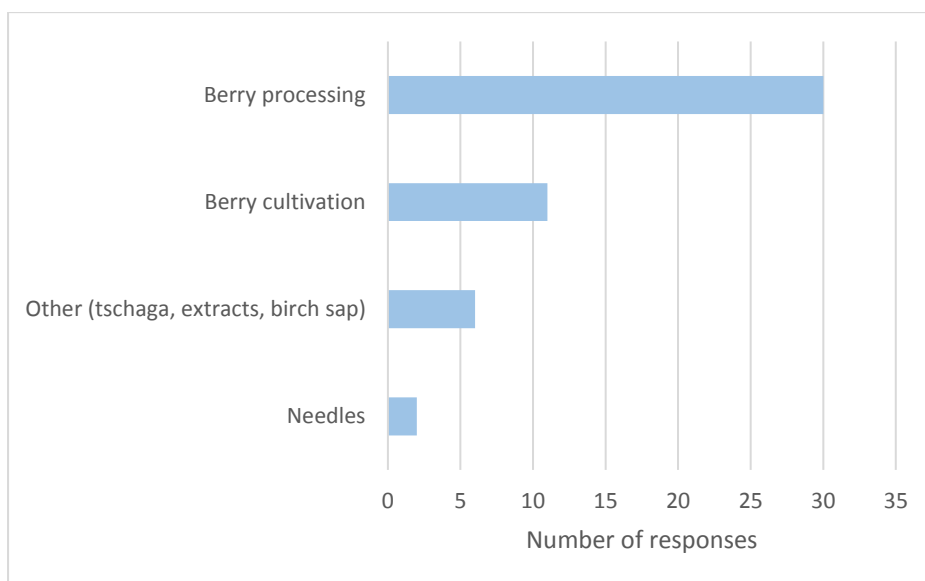


Figure 6. Production profiles of the enterprises involved in NTFP processing in project partner countries.



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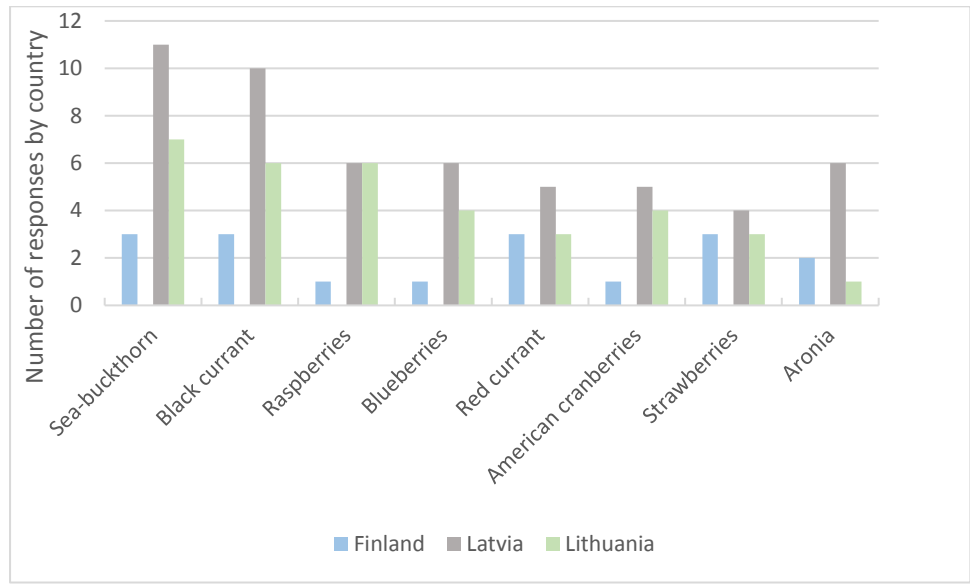
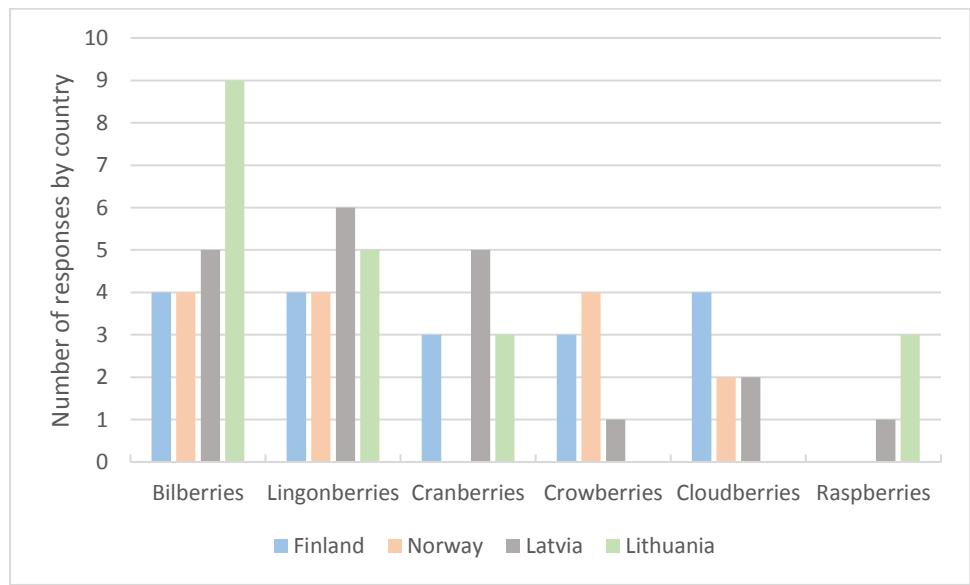


Figure 7. The number of enterprises interested in the processing of cultivated berries in project partner countries.

From the cultivated berries, of highest interest were sea-buckthorn, blackcurrant and raspberries, but from wild berries highly valued are bilberries, lingonberries and cranberries.





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Figure 8. The number of enterprises interested in processing of wild berries in project partner countries.

The cultivated and wild berries were collected either locally or imported from the neighbouring countries, including non-EU countries such as Belarus and Russia (in the case of Baltic States entrepreneurs).

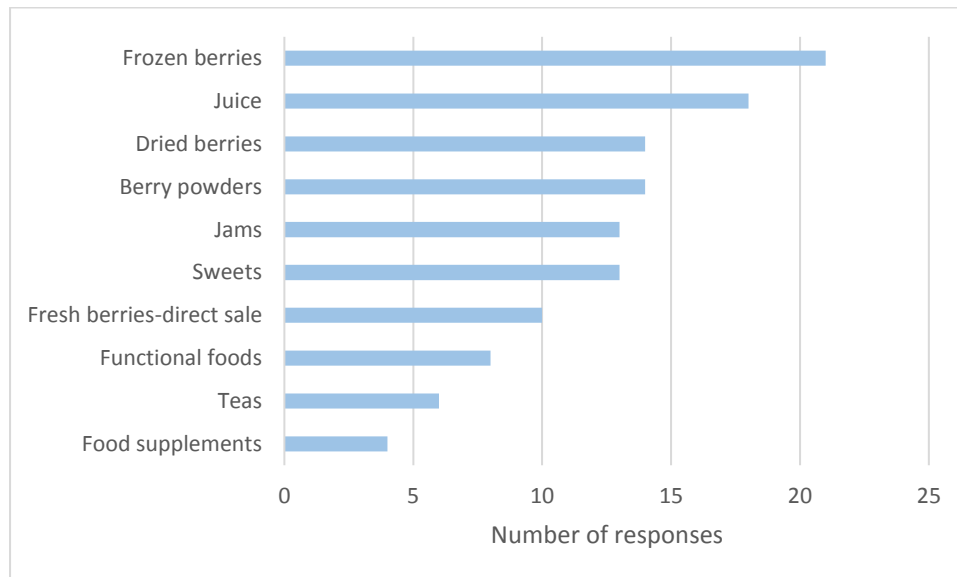


Figure 9. The end products for berries as reported by the interviewed enterprises in project partner countries. The results are based on the number of responses from the enterprises.

The most common ways of berry processing in the project partner countries are simple from the technology point of view. Berries are mainly used as fresh, frozen, or dried, and as berry powders, which require only storage or minimal processing. The use of berries for functional foods, food supplements require more processing and are of interest for a relatively small group of enterprises. Moreover, scientific research (molecular analyses, technical outcome, medical applications, etc.) is needed to provide new information on berry properties and their applicability on e.g. berry processing/products for regional and international markets.



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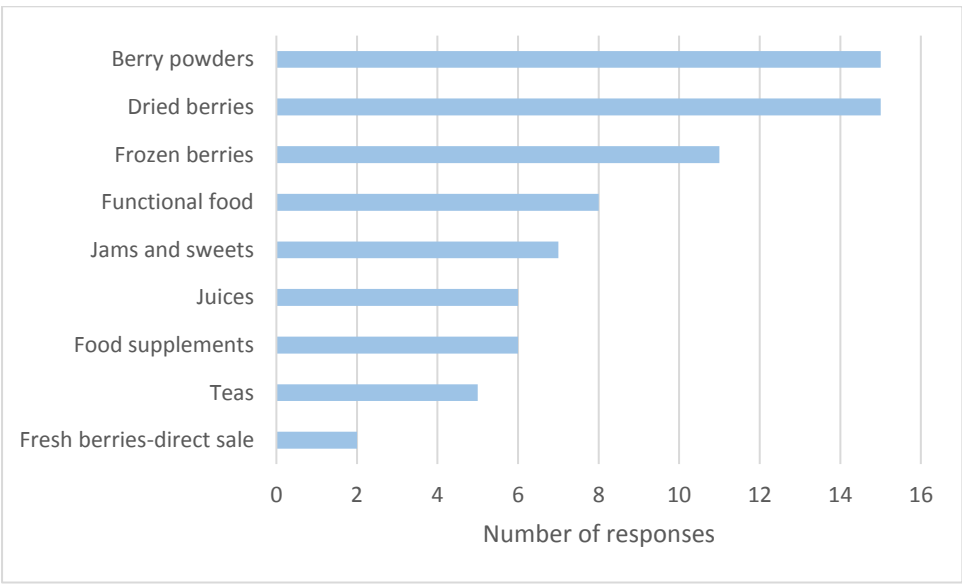
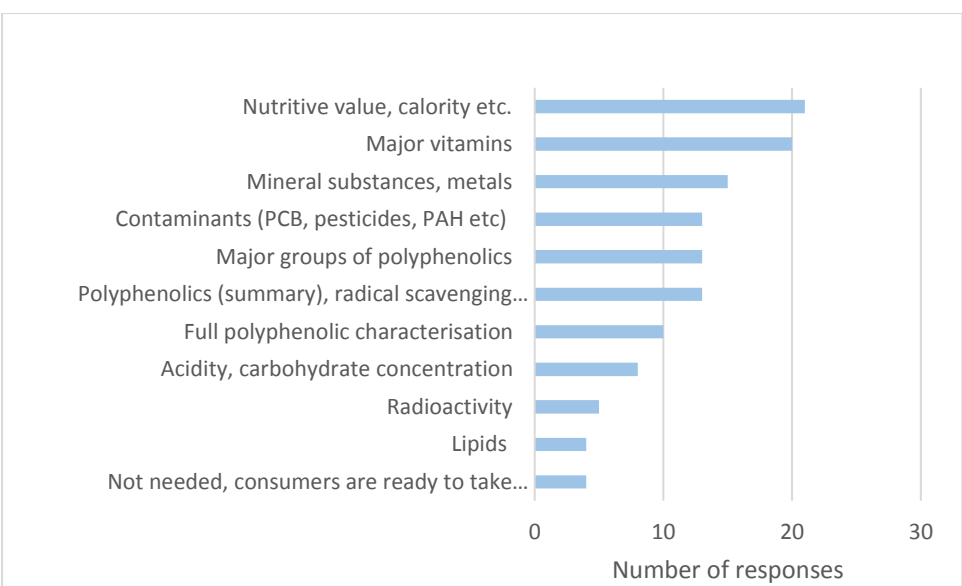


Figure 10. Interest of enterprises in the project partner countries to expand the way of berry processing and development of new products. The results are based on the number of responses from the enterprises.

The enterprises in the Baltic Sea region are interested in the development of new products as well as their application possibilities and have orientation towards technologically more complex production ways and more advanced berry processing products (Figure 10).





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Figure 11. Needs for analytical characterization of NTFPs. The results are based on the number of responses from the enterprises.

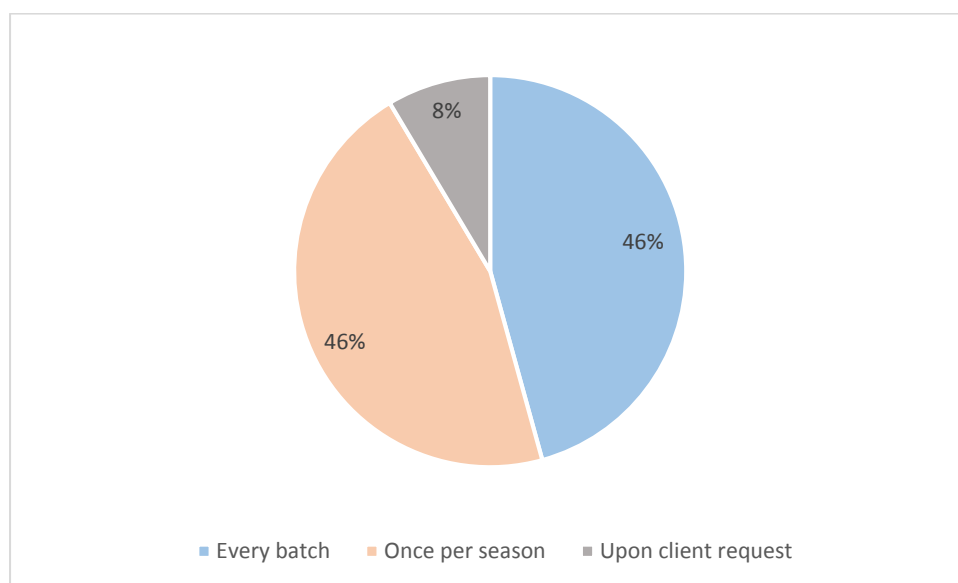


Figure 12. Needs for the regularity of analytical characterization (quality and authenticity) of NTFPs.

All the enterprises underlined the need for analytical characterization of NTFPs' quality and composition. During the interviews it was pointed out, that nearly all of the surveyed enterprises have met difficulties to obtain the needed information in full scale accordingly to their needs. The most needed analyses are the ones that provide information that is important to the consumer - concentrations of vitamins, nutritive value, and macro- and trace elements. Also, the presence of contaminants such as polychlorinated biphenyls, polyaromatic hydrocarbons, radioactivity, etc. was mentioned amongst the parameters critical to prove the quality of NTFPs. However, many producers were interested also for the quantities of functional components in berries, such as the concentration of polyphenolics, the radical scavenging capacity, the concentrations of individual polyphenolics, and lipid content. Correspondingly, the requirements for the regularity of the quality control were quite high (Figure 12). Thus, based on the survey, the need for analytical services can be considered high. However, the costs of the analyses may hinder the companies' interests (Figure 13).



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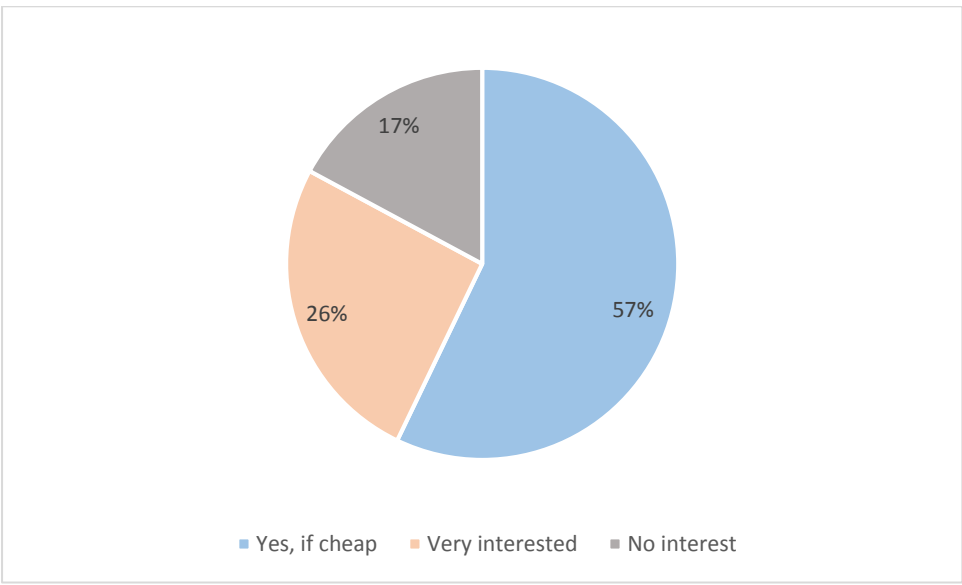


Figure 13. The interest of NTFP enterprises on product quality and authenticity testing.

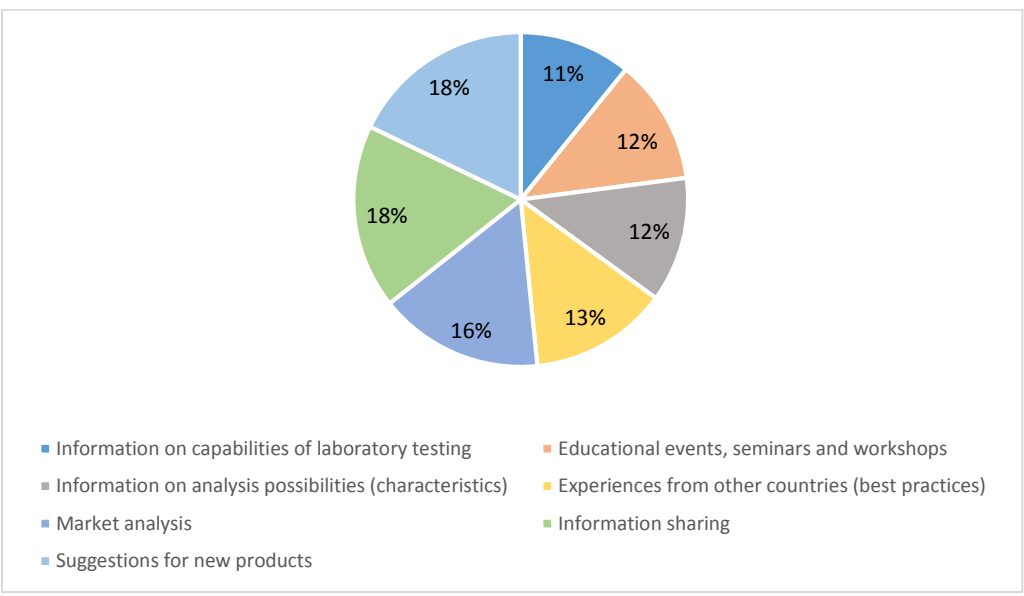


Figure 14. Expectations of NTFP enterprises related to the results of the NovelBaltic project



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During the interviews, seminars and informal meetings, the enterprises were informed about the NovelBaltic project and its aims. All representatives of the enterprises expressed their interest to get the information about the project results as well as suggestions on how to improve their business. 76% of the respondents build their experience by consulting with experts in the specific field (Universities etc.). 61% get their experience from literature in the specific field. 94% of the respondents gather their information on berries and their product markets on the internet, and only 3% in exhibitions and fairs. 61% of the respondents consult experts in the field and 37% of the respondents share their experience and expertise with professional associations. 81% of the respondents consult experts in field. 75% gather information on the berries used on the Internet and 53% relate to professional literature. 78% of the respondents need knowledge on new markets in order to expand? their berry utilization, while 39% need knowledge for the selection of best species, growth and storage conditions to advance the use and quality of berries and berry products. 85% of the respondents need to improve their knowledge on product development, while 76% need knowledge about the use of new technologies and information about new markets.

This result proves the importance of the NovelBaltic project and significance of the obtained results for further growth of the NTFP business and, in a wider sense, of bioeconomy in the Baltic Sea region countries.





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3. Research and development infrastructure available to the project partners and NTFP development and characterization

The project partners involved have a wide range of competencies within the fields of NTFP and biomass refinery. Competencies include knowledge on extraction methods used for laboratory scale analysis and pilot-scale experiments, analytical methods for identification of compound groups of interest, and qualitative and quantitative analytical methods used for characterization of specific compounds within a plant extract. For example, the evaluation of extract antioxidative properties can be done within the laboratories of project partners where various methods for determination of radical scavenging potential are used (e.g. DPPH 2,2-diphenyl-1-picrylhydrazyl, ABTS 2,2'-Azino-bis(3-ethylbenzothiazoline-6-sulfonic acid), FRAP ferric reducing antioxidant potential, CUPRAC copper reducing antioxidant capacity, and ORAC oxygen radical absorbance capacity). Authenticity testing of products can be done by either the use of analytical chemistry methods (chromatography, stable isotope analysis) as well as DNA-based methods which can be used to find out the sample origin. The methodologies available are presented in Tables 2, 3 and 4.

Table 2. The available extraction methods for NTFP processing in project partners institutions

Sample preparation and extraction methods	Performed analysis	Material used
Maceration	Comparison of conventional extraction methods and optimization of extraction process based on the used method and used solvents.	Various northern berries (bilberry, lingonberry, American cranberry, blueberry), fruits and their by-products
Freeze drying		
Vacuum ovens		
Ultrasound assisted extraction		
Microwave assisted extraction		
DNA/RNA extraction	Comparison of sample drying methods on degradation of bioactive molecules.	
Supercritical CO ₂ extraction		
Soxhlet extraction		
Volatile oil extraction	To obtain extracts rich with polyphenolics or lipids.	



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Table 3. The available chemical characterization methods of NTFPs processing in project partner institutions

Chemical characterization methods	Performed analysis	Material used
Spectrophotometry	Total polyphenolics, anthocyanins, carbohydrates, proanthocyanidins, vitamins, free radical scavenging activity using various methods, enzyme inhibition.	Blueberries, bilberries, bog bilberries, bog cranberries, American cranberries, sea-buckthorn, black currant, raspberries, various exotic fruits and vegetables. Extracts of various berries in powder or liquid form.
Liquid chromatography-MS	Determination of individual anthocyanidins and individual polyphenolics	
Gas Chromatography-MS	Analysis of lipids (fats) and plant wax, volatile substances used in fragrances and flavours, alcoholic beverages, oils	Blueberry varieties, rowanberry, hawthorn berries, crowberries, cranberries, bilberries. Latvian medicinal plants, herbs. Plants used in traditional Chinese medicine.
Titrimetric analysis methods	Total acidity	Berry juices
Stable isotope analysis	Analysis of stable light isotope ratio nitrogen 15, carbon 13, oxygen 18 (for solid samples) and oxygen 18 (for liquid samples)	Algae, mushrooms, honey, apples, grain, dry berries, humic substances
FT-IR	Chemical composition of different material	



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AAS and ICP	Analysis of macroelements (Mg, Ca, K, Na etc.) and micro elements (Li, Ba, Cu, Zn, Fe, Mn, Co, Cr etc.) - for samples with low concentration of metals.	Different varieties of blueberries and bilberries to assess their geographical origin. Analysis of metals in honey.
Capillary electrophoresis	Determination of carbohydrates (monosaccharides)	Products containing carbohydrates, birch sap
Fiber analysis	Crude fiber, acid detergent fiber and neutral detergent fiber determinations	Various dried berries, fruits and their processing by-products; dried vegetables and their by-products; dried medicinal, aromatic and spice plants, seeds and nuts
Electronic tongue	Taste measurement and comparison	Fresh fruit, berry and vegetable juice; various fruit and berry products

Table 4. The available cell culture and DNA based methods for NTFP processing in project partner laboratories

Cell culture and DNA based methods	Performed analysis	Used material
Sterile tissue culturing	Cell culturing under sterile cabinets and controlled growth chambers	Bilberry, potato, Scots pine, Norway spruce, aspen, tobacco, birch
High-throughput sequencing	DNA sequencing (e.g. barcoding)	Any species
Microscopy/confocal microscopy/electron microscopy	Analysis of microscopic samples, localization of bacteria and compounds	Any species
Production of transgenic material	Gene transfer and analysis of gene function	Silver birch, hybrid aspen



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PCR/qPCR analysis	Isolation of genes and analysis of gene expression	Bilberry, lingonberry, strawberry, blueberry, crowberry, Scots pine, Norway spruce, silver birch, hybrid aspen, etc.
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The research institutes and universities from project partner countries have significant experience in NTFP research (both analysis and development of new products) and capacity to work on with new challenges. The infrastructure is able to support new developments and services. The capacity of the infrastructure and resources can already meet the demands of industry, but there is also need to further development in order to meet the expectations of industry and consumers. For most of the institutions surveyed, the weak point is the missing capacity to scale-up with the results of research.



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Opinions and information on NTFP's: examples, needs of industry and academia



Address: Skøelv, 9310 Sørreisa, Norway, postal address: post-box 87, N-9315 Sørreisa

Webpage: www.bioform.no

E-mail: salg@bioform.no

Kenneth Ruud, Factory Manager

Bioform was established in 2000 and is a SMB company with 8 employees, where one is permanent located at our office in Beijing China. Product portfolio counts about 70 different products, and purity and supreme quality is our identity. Most of our products are 100% ingredients with no additives, fill materials or similar, our goal is to have 100% of our product range as 100% ingredients before end of 2020. For many years we have imported most of our raw materials for our product range but since 2015 we have set our main focus on using as much local raw materials as possible, therefore we are now starting a process to encourage agriculture, farmers, other businesses, people and groups to start harvesting wild raw materials or to grow raw materials, our company use a wide range of raw materials which we find growing naturally in our nature, and we also have other partners/customers interested in buying our raw materials. To make this work, there have to be a system to grow, harvest, collect and process these raw materials.

We are now planning a brand-new high-tech factory for washing, cleaning, drying, milling, extracting and packing of raw materials from both marine and agricultural raw materials, this mean we will now get in place the most important part of the supply chain as we will be a collecting, purchasing and sales point for those raw materials.

First of all we have all the most common raw materials, the wild berries, chaga, and seaweed. BUT! We also have loads of nettles, dandelions, roseroot and other known herbs. In addition to this we have so much undiscovered materials like berries from rowan trees, bark, sap and leaves from birch, rowan trees, alder and others bushes and trees. Every winter and spring we see the wild animals eating from those, this means they contain lots of nutrients, but we have no knowledge, and here might hide large and unique recourses from our region, so much more than berries.

We intend to analyse and take advantage of the raw materials available.



NOVELBALTIC

Market driven authentic non-timber forest products from the Baltic Sea region

Bioform is also an experienced exporter, working with worldwide export since 2009 where primary market has been Asia (China, Taiwan, Hong Kong), Europe and Africa. We have had office in Beijing China since 2014 and have strong knowledge about export, certificates and document preparations, we also have strong network and knowledge about import, documentation and customs work within China.

We have deep insight in export to China and especially into customs clearance and approval of products for import into China as we have management and ministry connections both within customs and Sanitary sections at the National administration of China.

In Norway, Bioform is working on a large project since 2014 for harvesting, collecting, transporting and processing of wild grown seaweed for use as feed material, food ingredients, food supplements and possibly medicine in the future. Rest raw materials will be used for production of fertilizer for the agriculture. This is also the fundament for the new high-tech factory we have started projecting. Based from this we have developed new technology for efficient dewatering of raw materials where we aim to reduce drying cost with 60% compared to traditional drying processes..

It should easily be possible to set up a required nutrient profile, analyse the large-scale raw materials estimated to contain needed nutrients and create a recipe, of course there would be some trials to succeed, but the market is already enormous and will only grow in the future. We have developed a gps-coordinated map system for tracking of detailed location and google earth views from gps coordinate where the raw material was harvested.

This map system is connected to a database where endless data can be collected and organized like date of harvesting, weather readings, registration of pollution and preserved areas in the maps, owner of the land, cycle of harvesting, registration of samples for analysis and results.

This system also allow usage of QR-codes on the product label connecting the consumer to a webpage where any of the above information can be listed together with other product/company information. Currently our company can also provide private label services as following: Recipe development, blending and hard capsule encapsulation, counting and packing of capsules, powders and liquids, and our factory have high capacity. When the new factory is completed, we can also offer handling of raw materials (cleaning, drying, cutting, milling and packing), we are also planning/considering production lines for spray drying, extraction, ultra-filtration and other methods. The new factory will also process both dried and fresh raw materials/products. Bioform As may be a partner for further product development and market access as we have solid network in many countries of the world.





NOVELBALTIC

Market driven authentic non-timber forest products from the Baltic Sea region

Dr. Uģis Klētnieks – JSC “BIOLAT” (Chairman of the Board), Latvia

Webpage: <https://www.biolat.lv/en/>



JSC “**Biolat**” was established in 1993 in Salaspils city, Latvia, and since then its aim has been applying of long-term research results about forest biomass to gain profit by producing high-quality and environment-friendly bio-active products of ecologically clean forest resources, mainly the green mass (spruce and pine needles). The Company’s philosophy matches the modern tendency to replace synthetic products with high-quality bio-active natural products derived from renewable plant materials by applying environment-friendly technologies.

JSC "Biolat" has implemented the quality management system, which is confirmed by a certificate ISO 9001:2015 issued in 2017, in order to ensure a constant quality of its products and their continuous compliance with customer's wishes and requirements, as well as to compete successfully in the market.

The Food and Veterinary Service of the Republic of Latvia has issued the Food Enterprise Certificate of Recognition No. A 026132 to the Company. The whole production process at AS “Biolat” follows the principles of HACCP system (Hazard Analysis and Critical Control Points).

Expectations and opinion:

- Expectation from science -

Science is ever-evolving and has been the basis for the most important discoveries in the human history. Nowadays we can go even further by exploring the boundaries of human ageing and related processes in order to build a longevity platform aiming to unlock regenerative capacity to reverse age-related changes in the body. I find that the next step of modern medicine and healthcare is targeting senescent cell mechanisms for potential applications in a range of degenerative diseases. I expect that continuous research of bioactive molecules of various plant species could yield useful tools for prevention of modern age health issues.



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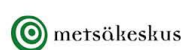
Market driven authentic non-timber forest products from the Baltic Sea region

- Existing collaboration

JSC “BIOLAT” has a long-standing collaboration with various scientific institutes (Latvian Institute of Organic Synthesis, Latvia University of Agriculture, Institute of Horticulture), universities (University of Latvia, Riga Stradins University, and University of Wrocław) research organizations (Competence center of smart materials and technologies) as well as a network of producers in the agricultural, pharmaceutical (BluestonePharma) and medical sectors. Our company welcomes any type of collaboration that is based on scientific discovery and innovation

- Vision on the NTFP potential for market and science-

In the traditional- and ethnomedicine forest resources have been used as remedies for all possible human ailments for centuries now. Forests of Northern hemisphere are a rich resource of biologically active ingredients due to harsher climate. We see an enormous potential for various forest plant parts’ applications in the pharmaceutical, nutraceutical and functional food segments. In my opinion our bodies are well adapted for digestion (with produced enzymes, ferments) of wild-growing berries as well as various plant leaves and conifer needles and buds that are found in the forest. Current market trends that favour natural plant based products go well hand-in-hand with the increased interest in anti-ageing, anti-inflammatory and overall health-boosting bioactive substances from ecologically clean environments that are the forests of the Baltic region.





NOVELBALTIC

Market driven authentic non-timber forest products from the Baltic Sea region



Ministry of Economic Affairs and Employment of Finland

The unadjusted turnover of the natural products sector in 2017 was approximately EUR 530 million. Micro-enterprises accounted for about 90 per cent of the companies listed in the natural products sector. The proportion of shareholders' equity in micro-enterprises has grown significantly while in small and medium-sized enterprises it has decreased.



The market supply volumes of wild berries and mushrooms in 2018 were highest in Lapland (43%) and East Finland (29%). The export value of wild berries primarily comes from frozen bilberries (EUR 4.7 million). Strong growth of tourism provides growth opportunities for smaller producers of natural products and services.

The Arctic element in the brand of natural products may provide added value in terms of exports. There is considerable demand for Finnish natural products in the global markets, for instance, in Asia. The sector report for the natural products sector focuses on the key source of natural products: the forest. The report discusses the biological diversity of forests, the availability of natural products and the related risks, and ways of raising the degree of processing. In the National Forest Strategy 2025 update, the development of service platforms based on open forest data is considered essential. The development work of PEFC and FSC certified natural products continues.

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Market driven authentic non-timber forest products from the Baltic Sea region

Andre Veskioja, Director of Estonian Crop Research Institute

Webpage: <https://www.etki.ee/index.php/eng/>



Estonian Crop Research Institute is a state research and development institute in the area of governance of the Estonian Ministry of Rural Affairs. Research and development activities of the Institute support the increase of efficiency and competitiveness of agricultural production, mitigate the negative impact of agricultural production on the environment and help in the maintenance of agrobiodiversity. The main activities are: breeding new varieties of crops, ensuring maintenance breeding of registered varieties, preserving plant genetic resources as well as production and distribution of certified seeds of various crops. Active national and international cooperation with



research and development institutes and universities is directed towards the increase of efficiency and scientific level of research. The Institute provides scientific expertise for the advisory system, state officials and development of legislation. Close collaboration with farmers and industry is a prerequisite for the implementation of research results in the practice.

Expectations and opinion:

- The expectation from science- Science has to give answers, but the answers have to be proved, not assumed. Nowadays it is very common, that the first google result is considered the truth and this is the end of the search. In science, you are in the constant road of looking at new hypotheses, proofs, and results.
- Existing collaboration- ECRI is doing a national and international collaboration. On a national level, it involves Ministry of Rural Affairs, biggest Estonian cereal producers, organic producers, local universities, etc. On international level collaboration involves Baltic and Scandinavian breeding associations, University of Aarhus, university of Ottawa, participating in different ERA-NET, EIT FOOD and Horizon 2020 projects.
- Vision on the NTFP potential for market and science- Small countries and producers can never be the most effective producers on the market- so price can't be the first criteria. Products have to have added value, and often science and collaboration can be used to achieve it.



NOVELBALTIC

Market driven authentic non-timber forest products from the Baltic Sea region

Laura Jaakola, UiT The Arctic University of Norway



Expectation from science:

I expect that NovelBaltic project has a good opportunity to develop new knowledge on the potential of using different methods to show authenticity of plant materials and products of interest in Nordic and Baltic region. The studies performed will also produce scientifically interesting novel information.



Existing collaboration:

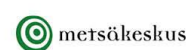
NovelBaltic brings together existing and new collaborations among researchers with different complementary expertise within Nordic and Baltic countries. In addition, all partners work in close collaboration with industry and other actors in the field, which gives us excellent network building opportunities.

Vision on the NTFP potential for market and science:

We have quite similar traditions and a good opportunity to better utilize NTFPs in the Nordic and Baltic countries. Developing methods for showing authenticity of the raw materials is an important part of the quality assurance and will further improve the value of the NTFP products and raw materials of the regions. The project will also bring new opportunities for the scientific collaboration.

Others:

The NovelBaltic project draws attention to our regional and traditional NTFPs, which could and should be utilized in a better and sustainable way.





NovelBaltic

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Market driven authentic non-timber forest products from the Baltic Sea region

