The Finnish Bioeconomy Strategy

Sustainably towards higher value added

Ministry of Economic Affairs and Employment, Ministry of Agriculture and Forestry,
Ministry of the Environment, Ministry of Education and Culture,
Ministry of Social Affairs and Health, Ministry of Transport and Communications,
Ministry of Finance, Prime Minister's Office

PUBLICATIONS OF THE FINNISH GOVERNMENT 2022:5 **vn.fi/en**

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Abstract

In July 2020, the Ministry of Economic Affairs and Employment launched a project to update the Bioeconomy Strategy. The project recognised that increasing the bioeconomy's value added is an important focus area which is not comprehensively and holistically discussed in other strategies. The Bioeconomy Strategy extends to 2035. Its vision is "sustainably towards higher value added".

In order to promote the wellbeing of society, attention is paid to the holistic sustainability of the bioeconomy and the fair distribution of benefits and disadvantages.

The measures of the Bioeconomy Strategy are divided under four headings: (1) higher value added from bioeconomy, (2) a strong knowledge and technology base, (3) a competitive operating environment and (4) usability and sustainability of bioresources and other ecosystem services. The strategy also includes sector-specific measures.

The measures to increase the value added of bioeconomy include implementing an RDI programme for the green transition of bioeconomy, and promoting the establishment of innovative pilot and demonstration facilities and the first industrial-scale plants in Finland. Regions are also encouraged to formulate action plans for the bioeconomy.

The measures will be funded for example through the Sustainable Growth Programme for Finland.

Keywords Bioeconomy, value added, ecosystem services, sustainable growth, bioresources, strategy, holistic sustainability

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Kuvailulehti

30.3.2022

Suomen biotalousstrategia
Kestävästi kohti korkeampaa arvonlisää

Valtioneuvoston julkaisuja 2022:5

Julkaisija	Valtioneuvosto		
Yhteisötekijä	Työ- ja elinkeinoministeriö, maa- ja metsätalousministeriö, ympäristöministeriö, opetus- ja kulttuuriministeriö, sosiaali- ja terveysministeriö, liikenne- ja viestintäministeriö, valtiovarainministeriö, valtioneuvoston kanslia		
Kieli	Suomi	**Sivumäärä**	53

Tiivistelmä

Työ- ja elinkeinoministeriö asetti heinäkuussa 2020 biotalousstrategian päivityshankkeen. Hankkeessa tunnistettiin biotalouden arvonlisän kasvattaminen tärkeäksi painopistealueeksi, jota ei käsitellä kattavasti ja kokonaisvaltaisesti muissa strategioissa. Biotalousstrategia ulottuu vuoteen 2035. Sen visio on "Kestävästi kohti korkeampaa arvonlisää".

Biotalouden kokonaiskestävyyteen sekä hyötyjen ja haittojen oikeudenmukaiseen jakaantumiseen kiinnitetään huomiota yhteiskunnan hyvinvoinnin edistämiseksi.

Biotalousstrategian toimenpiteet jakautuvat neljän otsikon alle: (1) Korkeampaa arvonlisää biotaloudesta, (2) Vahva osaamis- ja teknologiaperusta, (3) Kilpailukykyinen toimintaympäristö ja (4) Bioresurssien ja muiden ekosysteemien käytettävyys ja kestävyys. Strategiassa on lisäksi sektorikohtaisia toimenpiteitä.

Biotalouden arvonlisän kasvattamiseksi muun muassa laaditaan ja toteutetaan biotalouden vihreän siirtymän TKI-ohjelma, edistetään uusien, innovatiivisten biotuotteiden pilotointi- ja demonstraatiolaitosten sekä laatuaan ensimmäisten teollisen mittakaavan laitosten sijoittumista Suomeen. Lisäksi alueita kannustetaan laatimaan biotalouden toimintasuunnitelmat.

Toimenpiteitä rahoitetaan muun muassa Suomen kestävän kasvun ohjelmalla.

Työ- ja elinkeinoministeriö asettaa ohjausryhmän strategian toimeenpanoa varten.

Asiasanat arvonlisä, kestävä kasvu, bioresurssit, kokonaiskestävyys, biotalous, ekosysteemipalvelut, strategiat, kestävyys

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Presentationsblad

30.3.2022

Finlands bioekonomiska strategi
Högre mervärde på ett hållbart sätt

Statsrådets publikationer 2022:5

Utgivare	Statsrådet		
Utarbetad av	Arbets- och näringsministeriet, jord- och skogsbruksministeriet, miljöministeriet, undervisnings- och kulturministeriet, social- och hälsovårdsministeriet, kommunikationsministeriet, finansministeriet, statsrådets kansli		
Språk	Finska	**Sidantal**	53

Referat

Arbets- och näringsministeriet tillsatte i juli 2020 ett projekt för att uppdatera den bioekonomiska strategin. I projektet identifierades större mervärde i bioekonomin som ett viktigt prioriterat område som inte behandlas på ett täckande och övergripande sätt i andra strategier. Den bioekonomiska strategin sträcker sig fram till 2035. Visionen är ”Högre mervärde på ett hållbart sätt”.

Det fästs uppmärksamhet vid den övergripande hållbarheten i bioekonomin samt vid en rättvis fördelning av nyttan och olägenheterna för att främja välbefinnandet i samhället.

Åtgärderna i den bioekonomiska strategin fördelar sig på fyra rubriker: (1) Högre mervärde av bioekonomin, (2) Stark kunskaps- och teknikbas, (3) Konkurrenskraftig verksamhetsmiljö och (4) Bioresursers och övriga ekosystems användbarhet och hållbarhet. Strategin innehåller dessutom sektorspecifika åtgärder.

För att höja mervärdet i bioekonomin utarbetas och genomförs bland annat ett FoUI-program för den gröna omställningen inom bioekonomi, främjas placerandet av i Finland pilotprojektsanläggningar och demonstrationsanläggningar för nya, innovativa bioprodukter samt de första anläggningarna i industriell skala. Dessutom sporras regionerna att utarbeta handlingsplaner för bioekonomin.

Åtgärderna finansieras bland annat genom programmet för hållbar tillväxt i Finland.

Arbets- och näringsministeriet tillsätter en styrgrupp för genomförandet av strategin.

Nyckelord	Bioekonomi, mervärde, ekosystemtjänster, hållbar tillväxt, bioresurser, strategi, övergripande hållbarhet		
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FOREWORD

Dear reader,

Finland's first Bioeconomy Strategy was published in 2014 as part of the Government resolution titled The Leading Factors of Growth. In summer 2020, the Ministry of Economic Affairs and Employment set up a project to update Finland's bioeconomy strategy. The EU's Bioeconomy Strategy was updated in 2018, and the Council Conclusions on it, prepared during the Finnish Presidency, stated that the Member States would either prepare or update a bioeconomy strategy of their own.

The bioeconomy is an exceptionally important sector in Finland. In 2019, it created a value added of EUR 26 billion per year, accounting for 13% of the value added generated in the national economy. During the update of the strategy, opportunities were identified for doubling the bioeconomy's value added by 2035, taking holistic sustainability into consideration.

The Bioeconomy Strategy has connections with several other Government strategies and policy programmes that outline, for example, the use of national forest resources, safeguarding biodiversity, climate and energy policy and industrial policy. The update work has identified the most important national and EU strategies and programmes for the bioeconomy, which have been taken into account as premises, but at the same time it has been recognised that none of these address the possibility of increasing the bioeconomy's value added in a comprehensive and exhaustive manner.

A key aim guiding the update of Finland's Bioeconomy Strategy has been the preparation of a systematic, comprehensive and exhaustive action plan for developing the bioeconomy's value added. It is a clear change in direction to the 2014 Bioeconomy Strategy, in which the strategic objective was to significantly increase the amount of bioeconomy production. The updated strategy does not take a stand on the volume of production, but aims to create higher value added in different sectors of the bioeconomy.

A large number of national and regional actors participated in the preparation of the Bioeconomy Strategy update. Citizens' views were compiled using an otakantaa.fi survey. The Bioeconomy Panel set up by the Ministry of Economic Affairs and Employment, consisting of representatives of different sectors, administration, research,

non-governmental organisations and other stakeholders, participated actively in the update work throughout the process. Finland has also engaged in cooperation with Sweden, which is preparing its first national bioeconomy strategy, and update work has been presented at events organised by the European Commission. Studies and scenario models commissioned from the research community have helped to map out the Finnish bioeconomy's operating environment, its threats and opportunities now and in the future.

Responsibility for the implementation of the strategy is divided between several ministries, and it is carried out in cooperation with many actors. Changes in the operating environment are taken into account in the preparation of measures. The regions play a key role in achieving the objectives of the Bioeconomy Strategy, and the ministries hope that the regions will draft their own implementation plans. The Ministry of Economic Affairs and Employment will appoint a steering group for the implementation of the updated Bioeconomy Strategy.

I want to extend my thanks to all those who have participated in the Bioeconomy Strategy update.

Permanent Under-Secretary
Petri Peltonen

1 Premises for the update

Finland's first national Bioeconomy Strategy was adopted in May 2014 as part of the Government resolution on "Leading Factors of Growth". It was consistent with the content of the EU Bioeconomy Strategy adopted in 2012.

The EU Bioeconomy Strategy was updated at the end of 2018. At the request of the Commission, the European Bioeconomy Scene 2019 conference in Finland came to the conclusion that Finland would prepare the Council conclusions on the updated EU Bioeconomy Strategy.

The conclusions were adopted by the Competitiveness Council in November 2019. They urge Member States to accelerate the bioeconomy by drafting or updating their national bioeconomy strategies.

On 1 July 2020, the Ministry of Economic Affairs and Employment appointed a steering group, a coordination secretariat, and a Bioeconomy Panel providing advisory assistance and consisting of representatives of stakeholders for the Bioeconomy Strategy update project (TEM071:00/2020).

The draft of the strategy was published on the Lausuntopalvelu.fi website for opinions. The received feedback (50 opinions) were taken into consideration where applicable.

The aim of the Bioeconomy Strategy update is to increase the bioeconomy's value added so that social and economic equity and the planet's carrying capacity are taken into account.

1.1 Changes in the operating environment

The Finnish Bioeconomy Strategy was prepared in 2012-2014, when the Finnish forest industry was going through a transformation. The strategy has gone a long way to support the search for a new common direction and shared communication on the significance of the bioeconomy.

When the updated EU Bioeconomy Strategy was published in 2018, the next transformation was just beginning. The rulebook for the climate agreement was approved immediately after its publication. The importance of the circular economy in the measures was strengthened. The massive steps taken by digitalisation changed the demand for pulp-based products, as online trade required more packaging materials and the demand for printing paper continued to decrease. The debate on plastic and restrictions on its use led to a ban on some single-use plastic products. Regarding bio-based products, concerns have been voiced on the impacts of their production on biodiversity and the adequacy of raw materials for products replacing plastics, which in Europe has also turned public debate partly against the bioeconomy. The European Green Deal, the Renovation Wave Strategy and the New European Bauhaus emphasise the carbon storage impact of bio-based materials, especially in renovation.

An operating environment analysis was commissioned for the strategy update in the form of a material and interview study. The operating conditions are still fairly similar to those of the previous Finnish Bioeconomy Strategy. The bioeconomy or circular economy is increasingly being described as a necessary change to meet global challenges. The main documents are the Paris Agreement and its continuation the Global Warming of 1,5°C report published by the Intergovernmental Panel on Climate Change (IPCC) in October 2018. The IPCC report states that the ambitiousness of climate policy must be increased if countries want to pursue a 1.5 °C target in accordance with the Paris Agreement. The new reports confirm the need for action.

Sustainable development has increasingly become a principle guiding the economic activities of society. The global Agenda for Sustainable Development (Agenda 2030), adopted by the UN in 2015, aims to turn global development onto a path where people's welfare and human rights, a prosperous economy and a stable society are ensured in a sustainable manner from the perspective of the environment. The change is also reflected in the development of the bioeconomy. The updated EU Bioeconomy Strategy will increasingly focus on the implementation of SDGs and the Paris Agreement.

The predictability of the industrial operating environment, safeguarding the availability of raw materials and ensuring the functioning of the market remain at the core of both national and European publications, and as even stronger priorities than in the previous Bioeconomy Strategy. The demands for diversity and preservation of natural values are now more important than before in the current operating environment. The key driver here is the EU Green Deal, which gives them a great deal of weight.

In particular, the use of forests is subject to significant pressures and the use of forest raw materials may not be seen in quite the same way as in the previous strategy. The Finnish Forest Strategy is updated regularly, so it provides a foundation for the Bioeconomy Strategy, from which we can determine the marginal conditions related to the availability and growth of Finnish forest biomass.

Increasing the degree of wood processing, new products and entirely new product areas are strongly emphasised in several Finnish studies on the utilisation of wood biomass. A green transition and the circular economy are considered key drivers of change. The importance of industrial side streams and the increased efficiency of material cycles are emphasised in nearly all the other examined strategies related to the bioeconomy.

The growth in the demand for food and clean water and changes in consumer habits create opportunities for the bioeconomy related to the food system. Consumers are increasingly aware of and have higher demands regarding the quality, origin, ethicalness and environmental friendliness of food. In order for the food system to be able to respond to consumers' wishes and demand, it must be profitable and competitive for its operators. Research and development can help in finding new ways for producing food and developing the sustainability of existing operating methods.

The provision of education in the field of bioeconomy has developed considerably in recent years. There have also been a good amount of applicants. Cuts in funding to higher education institutions and research are weakening the competence base at the higher level. The need for continuing education for those employed in industry was highlighted as a desire priority for further education. There is a great deal of concern about the interest and expertise in natural sciences also outside the bioeconomy sector.

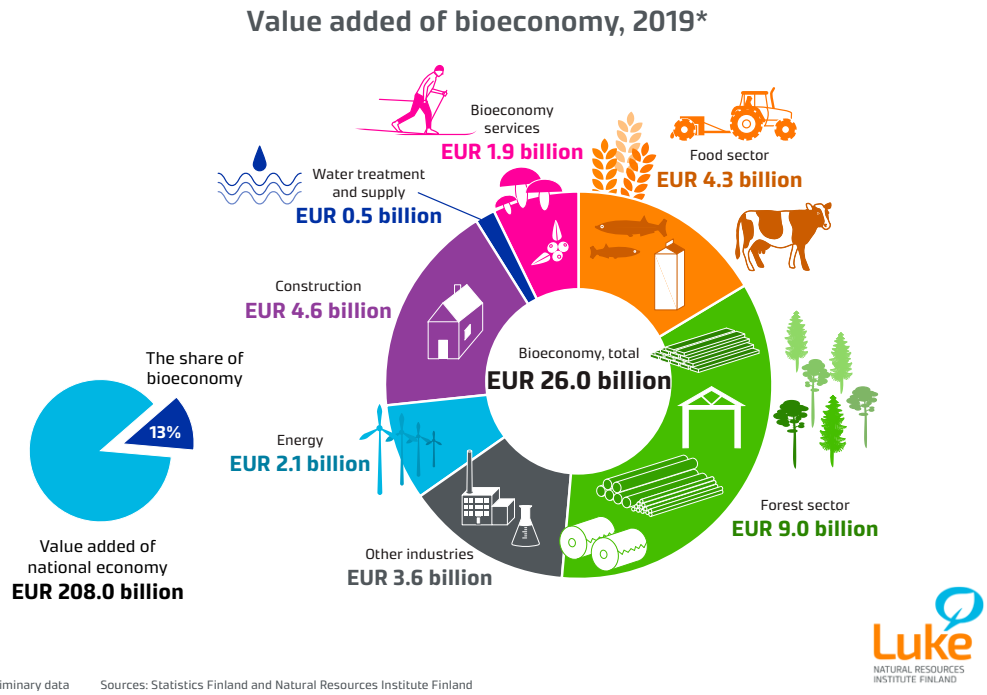
Positive priorities and growth estimates remain for the chemical industry and wood construction. The EU Bioeconomy Strategy identifies biotechnology and biotechnologies, as well as biomedicine and health as an area of growth that is expected to double in size over the next 10 years, although they are not included in the definition of bioeconomy.

The pull factors of Finnish tourism are based on nature and increasingly also on experiencing Finnish lifestyle and culture. The largest number of new tourism undertakings have been established in programme services industry, which utilises companies operating at interfaces as partners and nature as their operating environment. Nature-assisted health and well-being services are also increasingly popular.

1.2 Review of the bioeconomy

The bioeconomy sector's output, value added and exports have grown and the number of people it employs has remained at the same level after Finland's Bioeconomy Strategy was published in 2014. In 2019, the bioeconomy output was EUR 74.4 billion and the value added was EUR 26 billion, whereas in 2014 the output was EUR 62.6 billion and the value added was EUR 21 billion at current prices. The bioeconomy accounted for 16 per cent of the total national output and 13 per cent of the value added. In the 2010s, the output and value added generated by bioeconomy sectors have changed almost at the same rate as the national economy on average.

Figure 1. Natural Resources Institute Finland compiled picture on the shares of bioeconomy sectors and the division of value added between sectors.



* Preliminary data Sources: Statistics Finland and Natural Resources Institute Finland

Bioeconomy products account for about one third of Finland's goods exports. Within the bioeconomy, forest products alone account for more than 70 per cent of the value of bioeconomy exports. In 2019, exports of bioeconomy products totalled EUR 18.8 billion.

In 2019, the bioeconomy sectors employed a total of 301,800 people, or 11 per cent of the total number of people employed in Finland. Outsourcing, automation and mechanisation in both industry and agriculture also complicate the temporal comparability of statistics in monitoring the overall impacts of changes.

1.3 Bioeconomy interfaces with other strategies

The update of the Bioeconomy Strategy examined a wide range of national and EU level strategies and policy programmes that have an interface with the bioeconomy. There is an exceptionally large number of these as shown in the images below. A great deal of attention is focused on the bioeconomy and there are an abundance of wishes related to it, but there are also considerable cross-pressures both in Finland and in the EU.

The ecological, social and economic sustainability of bioresources as well as biodiversity are a necessary and undeniable starting point for the bioeconomy strategy. The purpose of the Bioeconomy Strategy is not to challenge or question these basic principles or relevant parallel strategies. For this reason, the objectives and measures outlined in them have not been separately introduced into the Bioeconomy Strategy, but they have been taken into account as interfaces in the preparation of the strategy and as starting points. Some of them also act as accelerators of demand for new products, services and solutions.

The interactive strategy process has made it clear that the value added and growth potential of different sectors of the bioeconomy have been overshadowed. This increase is not covered systematically and ambitiously much at all in the large numbers of parallel strategies. This is now the key objective of the new strategy. The growth of the bioeconomy's value added is of considerable importance for the growth of the Finnish economy as a whole.

The Bioeconomy Strategy has interfaces with several other Government strategies and policy programmes that outline, for example, the use of national forest resources, safeguarding biodiversity, climate and energy policy and industrial policy. The Bioeconomy Strategy identifies the strategies and programmes that are central to the bioeconomy, and the policies and objectives set out in them have been taken into account as starting points.

Finland's targets for carbon neutrality in 2035 and the halting of biodiversity loss will be taken into account in the implementation of the Bioeconomy Strategy. The Government's sustainability roadmap describes the objectives for ecological, social and economic sustainability, which also guide the promotion of the bioeconomy, in more detail.

National targets for the use of natural resources have been set out in the Circular Economy Action Plan. The aim of the action plan is to reduce the consumption of non-renewable natural resources and increase the productivity of resources and the degree of circular economy in materials. The sustainable use of renewable natural resources plays a key role in achieving these objectives. The National Forest Strategy sets targets in areas such as the management and usability of forest resources, forest biodiversity and climate change mitigation.

The Bioeconomy Strategy's operating environment is also affected by a number of international commitments, such as the UN 2030 Agenda for Sustainable Development and the implementation of the Paris Agreement. Other national, EU and international strategies, action plans and agreements also have objectives for the sustainable use of natural resources.

The preparation and updating of these national and international strategies and programmes will be taken into account in the monitoring of the Bioeconomy Strategy.

Figure 2. The bioeconomy has interfaces with a large number of other national strategies and programmes

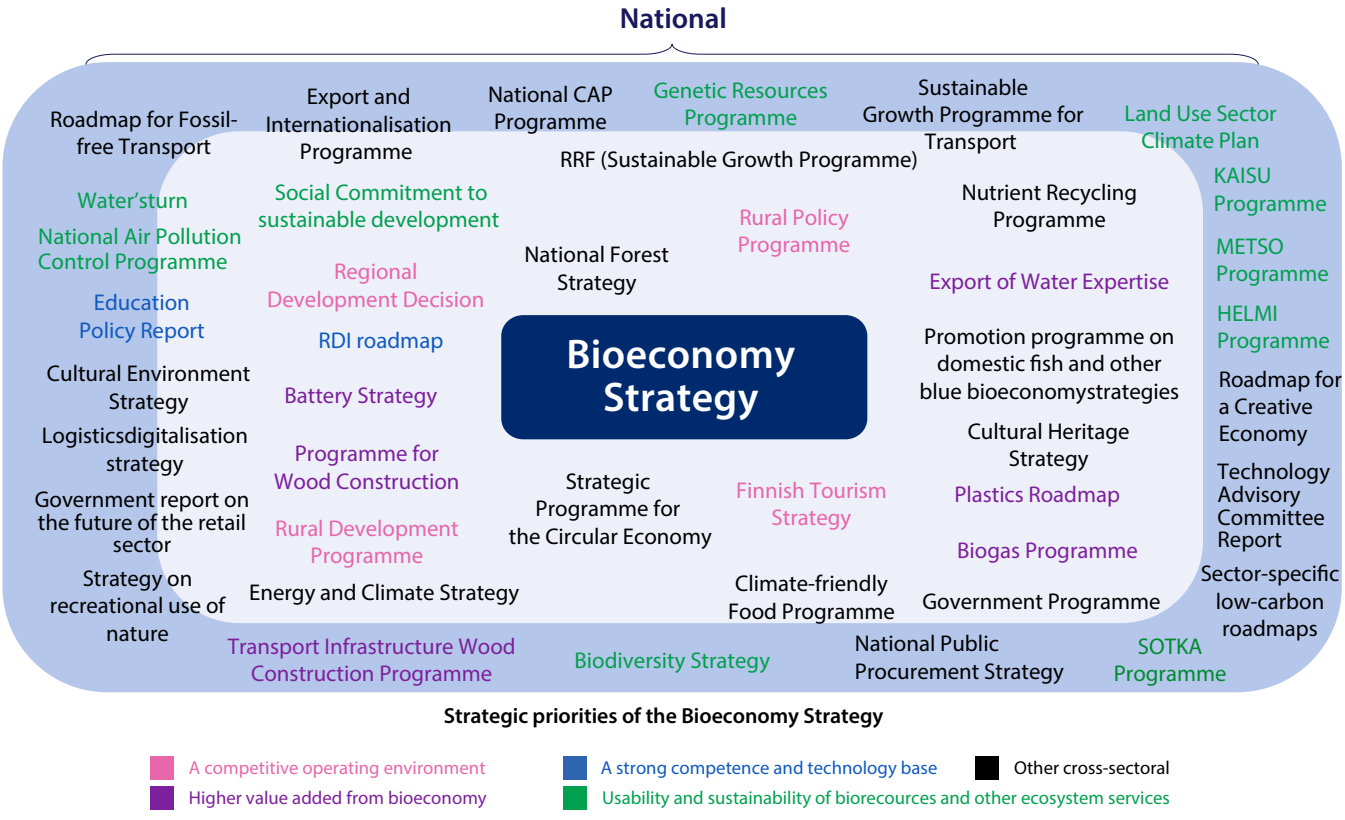
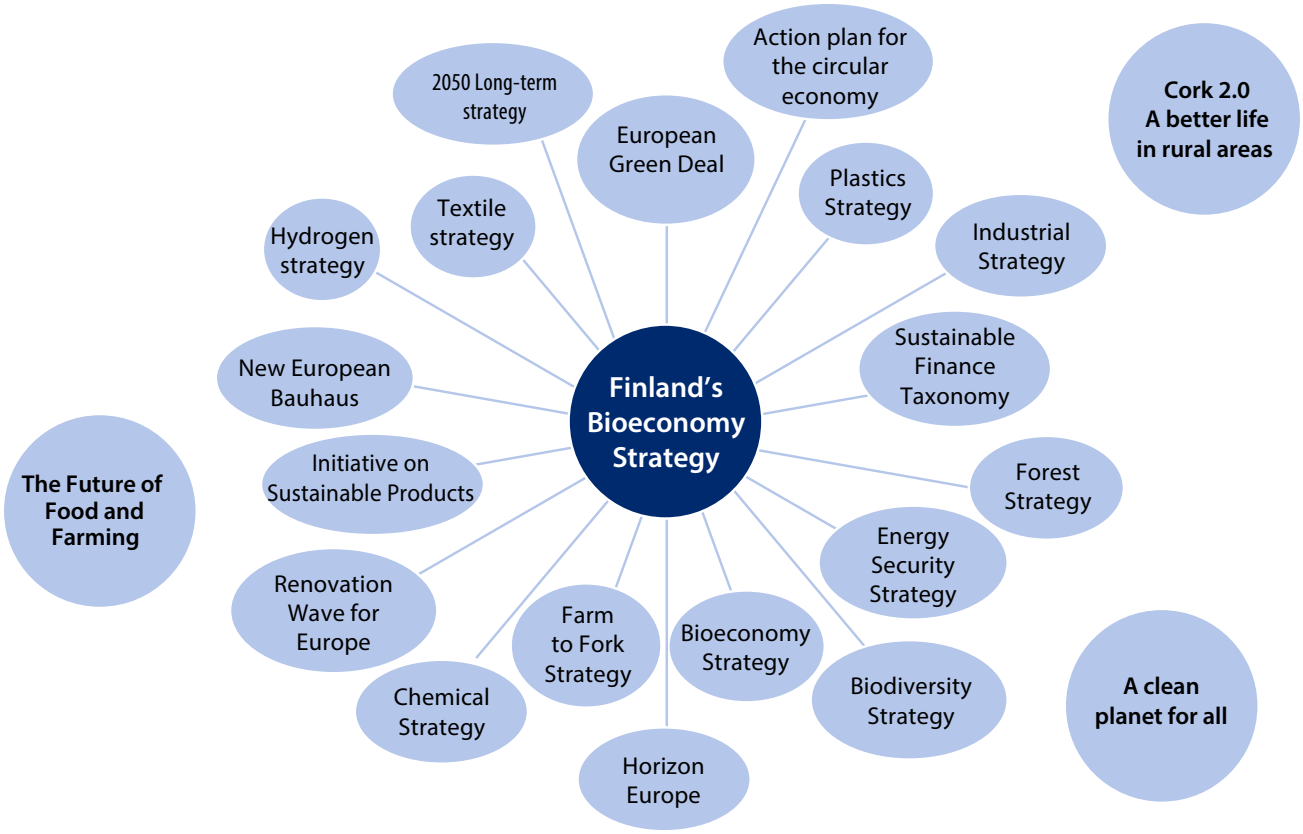


Figure 3. Finland's Bioeconomy Strategy under EU review, especially in comparison to the EU Bioeconomy Strategy, but also for a significant number of other strategies, programmes and funding instruments.



1.4 Holistic sustainability and equity of the bioeconomy

The Government Programme aims to achieve a socially, economically and ecologically sustainable society. The sustainability roadmap brings together the elements of sustainability's different dimensions (social, economic and ecological sustainability) into a balanced whole, recognising the close links between the dimensions. The Bioeconomy Strategy aims to direct Finland towards a carbon-neutral society in a socially and regionally fair manner.

The approach that relies on the holistic sustainability of the Bioeconomy Strategy is based on cooperation between different sectors and the system transformation that it enables. Closer cooperation is a prerequisite for building a common operating model based on information on the total resources available in a sustainable manner and the distribution of access between sectors. In the best case scenario, this will lead to integrated use and

recycling of raw materials through the identification of new opportunities, allowing sectors to use resources in parallel and as a continuation and to make efficient use of them. It is also creating new opportunities for innovation.

Sustainability is assessed on the basis of scientific data. Demonstrating the sustainability of the Finnish bioeconomy is a key issue for the success of the future bioeconomy.

Social sustainability

All members of society are guaranteed opportunities for a good life, health, education and employment. A socially sustainable society treats all its members in an equal manner, supports health and functional capacity, and provides the necessary security and services. Existing resources will enable the narrowing of inequality and a better quality of life. A high level of education and general knowledge as well as social mobility will be promoted as part of social sustainability. The diverse values, objectives and practices related to bioeconomy are implemented in such a way that they also support cultural sustainability.

Economic sustainability

A sustainable economy is a prerequisite for the key functions of society. Economic well-being cannot be based on long-term indebtedness or the overconsumption of natural resources. Strengthening the 'Doing More from Less' principle of the circular economy will enable the growth of well-being without increasing the consumption of natural resources. The change towards a more sustainable economy is based on the efficient use of natural resources, strengthening expertise and increasing the number of jobs. The creation of jobs, well-being at work and occupational safety will be promoted, for example, by reforming production methods and operating models. Industrial reform will be promoted in order to create more jobs that have added value and high productivity.

Ecological sustainability

Ecological sustainability means the ability of society to act within the limits of the planet's carrying capacity. The aim is to safeguard the functioning of natural systems and their capacity for renewal now and in the future. Compliance with the precautionary principle is essential for ecological sustainability. Before taking action, the risks, disadvantages and costs must be assessed. It is also important to prevent harmful effects and to combat them at source.

Ensuring the ecological sustainability of bioeconomy measures is of primary importance. Achieving climate and biodiversity targets as well as reducing the overconsumption of natural resources will require ensuring the sustainability of the raw material base and

strengthening the utilisation of side and waste streams as well as extending the life cycle of products and planning and operating models in accordance with the circular economy.

Equity

Attention should be paid to the fair distribution of the bioeconomy's advantages and disadvantages in order to promote equal well-being for all. When setting bioeconomy objectives, it is essential to take into account possible conflicts of interest and equity between different parties. In terms of the participation of the parties concerned, it is essential to identify the needs and rights of different groups.

Ethical sustainability is a comprehensive theme that should be taken into account in general political preparation. According to the Government Programme, the transition to a carbon-neutral society must be done in a regionally and socially fair manner. In order to ensure a fair transition, a Scientific Panel on Ethical Sustainability is being put together, whose tasks will include acting as an independent advisory body to support the implementation of the Bioeconomy Strategy.

1.5 Education and competence

Competence and ensuring it are of primary importance in the bioeconomy operating environment defined in the strategy. Bioeconomy actors have identified industry-specific and common technological development needs related to the operating environment and business, both in education and working life.

Educating bioeconomy sector experts and producing new knowledge are essential. This will require a national ability to utilise not only information produced in Finland but also new knowledge produced elsewhere in the world. Bioeconomy research and the experts trained using this research are a prerequisite for innovations. Both public and private research are significant, and their interaction must be increased, for example through programmes. With regard to the creation and application of knowledge, the bioeconomy is a multidisciplinary environment in which a sustainable way of using renewable natural resources to produce bio-based products, food, energy and services is studied. The utilisation of digitalisation is increasingly linked to the bioeconomy is increasingly, for example in the form of artificial intelligence and the Internet of Things.

The range of studies related to the bioeconomy offered by higher education institutions has expanded. Universities and universities of applied sciences have dozens of degree programmes related to the bioeconomy from basic education to opportunities to specialise in bioeconomy (www.opintopolku.fi). For example, specialisation in bioeconomy is a module implemented by ten universities of applied sciences and two universities.

Open higher education offers opportunities to develop competence based on one's own interest or parallel with working life. The "Bioeconomy Expert's Competence Portfolio" is a study module offered by higher education institutions, which includes courses in bioeconomy offered as part of open higher education at many different higher education institutions.

An effort is made in vocational education and training and its planning to anticipate the increasing competence needs of different sectors, including the renewal of the bioeconomy. At the moment, challenges have been encountered between the provision of vocational education and training and the needs of professionals.

New competence needs and wishes related to strengthening resilience have been proposed for vocational education and training. In working life, competence requirements are constantly changing and vocational competence should be updated regularly, as tasks change and new technologies challenge employees. Natural sciences and specialisation in the bioeconomy alone are not enough, and education must also develop expertise related to cooperation and business: Management skills, understanding and implementing strategy processes, project work competence and other cooperation skills. As circular economy and ecosystem practices become more common, the understanding and skills for the utilisation of different business models will significantly challenge our corporate culture.

1.6 Environmental health and occupational safety in the bioeconomy

Bioeconomy products and raw materials are organic material. In certain circumstances, environmental health and occupational safety aspects should be taken into account in their handling. As the circular economy becomes stronger, the processing, storage and recycling of organic, biological raw materials will increase. Their properties change during biomaterial cycles, and new components are combined with their composition during use and handling.

As the bioeconomy develops, not only the working and storage conditions require attention but also the safety of end products (e.g. heavy metals, pharmaceuticals, organic pollutants) before they are introduced as either new or recycled materials.

The disposal of organic waste in landfills was prohibited in 2016. Numerous national strategies and EU directives include targets for the treatment of biodegradable waste fractions in ways other than incineration. In Finland, the permits and regulations related to occupational safety and health and the handling of chemicals are of a high standard. Innovations and products must be examined from the safety perspective as early on as possible. Environmental health and occupational safety and health are cross-cutting themes that are not examined in more detail in this strategy, but this perspective should be kept at the forefront to facilitate continuous support for the acceptability of bioeconomy products and activities.

2 Vision and strategic objectives

2.1 Definition of bioeconomy in Finland

Some clarifications were made to the definition set out in the 2014 strategy:

Definition of bioeconomy

In Finland, bioeconomy refers to an economy that relies on renewable, biological natural resources in a resource-wise manner to produce food, energy, products and services.

The most important renewable, biological resources in Finland are the biomass, i.e. the organic matter, in the forests, soil, fields, water systems and the sea, and fresh water. These are used as raw materials and derivates.

Ecosystem services are part of the bioeconomy.

The bioeconomy can also include the development and production of technologies, applications and services based on the sustainable exploitation of natural resources.

2.2 Vision

The Bioeconomy Strategy extends to 2035.

Vision of the Bioeconomy Strategy 2035

Sustainably towards higher value added.

The parameters for the increase in value added are the quality of work and the pay level, which reflect degree of education. The aim is that jobs will develop and new ones will be created with increasing investments. It would appear that development will not significantly increase jobs, but measures should ensure that the current number of jobs is maintained and the jobs are developed. Growth will be generated through improved work productivity based on technological development. These solutions can be used both in Finland and as engines for export growth.

2.3 Objectives

The strategy's main objective is to increase the value added by the bioeconomy. The aim is to create economic growth and jobs based on sustainable solutions by producing the highest possible value added products and services.

The value added of the bioeconomy was EUR 26 billion in 2019. The objective of the strategy is to accelerate the annual growth of the bioeconomy's value added from 3% to 4%. If the objective of the Bioeconomy Strategy is realised, the bioeconomy's value added will be EUR 50 billion in 2035.

The bioeconomy plays an important role in supporting the green transition of society. A sustainable bioeconomy is a solution to many climate and biodiversity issues. The active role of the bioeconomy in the green transition is contributing to ensuring socially and regionally just and economically sustainable change.

At the same time, the Bioeconomy Strategy also aims to:

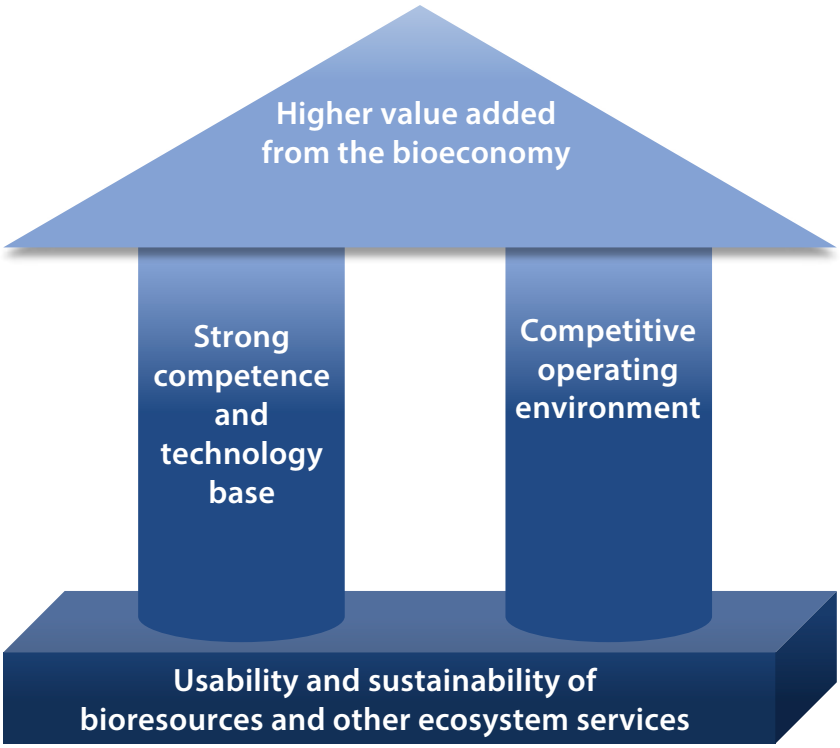
- create competitive and innovative bioeconomy solutions to global problems
- generate business that promotes renewal both to the domestic and international markets, which will bring well-being to Finland as a whole
- increase the resource-efficient use and recycling of materials and utilise side streams
- reduce dependence on non-renewable raw materials, especially those that are fossil based
- ensure ecological sustainability, social justice as well as the capacity of renewable natural resources to renew and to broadly strengthen bioeconomy competence
- strengthen and renew technological foundations

2.4 Strategic focus areas

The 2014 Bioeconomy Strategy's strategic goals have now been replaced by a focus area analysis. The changes to the analysis reflect the development of both our thinking and operating methods. Goals and the greatest need for measures are also largely parallel in a wide range of sectors. Chapter 3 outlines measures for the priorities presented, the main focus of which was on measures promoting the bioeconomy's value added in general and in different sectors.

The bioeconomy is based on ecological, social and economic sustainability. There are separate strategies for many of the factors on which this strategy, too, is based. The promotion of the bioeconomy still requires strong RDI investments and support for the commercialisation of innovations. Supporting the bioeconomy's value added was identified as an important priority area that other strategies do not currently support. The value added is also a good, distinctive spearhead in international and EU influence.

Figure 4. Strategic priorities of the Bioeconomy Strategy



3 Measures

The measures of the Bioeconomy Strategy are funded with existing resources such as the Sustainable Growth Programme for Finland. In addition, funding can be directed from conventional sources of public funding for the implementation of measures. Any additional funding will be decided on separately in the budget and government finances planning processes.

3.1 Higher value added from the bioeconomy

The aim of the Bioeconomy Strategy is to create economic growth and jobs based on sustainable solutions by producing products and services of the highest possible value added. The aim is also to increase the resource-efficient use and recycling of materials, to utilise side streams and to reduce dependence on non-renewable - especially fossil-based - raw materials. In order for the implementation of the strategy to be possible, the capacity for renewable natural resources to renew, ecological sustainability and social justice must also be ensured.

The economic output of the bioeconomy has primarily increased through increasing production volumes. However, in the future, more emphasis should be placed on investments and production that produce more value added. Concerns about the changing climate and the decline in biodiversity challenge the life cycles of the bioeconomy, the procurement of its raw materials and its products. Investing in new, resource-efficient processes will offer significant potential for increasing both total production and the value of the use of existing resources in the bioeconomy. Versatile service business has become an important part of the production of the bioeconomy's value added.

One of the bioeconomy's key strengths is the ability to make sustainable and efficient use of raw materials, including side streams, in the production of high value added products and chemicals. In the future, multi-product biorefineries, in which cellulose is not alone the main product, will produce a number of sustainable alternatives for existing fossil-based products. In biorefineries, cellulose can also be further processed into new products.

Resource efficiency through material recycling is an important area. It must be possible to recycle the materials used in the products as raw material either in the same or other value chains. Efficient recycling processes and effective circular economy business and social models are needed for this.

In order to recycle bio-based materials and products in a manner that increases the value added, new expertise and a new approach are needed for the design of materials, material systems and products. The design of products made from bio-based materials should take into account not only customer and functional requirements, but also material connections and differences, as well as the possibility of finding new uses for the components of the product or possibilities for clean material recycling.

The starting point for updating the Bioeconomy Strategy is a value pyramid, which begins with using the available raw materials as accurately and sustainably as possible. The realisation of a value chain requires the sustainable and profitable production of intermediate products. In addition to the current intermediate products, a larger amount and wider range of higher value added products will be produced. Products must be competitive and have a functioning market. Many bioeconomy products must also be competitive globally.

When aiming to increase the value added, it should be noted that sustainable, competitive volume business creates an important foundation for increasing the value added.

Measures

Draft and implement the RDI programme for the bioeconomy's green transition to strengthen the knowledge base for the development of bioeconomy competence, new products, resource efficiency, business and services

- Reform the contents of research and produce information for the development and commercialisation of new bioeconomy products and services
- Ensure cooperation between funding providers for the implementation of a coordinated programme package. This will ensure interaction between research and innovation work, the development of strategic competence in research and the impact on the entire bioeconomy cluster.
- Accelerate the commercialisation and scaling of new materials resulting from a bioeconomy where resources are used efficiently by supporting SMEs, start-ups and growth enterprises. Support can be focused on the development of spinoffs, on patents and on learning about commercialisation and scaling
- Identifying the role of flagship companies as an accelerator of ecosystems
- Gather research actors, companies and funding providers to discuss product concepts according to the PPP model and ensure that products are placed on the market, for example forest resource data collected with public funds and research data will be processed into a form needed for product development

- Measures will be produced to increase the sharing of researchers' expertise among higher education institutions, research institutes and companies, for example through fixed-term mobility funding
- The compatibility of the RDI programme with the national RDI roadmap (national smart specialisation programme) and the regions' smart specialisation programmes will be ensured
- The chain from scientific research in the bioeconomy to applied research must be intact

Responsibility: Ministry of Education and Culture, Ministry of Employment and the Economy

Actors: Academy of Finland, Business Finland, other ministries, regions

Promoting Finland as the location of pilot and demonstration plants for new, innovative bio-products and the first industrial scale plants of their kind.

- Strengthen funding for demonstration and equipment investments promoting the bioeconomy and the circular economy
- Strengthening the role of national (such as Bioruukki) and regional piloting environments in developing new methods for the sustainable and efficient utilisation of biomass and industrial side streams
- Reform and better reconcile Business Finland and Finnvera and regional development instruments and operating models to accelerate piloting and demonstration projects
- Utilise the room for manoeuvre provided by the EU Green Deal, sustainable growth (RRF) and a more European-centred industrial policy to support new industrial production pilot/demonstration and industrial scaling plant projects
- Bioeconomy and technology expertise to be increased to support the export of services

The objectives are also supported by such things as the acceleration lane for investments and the related development of the investment permits procedure, which have been agreed upon in the Government's mid-term policy review in 2021.

Responsibility: Ministry of Economic Affairs and Employment, Ministry of Agriculture and Forestry

Actors: Business Finland, Finnvera, VTT, Luke, Syke, The Finnish Climate Fund

Identifying the means of the bioeconomy to mitigate climate change and promote adaptation to its impacts and halting the loss of biodiversity.

Responsibility: Ministry of the Environment, Ministry of Agriculture and Forestry, Ministry of Economic Affairs and Employment

Regions are encouraged to prepare bioeconomy implementation plans on the basis of their own strengths

- Support the development of regional bioeconomy clusters and technology platforms and cooperation between them
- When preparing regional bioeconomy action plans ensure their compatibility with regional programmes and regional smart specialisation strategies.
- Implement the monitoring of regional action plans in the regions

Responsibility: Ministry of Economic Affairs and Employment, Ministry of Agriculture and Forestry

Actors: ELY Centres, regions, Finnish Forest Centre

3.2 Strong competence and technology base

RESEARCH

Research plays a key role in identifying the growth and potential of the bioeconomy as well as in demonstrating new utilisation paths. Without the competence and experts created by national research, new knowledge on the bioeconomy generated globally could not be utilised. Bioeconomy research covers the production, harvesting and use of bioresources and the development of processes, technologies and systems needed for these. Basic research of a high standard plays an important role in creating an understanding of how biological and ecological processes function so that the future bioeconomy works within the limits of sustainability. Understanding social change with all its consequences is an important part of bioeconomy research. Research will create the prerequisites for shaping the transition to a bioeconomy so that it is compatible with the requirements of society and the sustainable development goals. The aim is to create a scientific and technological foundation for sustainable bioeconomy products, processes and services.

Measures

Encourage more scientific research related to the bioeconomy, and increasing its impact

- Encourage multidisciplinary bioeconomy research, the topics of which may include the preconditions and constraints for bioeconomy growth, understanding biological processes, the identification of the ecological premises for the bioeconomy, the development of new biotechnology tools, health research, consumer research, etc.
- Promote the participation of companies in large research projects (for example, the Finnish Academy of Finland's flagship initiative FinnCERES)

Encourage more applied research related to the bioeconomy and increasing its impact

- Review and develop the funding instruments for applied research (e.g. Business Finland's Co-creation and Co-innovation) to facilitate the better assessment of the potential of new bioeconomy technologies, such as synthetic biology, nanotechnology, automation, robotics and artificial intelligence

Encourage actors to participate in international networks and to make use of EU research and innovation funding

Improve and encourage cooperation between research and business life by improving its preconditions and through the regional profiling of universities and universities of applied sciences. Identify, map and utilise the higher education sector's regional research infrastructures. Identify the competence provided by vocational education and training and the share networks play in an education path.

Responsibility: Ministry of Education and Culture, Ministry of Economic Affairs and Employment, Ministry of Agriculture and Forestry

Actors: Vocational institutions, higher education institutions, research institutes, Academy of Finland, Finnish Forest Centre, regions, companies

DEVELOPMENT OF TECHNOLOGY

The production of competitive products from biomass-based raw material will require new and more cost-effective processes. The processes must ensure the correct and stable product properties of the product, even though the quality of the raw material varies. The potential of many new products and processes is high due to the efficient use of raw materials and compliance with the principles of the circular economy. The development of the bioeconomy's industrial applications and technologies will be of wide-ranging benefit

if the new solutions are affordable, sustainable and easy to adopt in practice, and where possible supported by digitalisation. In addition, the development of new bioeconomy processes will create significant export and business opportunities for technology suppliers in the sector.

Inputs will also be needed to help scale business. New technologies and processes are often capital intensive investments with a long payback period. Opportunities to support piloting plants, high-risk demonstration projects and the industrialisation of new products significantly accelerate development.

Measures

Support the creation of new types of networks and partnership models for the development and utilisation of technologies

- Support national and regional bioeconomy piloting and demonstration infrastructures and increase cooperation with European bioeconomy infrastructures, for example through the Pilot4U network and database
- Strengthen bioeconomy renewal and networking across sectors in Business Finland missions and programme work
- Support the bioeconomy's innovation and business ecosystems for example through funding from Business Finland's flagship company and ecosystem funding
- Encourage and help actors to become involved in international networks and to make use of EU research and innovation funding

Responsibility: Ministry of Employment and the Economy, Ministry of Education and Culture, Ministry of Agriculture and Forestry

Actors: ELY Centres, research institutes, companies, vocational institutions, higher education institutions

OPTIMAL UTILISATION OF DIGITALISATION

The digitalisation of the bioeconomy has already progressed quite far. An enormous amount of data and highly automated processes create a good foundation for the next digital leap. Digitalisation and investments in the future of industry must also be used to optimise the bioeconomy's existing industrial production and to increase its efficiency. Circular economy digital projects and European platform economy cooperation provide a good foundation for achieving a safe, transparent and origin-enhancing operating model in the transfer of information when data transfer interfaces are compatible. The EU Green Deal includes its own requirements, for example in the form of an electronic product card.

Measures

Preparing for the bioeconomy's next digital leap, in which data is used to produce value added, for example as services or modelling tools

- Cooperation projects combining the bioeconomy and the circular economy will be launched to develop data compatibility by experimenting and building trust in a constructive environment. The aim is to produce open data that respects the ownership of data, based on which new products and services can be designed based on digital modelling
- Digital platforms suitable for bioeconomy cooperation networks will be developed to improve efficiency. Strengthen the connection to development programmes and experiments in the digitalisation of the circular economy
- Build an operating method for linking data on carbon footprint and other sustainability aspects to e.g. food products and raw materials, which already have highly transparent monitoring
- Add the needs for the digitalisation of the bioeconomy to national and EU level digitalisation and artificial intelligence programmes

Responsibility: Ministry of Economic Affairs and Employment, Ministry of Transport and Communications, Ministry for Foreign Affairs, Ministry of Agriculture and Forestry

Actors: Sitra, Business Finland, VTT Technical Research Centre of Finland, GAIA-X Foundation, research institutes, regions, companies, vocational institutions, higher education institutions, Finnish Forest Centre

STRONGER RESEARCH AND EDUCATION

Versatile expertise in the bioeconomy is a competitive advantage. Positive development must be managed to ensure that natural sciences education and interdisciplinary understanding can remain a strong part of Finnish society. Education in the bioeconomy will be developed in a steadfast manner at all levels of education. Employers should encourage employees to take part in continuous learning and see the strengthening and updating of competence as a key factor of competitiveness.

Measures

Enhance the appeal of the bioeconomy sector as an alternative for students through excellent study content and communication, and develop forms of cooperation in continuous learning, including between educational institutions and business life

- Improve the appeal of education and training in the field by highlighting the opportunities in careers in the bioeconomy sector through communication that appeals to young people
- Build and strengthen bioeconomy education networks that can be used to anticipate and promote the availability of skilled labour for the needs of society throughout the country. Support cooperation between education levels in education and training related to the bioeconomy
- During anticipation work and the planning of studies, take into consideration the up-to-date competence and sustainable transition needs of bioeconomy and circular economy employers in degree programme content to ensure the availability of skilled labour and up-to-date and versatile competence
- Business models and competence related to the content of business must be included as part of the education. Work to improve competence in strategy management, project work and cooperation skills is also recommended at all competence levels
- Ensure the quality of teacher education and continuing education in bioeconomy and circular economy themes
- Support the development of competence in the workplaces and among working-age people through long-term development of continuous learning, which responds to changing development prospects, such as structural changes in the bioeconomy and demographic change caused by the circular economy and digitalisation. Resources will be allocated for organising education and training in accordance with the idea of continuous learning.

Responsibility: Ministry of Education and Culture, Finnish National Agency for Education, Ministry of Economic Affairs and Employment, Ministry of Agriculture and Forestry

Actors: Vocational institutions, higher education institutions, regions, anticipation working groups, companies

3.3 Competitive operating environment

The bioeconomy's operating environment is determined by the national, EU-level and international operating environment and the related legal and policy environments. Bioeconomy investments require a fairly long payback period, and actors must be able to rely on the predictability of the legal and policy environment. On the other hand, if the ways of using renewable raw materials change, for example, in a direction that produces more value added, there may be characteristics in the current operating environment that do not support this. EU regulation is an important part of the Finnish bioeconomy's regulatory environment. Areas such as financing, industrial policy, research and development policy and agricultural and environmental policy are subject to EU regulation. New bio-refinery investments and the development of existing plants are important so that high value added products can be brought to the market.

Measures

Examination of the characteristics and possible incentives of the sector related to the commercial use of ecosystem services and entrepreneurship

- Determine the characteristics of the sector related to the commercial use of ecosystem services and entrepreneurship (in the forest sector in particular in "other income from forests") and what types of incentives (including taxation) would be useful for developing value added

Responsibility: Ministry of Agriculture and Forestry, Ministry of Finance, Ministry of Economic Affairs and Employment

Actors: Research institutes

Continue the streamlining of permit processes for bioproduction plants by strengthening cooperation between authorities in order to attract investments

- Cooperation between authorities and applicants will be developed and established
- Utilise digital information in the application process

Responsibility: Ministry of the Environment, Ministry of Economic Affairs and Employment

Actors: ELY Centres, Regional State Administrative Agencies, centres of expertise in bioeconomy and circular economy

Promoting the use of public funding instruments for the different stages of the development of bioeconomy value chains

- Provide information in a manner better than at present to actors about the possibilities of using bioeconomy funding instruments and develop advisory services related to these
- Develop guarantee and financing instruments to more effectively support the growth of bioeconomy start-ups
- Increase business advisory services for SMEs and provide better communication on available funding opportunities;
- Ensure that public investments in the development of logistics solutions, data networks and transport infrastructure are sufficient to support new biorefinery investments and other bioeconomy business taking into account the changes that will take place in production and consumption.

Responsibility: Ministry of Economic Affairs and Employment, Ministry of Agriculture and Forestry, Ministry of the Environment, Ministry of Transport and Communications

Actors: ELY Centres, Business Finland, Finnvera, Tapio Oy, regions

Increasing the impact of sustainable funding and new performance-based funding models

- Examine the usability of a performance-based funding model utilising private investment capital to promote bioeconomy objectives
- Increase communication provision on sustainable finance ecosystems steering private investment capital towards solving key bioeconomy challenges and accelerating growth opportunities

Responsibility: Ministry of Economic Affairs and Employment, Ministry of Agriculture and Forestry, Ministry of the Environment

Actors: Finnish Climate Fund, Finnish Industry Investment, Centre of Expertise for Impact Investing

Encouraging cross-border cooperation

- Prepare a Memorandum of Understanding (MOU) with key partner countries based on the needs of companies and actors
- Strengthen bilateral cooperation with Sweden and other neighbouring countries in bioeconomy sectors, including research

- Support the participation of operators in the EU's joint bioeconomy networks and projects;

Responsibility: Ministry of Economic Affairs and Employment, Ministry of Agriculture and Forestry

Actors: ELY Centres, Business Finland, regions, vocational institutions, higher education institutions, research institutes

3.4 Usability and sustainability of bioresources and other ecosystem services

Bioresources refer to all bio-based materials such as plants, animals, microbes and bio-based process side streams. Sustainable biomass production based on Finland's abundant renewable resources and water systems provides a solid basis for bioeconomy value chains, the most important of which are currently agriculture, the food system, forestry, forest-based products and materials, wood construction, wood products and bioenergy, as well as food, energy and other commodities produced from water. There are still unused possibilities in water biomass (e.g. underexploited fish species and algae). Sustainable forest management and use as well as plant breeding ensure the availability of bioresources and ecosystem services also in the changing climate.

The basic requirement for the availability of bioresources is profitable agriculture and forestry, as well as fishing and aquaculture, while safeguarding ecological sustainability and social equity. The use of renewable natural resources will increase as we move from the fossil economy to the bioeconomy, while the strong growth of the world's population will also increase the demand for food. There are many ways to increase the sustainable production of bioresources while ensuring biodiversity.

The growth potential of the Finnish bioeconomy is largely due to the resource efficient utilisation of our biomass reserves and the increased value added of products and services based on them. We will need research-based information on the availability and sustainable use of biomass resources, new business models and funding models as well as cross-sectoral cooperation.

Ecosystem services is a concept developed in environmental economics, which refers to tangible and intangible services produced by natural processes. They are transformed by human activity into goods for which a monetary value can be determined. The operation of land and water ecosystems will be secured intergenerationally.

Measures

Increasing information on the demand, availability and competitive status of biomass and side streams by improving statistics and ensuring that information is available to actors. Developing digital platforms and increasing their number in cooperation with different actors

- Determine the impacts of carbon compensation on the sustainable production, use and market of biomasses
- Utilise and develop existing digital marketplaces for side and waste streams
- Encourage companies in different sectors to engage in regional cooperation to develop a business ecosystem based on side and waste streams
- Develop monitoring methods to demonstrate the origin and sustainability of biomass to the consumer, including information on the environmental sustainability of new technologies and processes;
- Introduce new tools for gene technology, make more versatile use of genetic resources and enhance processing processes

Responsibility: Ministry of Agriculture and Forestry, Ministry of Economic Affairs and Employment, Ministry of the Environment, Ministry of Social Affairs and Health

Actors: Natural Resources Institute Finland, National Land Survey of Finland, VTT Technical Research Centre of Finland, vocational institutions, higher education institutions, Finnish Forest Centre

Increase the value added of industries based on ecosystem services by improving the supply of ecosystem services and strengthening the natural product sector;

- Examine the sustainable value added potential of ecosystem services, develop business models and markets based on them, and, where necessary, develop technologies (e.g. soil carbon sequestration and maintenance of carbon stocks by developing technologies, health tourism, adaptation to climate change)
- Developing production methods and plants for the production of and new business models for biomass grown in former peat production areas

Responsibility: Ministry of Agriculture and Forestry, Ministry of Economic Affairs and Employment

Actors: Advisory organisations, research institutes, companies, landowners, Finnish Forest Centre

3.5 Increasing value added in different sectors

The industrial structure of the bioeconomy is increasingly cross-sectoral. The introduction of solutions will require the creation of new types of value chains across traditional sectoral boundaries. However, the increase in value added will also be examined by sector, which will facilitate monitoring with existing instruments.

THE FOREST SECTOR

A number of new forest-based products and services are under development and coming to the market, including food packaging, textiles and biocarbon and its composites. Wood-based biodegradable materials will increasingly be used in place of fossil-based plastics. The multiuse of forests and forest-based services will also diversify and increase. The importance of digitalisation will increase in the sector, for example in trade, and interest in automation, robotics, machine learning, artificial intelligence and big data in the supply chain will increase. They also provide preconditions for improving resource efficiency, which will promote the more sustainable use of raw materials. In practice, increasing efficiency in the use of raw materials means that more products and value added are obtained from the same amount of wood. Side streams are utilised for the highest possible degree of processing. Trees and timber products as carbon sinks or stores will contribute to increasing the sector's potential for earning income.

The forest sector aims to establish not only intermediate products (e.g. cellulose), but also to manufacture products with a higher degree of processing in Finland, increase the formation of value added for the product portfolio by means of new products and services, improve the management of material flows, for example by means of digitalisation, and increase the utilisation of side streams in products with a higher degree of processing while respecting the principles of the circular economy. The new revenue logics support the desired development.

Sustainable forest management is at the core of the forest-based bioeconomy. Versatile forests with a high level of biodiversity are the ecological foundation on which all forest management and use is based. The carbon sequestration capability of forests will also be managed. Many objectives will be taken into account in a balanced manner when planning forestry and promoting a sustainable bioeconomy.

Chemical forest industry

As the paper market declines, the chemical forest industry has had to look for new areas of business. New business is being sought from a variety of biomaterial applications where bio-based chemicals and fuels, packaging, textiles and biocomposites are interesting

markets for the future. Entering these markets will require both the development of new technology and expertise and new business models and cooperation structures.

Finnish cellulose expertise is of a very high standard, and it offers an opportunity to take a try at the bio-based materials market with new and advanced cellulose materials.

Measures

Companies are encouraged to launch new industrial ecosystems with the aim of developing technologies and business concepts around new bio-products

- Pulp fibre from wood will be utilised in new applications such as textiles, biocomposites, packaging, etc.
- Utilise forest industry side streams as new products (e.g. lignin, extractives, hemicellulose)

Promoting an increase in value added for bio-based packaging

- Accelerate the development of cellulose-based packaging and related material-neutral technologies for the needs of the global food and beverage industry
- Ensure the safety of Finnish bio-based packaging products as well as their competition and environmental performance in food packaging through the RDI programme and by strengthening competence
- Support the circulation of packaging with digital solutions and deposit systems
- Encourage cooperation throughout the packaging value chain

Responsibility: Ministry of Economic Affairs and Employment, Ministry of Agriculture and Forestry

Actors: Business Finland, VTT Technical Research Centre of Finland, CLIC Innovation, companies, vocational institutions, higher education institutions, research institutes

Strengthening the resource-efficiency and cost-effectiveness of the forest sector through digitalisation

- Invest in the digitalisation of wood procurement and biorefinery processes and in precision steering accelerated by Big Data so that the resource-efficiency and cost-effectiveness of the entire value chain is improved, thus increasing the amount of raw material used

- Increase the formation of forest bioeconomy value added by making the use of Big data more efficient so that the raw material is steered to products and services with the highest possible value added

Responsibility: Ministry of Agriculture and Forestry, Ministry of Economic Affairs and Employment

Actors: Finnish Forest Centre, Natural Resources Institute Finland, Business Finland, VTT Technical Research Centre of Finland, vocational institutions, higher education institutions, companies

The wood products industry and construction

Sustainable wood construction and other timber products have significant potential for carbon sequestration and storage, as they serve as long-term carbon stocks. The challenges and opportunities encountered by the sawmill industry and timber product manufacturers are related in particular to the resource-efficient use of materials throughout the manufacturing and end-use processes and to the replacement of fossil-based materials and products used in construction with renewable, low-carbon timber products.

The efficiency and productivity of construction must be significantly improved. Industrial wood construction provides an opportunity for a productivity leap in the entire construction sector. In addition to product development in the sector, this will require the development of the entire construction process; overall optimisation of design, industrial prefabrication and site operations. The focus must be on design and product standardisation, process development of industrial prefabrication and the optimisation of work site operations as enabled by industrial prefabrication. The development of digital tools supports and is a prerequisite for the overall optimisation of the industrial wood construction process. There is a need for product development, especially in the recycling and reuse of materials as well as low-carbon fibre-based insulation materials in wood construction. The objective must be optimal building performance with minimal environmental and climate impacts.

Measures

Improving the resource efficiency of the wood product industry and wood construction in energy, raw materials, labour, information and capital use

- Make use of EU and Finnish low-carbon construction programmes, which support advanced overall solutions for housing, construction and infrastructure, to promote timber products and wood construction.

- Encourage the introduction of new technologies to increase energy and material efficiency
- Develop comprehensive information systems from the tree stump to the customer
- Make better use of the raw material base in production processes and customer solutions than previously

Improve the product properties of wood in the current areas of use and expand use to new application areas

- Improving the longevity of wood by utilising wood modification and surface modification technologies
- Develop fibre-based insulation materials
- Develop bio-based chemicals, such as saturation, gluing and surfacing substances

Promote the use of wood and other natural materials in new construction

- Promote the development and use of Finnish renewable construction products by directing research and development inputs to renewable construction materials, product parts and process development in construction. Development targets include wood construction in its entirety, glues, insulation, paints, fire safety solutions, infrastructure construction, additional layer construction, etc.
- Promote the system leap in apartment block construction by investing in the broad-scoped development of industrial wood construction such as its digital development, increasing the competence level of experts in the field (especially demanding wood structures), developing the overall process of industrial wood construction (design - industrial prefabrication - site operations) and developing the role of construction processes and developer competence
- Promoting wood construction in public procurement.

Support the development and export of construction products that increase the value added of wood

- Launch an export programme for log and solid wood buildings by supporting industrial investments and exports and increasing the incentives based on the unique climate and environmental profile of logs and solid wood

- Promote the export of wood-based building components by supporting industrial investments, developing component exports and networking with the construction sector in the target market through product exports

Responsibility: Ministry of the Environment, Ministry of Agriculture and Forestry, Ministry of Economic Affairs and Employment

Actors: VTT Technical Research Centre of Finland, Finnish Environment Institute, Natural Resources Institute Finland, vocational institutions, higher education institutions, Finnish Forest Centre, the sector's industry and companies

THE FOOD SECTOR

Versatile food production and the export of high-quality products will change agriculture and food industry processes. For example, the growing need for new plant-based food products will create opportunities for the entire food chain. In addition, many other solutions under development, such as vertical farming and cellular agriculture, can open up new business and export opportunities for Finnish agricultural and food products.

The food sector's share of the Finnish bioeconomy's value added is growing. The increase in value added will require that cultivation techniques are improved, new crops are introduced and self-sufficiency is increased, for example in feed. In the next few years, value added will be created in the Finnish and export markets with high-quality food and beverage products and digital information on product responsibility.

The aim of the food sector is to increase the value of its product portfolio, enhance the use of production inputs through digitalisation and utilise the regional strengths in the food chain. Circular economy methods are particularly aimed at improving the circulation of nutrients. The opportunities provided by digitalisation are widely utilised in the development of production technologies and methods.

Measures

Developing agriculture and food economy in a consumer-oriented manner with the aim of sustainable and profitable agriculture and food economy

- New technologies will be utilised in the development work throughout the entire food value chain
- Develop production and products based on plant-based raw materials (including natural products) into food (including synthetic food), growing medium, textiles, building materials, etc, in a determined and systematic manner.

- Developing raw materials and products of high value added from agricultural and food economy side streams for both the Finnish market and export markets
- Digitalisation and data will be strengthened as a base for value added and new services (incl. data collection required for organic production)
- Participate in international networks and value chain-based development projects such as EU research and innovation projects;

Responsibility: Ministry of Agriculture and Forestry and Ministry of Economic Affairs and Employment

Actors: Natural Resources Institute Finland, VTT Technical Research Centre of Finland, other research institutes, vocational institutions, higher education institutions, companies

Utilise genetic resources more diversely than before and create opportunities for the improved efficiency of breeding processes

- The legislation on the introduction of new gene technologies will be adapted in the light of scientific and technical progress;

Responsibility: Ministry of Agriculture and Forestry, Ministry of Social Affairs and Health, Ministry of Economic Affairs and Employment, Prime Minister's Office

Actors: Plant and animal breeding operators

THE ENERGY SECTOR

Bioeconomy plays an important role in energy production in Finland. Bioenergy, meaning energy produced from biomasses, is our most important source of renewable energy. The growth in biomass material use and the higher value added are expected to transfer the by-product streams that were previously used directly as energy directly to further processing. On the other hand, the termination of peat use in energy production is expected to increase the demand for biomass and, in particular, for wood fuels in energy production in the next few years.

Measures

Increasing the efficiency of bioenergy raw materials and production

- Enhance the value chain from biomass harvesting and storage all the way to energy plant conversion and recovery technologies

- Further develop logistics for the harvesting and storage of energy biomasses, taking into account security of supply considerations, and develop the predictability of the availability and adequacy of Finnish energy biomasses
- Develop value chains based on biogas, e.g. build biogas plants and biogas cleaning and transport processes at farms, build a biogas distribution network and develop the distribution markets for recycled fertilisers

Responsibility: Ministry of Agriculture and Forestry, Ministry of Economic Affairs and Employment

Actors: Energy and forestry sector actors, Energy Authority, Finnish Safety and Chemicals Agency, National Emergency Supply Agency, vocational institutions, higher education institutions, Finnish Forest Centre

Supporting the development and production of electric fuels

- Support bioenergy hybrid pilots and demos to increase the readiness level of technology
- Develop BIO-CCU processes with the aim of achieving negative carbon emissions from industry
- Create hybrid concepts and process integrations that produce not only energy but also materials

Responsibility: Ministry of Economic Affairs and Employment, Ministry of Agriculture and Forestry

Actors: VTT Technical Research Centre of Finland, Business Finland, research institutes, vocational institutions, higher education institutions

WATER AND WATER BIOMASS

Finland has unique inland water systems, coastal areas and archipelago, rich fish resources, large freshwater and groundwater reserves and efficient water supply. These resources combined with advanced technology and expertise will facilitate both the sustainable utilisation of natural water resources and the substantial growth of business based on water supply solutions. Climate change and urbanisation emphasise the importance of well-functioning water supply, and this also involves a significant potential for exporting technology and expertise (Growth portfolio 2.0). The utilisation of new technologies such as digitalisation, automation, robotisation and the platform economy will also facilitate the growth of value added.

Water expertise clusters, ecosystems and networks have already emerged in many regions in Finland. These include the region's municipalities, actors in the water, energy and waste sectors, other companies and educational institutions. However, cooperation between regional and county centres of expertise and national cooperation must be further strengthened.

In water supply, wastewater in particular is seen as a resource and nutrients and other valuable substances, such as metals, can be recovered from it. Heat energy can also be recovered from waste water, and biogas can be produced from the sludge produced as a by-product of wastewater treatment. Significant sustainable growth potential also exists in aquaculture as well as in the processing of algae, large numbers of underutilised fish species (e.g. carp and herring) and by-flows from the fish industry into food products and high added value products (nutrient supplements, cosmetics industry and medicine-like products).

Measures

Securing a high-quality and efficient water supply and utilising the related export and growth potential in cooperation between the public and the private sectors

- Development of experimental and piloting environments, reference and pilot projects and industrial symbioses in the water sector for testing and utilising new innovations and technologies, such as the recovery and utilisation of energy and material resources contained in urban waste water, the production of new water, the removal of pollutants and the sustainable use of sludges.
- Promote the implementation of technological innovations and new methods and business models for the renovation and modernisation of water infrastructure. Utilise public investments in the water sector as references in the development of export business

Responsibility: Ministry of Agriculture and Forestry, Ministry of Economic Affairs and Employment, Ministry of the Environment

Actors: Companies, actors in the water, energy and waste sectors, research institutes, educational institutions, municipalities, regional authorities

Multiplying the added value to water biomass

- Support sustainable growth and renewal of Finnish fisheries by targeting development and investment support to the largest and most resource-sustainable growth opportunities. The specific objective is to promote the processing of the abundant but underutilised fish species, algae and

by-streams from the fish industry into food and products with high value added (nutrient supplements, cosmetics and pharmaceutical-like products) and to accelerate their export.

- Promote the development and deployment of new aquaculture technologies, such as water recirculation plants, on land, in inland waters and in open sea areas, including, taking into account the achievement and maintenance of good state of both inland and sea waters. Sustainable aquaculture opens up opportunities for the sustainable growth of fish and algae production and exports of related technology and expertise. Cooperation between the private and public sectors will accelerate the development and deployment of new sustainable operating models and technologies promoting water protection, such as measures to reduce nutrient emissions

Responsibility: Ministry of Agriculture and Forestry, Ministry of Economic Affairs and Employment, Ministry of the Environment

Actors: Natural Resources Institute Finland, VTT Technical Research Centre of Finland, Finnish Environment Institute and companies

BIOECONOMY SERVICES

In addition to investments and new technologies, various services can be used to accelerate the development of the bioeconomy. Bioeconomy value chains include strong service production related to the growth, harvesting and transport of bioresources. In Finland, both technology suppliers and consultancy companies are competent and internationally respected. In recent years, technology suppliers have significantly increased the service business related to their products.

Consultations concerning technical services and the bioeconomy are expected to increase and diversify significantly as a result of digitalisation. The integration of digitalisation with services will also bring new opportunities for reaching consumers.

The natural products sector

Natural products (berries, mushrooms, herbs, sap and ornamental plants) can be used to develop high value added consumer products with export potential. There are hundreds of companies in the natural products sector that practice the collection, cultivation or semi-cultivation of natural products. The commercial recovery of natural products is growing in the food, well-being and cosmetics industries and in the nutrition sector. Organic certification can be utilised in the natural products sector.

Increasing value added in the natural products sector

- Promote the use of natural products in the food, biotechnology, cosmetics, pharmaceutical and herbal industries.
- Create new business models by combining natural products with welfare services, health and tourism.
- Improve network-like cooperation across sectoral boundaries to develop innovative products and services related to natural products.
- Develop the business ecosystem of the natural products sector and the activities of the sector's value network

Responsibility: Ministry of Agriculture and Forestry, Ministry of Economic Affairs and Employment

Other actors: Ruralia Institute, Finnish Forest Centre

Nature tourism

Tourism based on the biodiversity of natural ecosystems is becoming more versatile, growing and finding new ways for generating revenue. Nature as an environment enables a versatile range of activities (incl. cycling, fishing and hunting) on land, water and air all year round. Nature offers raw materials for the development of food tourism and well-being tourism based on nature in the operating environment. The ecologically sustainable utilisation of nature must be ensured in the provision of tourism services.

Productise and market services that utilise nature to both Finnish and foreign customers

- Promote the operating preconditions for tourism services and health and well-being services based on natural ecosystems, such as forests and water systems
- Promote cooperation between nature tourism and other nature entrepreneurs
- Strengthen innovation activities, customer-oriented marketing and sales
- Encourage the utilisation of technology and digitalisation in the sales and marketing processes and product development of nature tourism
- Communicate funding opportunities for SMEs and develop existing instruments to support development and experimentation
- Practical experiments with new funding and operating models and research supporting them will be implemented to ensure the quality of the natural environment. Develop statistics on nature tourism and recreational use to distinguish them from other tourism

Responsibility: Ministry of Economic Affairs and Employment, Ministry of Agriculture and Forestry, Ministry of the Environment

Actors: Natural Resources Institute Finland, Metsähallitus, companies, Finnish Forest Centre

THE TEXTILES AND CLOTHING INDUSTRY

The processing of bio and waste-based textile fibres and other materials needed in textile production, and the development and export of related technologies and competence, can increase the value added and exports gained from bio-economy raw materials, and at the same time decrease the harmful environmental impacts of the textiles industry. The majority of the raw materials used in the textile and clothing industry remain primary raw materials, and the most common raw material in the clothing industry is polyester produced from oil. Today's raw material production consumes a great deal of energy, water, chemicals and non-renewable natural resources, and produces emissions. In the EU, textiles consume the fourth largest amount of natural resources, and are the fifth largest source of CO2 emission. Globally, the textile sector produces more greenhouse gas emissions than shipping and air transport together. The textiles industry is aiming to implement more sustainable and circular operating models that can reduce climate and other harmful environmental impacts. -

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The textiles industry is aiming to implement more sustainable and circular operating models that can reduce climate and other harmful environmental impacts. Sustainable bio-based and waste-based raw materials, material recycling and closed cycles as well as the development of related technologies, innovations and expertise play an important role. Clean technologies developed in Finland and innovative bio-based and waste-based fibres can in the future replace the use of traditional materials such as cotton, viscose or polyester in textile products. The development of new bio-based and waste-based textile fibres is a globally significant area of research and development in which Finland has great export potential. -

Measures

Launch a programme for the development of bio-based and waste-based textile fibres and materials

- Supplement and develop the value chain in Finland required by the textiles industry's closed cycle system and high value added production and develop missing parts (e.g. twine spinning and fabric weaving)
- Encourage industry actors to participate in international networks and value chains and to make use of EU research and innovation funding;
- Promote Finland's profile as a centre of the bio- and waste-based textile sector at the EU level as part of the strong construction of the textiles sector's closed cycle value chain in Finland.
- Develop the textile industry's raw material base: Exploiting the side streams of agriculture and forestry and the food industry, and the use of new plant species and other bio-based raw materials in the textile industry;
- Develop new bio-based dyes and auxiliary chemicals
- Develop new technologies and methods for the utilisation of bio- and waste-based textile fibres
- Develop the assessment of the environmental and climate sustainability of textiles and the related flow of information all the way to consumers
- Develop the product design of both industrial textiles and clothing and circular economy business models

Responsibility: Ministry of the Environment, Ministry of Agriculture and Forestry, Ministry of Economic Affairs and Employment

Actors: VTT Technical Research Centre of Finland, Natural Resources Institute Finland, Finnish Environment Institute, Finnish Textile & Fashion, textile sector companies, higher education institutions

THE CHEMICAL INDUSTRY

The chemical industry is undergoing a raw material revolution. The industry is shifting from fossil-based raw materials to bio-based, recycled and synthetic raw materials. In a carbon neutrality scenario commissioned by the chemical industry, the share of bio-based and recycled raw materials it uses would increase to 83% by 2050.

Bio-based chemical products come from forest industry side streams, crop cultivation and its side streams as well as municipal waste from which basic chemicals, transport fuels,

solvents and composites can be produced. The demand for bio-based plastics is growing not only as a substitute for oil-based plastics, but also because of their diverse properties. The development of technologies is still ongoing and will require additional investments.

The complex and varying composition of biomasses will require new and improved processes for component separation and fractionation as well as conversion and product cleaning. This also applies to the side streams of biomass processing and recycled bio-based products as raw materials.

The demand for bio-based chemicals is growing steadily. The preconditions for bio-based products will be strengthened as more and more political decisions restrict the use of fossil raw materials and consumers increasingly demand renewable alternatives.

Measures

Launching extensive ecosystem projects to develop biomass-based chemicals and fuels

- Ensure the availability of bio-based and side-stream raw materials to accelerate new production plant investments
- Develop separation and purification technologies for biomass-based chemical manufacturing processes
- Utilise biotechnology's new tools, such as synthetic biology and gene scissors
- Develop manufacturing technologies for bio-based plastic

Responsibility: Ministry of Economic Affairs and Employment, Ministry of the Environment, Ministry of Agriculture and Forestry

Actors: Companies, Business Finland, VTT Technical Research Centre of Finland, higher education institutions, the Finnish Climate Fund, other actors in the sector

4 Monitoring

4.1 Management of strategy implementation

The Finnish bioeconomy strategy will be implemented in cooperation by several ministries. The Ministry of Economic Affairs and Employment will continue to coordinate the work as the responsible ministry. The Ministry of Economic Affairs and Employment will appoint a steering group and a secretariat for the strategy. The steering group will be tasked with monitoring the progress of both the strategy and its measures.

The organisations in the administrative branches of these ministries will take part in the adoption of the strategy extensively. The implementation will utilise a national Bioeconomy Panel comprising bioeconomy stakeholders, which will continue as a broad-based dialogue and cooperation group. The Ministry of Economic Affairs and Employment will set up a panel whose composition can be changed during the term. The ministries' steering group members will also be involved in the panel. The panel's work will be supported by the secretariat of officials.

The panel may establish its own working groups, projects, programmes and other activities. As a rule, ministries can assist in practical work but will not provide financial support for the implementation of projects unless they have been allocated resources in the budget.

Communication will continue to be implemented in cooperation between the communications group, which has worked well during the previous strategy period, and it will be supported by the biotalous.fi website.

4.2 Monitoring of the strategy and measures

The impacts of the Finnish Bioeconomy Strategy will be monitored through a set of statistics produced in cooperation between the Natural Resources Institute Finland and Statistics Finland. The indicators for the monitoring the implementation of the strategy's key objectives are the bioeconomy's

- value added
- investments
- export of goods
- number of employed people

Natural Resources Institute Finland and Statistics Finland specify the existing indicators for each industry and sector as one strategic measure. One of the strategy measures will be the more specific definition of responsibilities and methods. The clarification of the industries and sectors covered by monitoring and the manner in which they are presented may in some respects alter the previously presented figures on bioeconomy value added, investments, exports of goods and number of employed people.

Ecological, economic and social sustainability is monitored with other existing indicators, including sector-specific indicators. For example, social sustainability indicators are monitored in the monitoring of sustainable development in accordance with the UN Agenda 2030, www.kestavakehitys.fi. In addition, the sustainability indicators included in the EU Bioeconomy Strategy will be used. The appropriate indicators of other strategies and policy programmes, such as diverse ecosystem services-related indicators, will also be used in monitoring the strategy

The monitoring of the Bioeconomy Strategy examines which indicators or measurements of ecological sustainability are suitable for assessing the impacts of measures.

The Ministry of Economic Affairs and Employment is responsible for implementing the monitoring of the strategy's impacts. The strategy will be assessed for the first time at the latest in 2024 and during each government term thereafter.

The impacts of the strategy have been assessed in scenario work and in reviews of Finland's national economy.

5 Appendices

5.1 Appendix 1: Updating the Bioeconomy Strategy

5.1.1 Organisation

On 1 July 2020, the Ministry of Economic Affairs and Employment appointed a steering group, coordination secretariat and a national Bioeconomy Panel for the update of the Bioeconomy Strategy.

The steering group was tasked with steering the progress of the bioeconomy strategy update, deciding on the necessary studies and other measures, presenting proposals on the objectives and limitations of the strategy, and outlining the key guidelines for the preparation of strategy work in accordance with the guidelines of the Ministerial Working Group on Climate and Energy Policy. The steering group was chaired by Petri Peltonen, Permanent Under-Secretary at the Ministry of Economic Affairs and Employment, and included representatives from the following ministries: Ministry of Economic Affairs and Employment, Ministry of Agriculture and Forestry, Ministry of the Environment Ministry of Education and Culture, Ministry of Social Affairs and Health, Ministry of Finance, Ministry of Transport and Communications, Prime Minister's Office.

The Coordination Secretariat was responsible for the practical progress and timetable of the strategy update as well as for writing the actual updated bioeconomy strategy, utilising such things as the commissioned background studies, completed scenario reviews, materials from the bioeconomy panel workshops and other hearings, the views of experts and the scientific world, as well as other relevant reports and information, such as the updated EU Bioeconomy Strategy and the European Green Deal. The Ministry of Economic Affairs and Employment, the Ministry of Agriculture and Forestry, the Ministry of the Environment, the Ministry of Education and Culture, the Ministry of Social Affairs and Health and the Ministry of Transport and Communications were all represented in the secretariat.

The role of the Bioeconomy Panel was to participate in the preparatory work and in drawing up policies as an advisory body. This allowed for comprehensive dialogue with stakeholders and made it possible to get the entire field to commit to the objectives and implementation of the strategy. At the end of the preparatory phase, the panel will also continue its work as a bridge over government terms.

5.1.2 Background assessments

An **operating environment analysis** was used to create a picture of the change in the bioeconomy's operating environment after the publication of the 2014 Bioeconomy Strategy. **Scenarios** produced a future picture of the bioeconomy, described the significance of the bioeconomy to the national economy and assessed the strengths of the bioeconomy, or the so-called hard core, which can be used to increase the bioeconomy's value added. A commissioned report produced estimates on value added and measures to increase value added in different sectors of the bioeconomy. A SWOT analysis was created in the scenario work.

Regional bioeconomy forums examined the potential success factors of the bioeconomy from the perspective of the regions and how their development can be supported. A comparative study on **bioeconomy strategies in other countries** collected comparative information on solutions in other countries. The **Otakantaa.fi** website allowed all Finns the opportunity to share their views on the bioeconomy strategy.

At the **Bioeconomy Panel's strategy workshops**, stakeholders brought their own views to the vision and measures through low-carbon roadmaps and cross-cutting themes from different sectors.

The update has also utilised existing strategies and programmes or those under preparation that have clear links to the bioeconomy.

5.1.3 Communication

The update of the Bioeconomy Strategy was launched in August 2020. The Ministry of Economic Affairs and Employment has carried the main responsibility for updating the strategy. Information on the update process was mainly provided through the ministries' normal communication channels. In addition to the progress of the process, communication priorities included the regional bioeconomy forum, the citizens' survey conducted in summer 2021 and the maintenance of normal news flow on the Biotalous.fi website.

In early 2021, the Bioeconomy Panel discussed the strategy update at four individual workshops on the basis of each sector's low-carbon roadmaps, taking cross-cutting themes into account.

The Ministry of Agriculture and Forestry has been responsible, in particular, for consulting the regions and bringing the perspectives that emerge in this context into the strategy.

Different regions are developing the bioeconomy based on their own strengths and special characteristics. Interregional cooperation was considered important for the bioeconomy.

On 18 June 2021, a citizen's survey was opened on the Otakantaa.fi website, in which respondents were asked to comment on the direction in which the strategy should be developed in the update. The results were used in the preparation of the measures included in the strategy. The strategy was posted on the Lausuntopalvelu.fi website for opinions 1 November - 7 December 2021.

Organisation of communications

The task of communications in the updated Bioeconomy Strategy is to strengthen understanding on the importance of the bioeconomy for Finland and the EU, to openly describe the objectives, content and implementation of the Bioeconomy Strategy, to create interaction with stakeholders and to influence the increased prominence of the bioeconomy in the EU.

For this purpose, there is a communication team with representatives from the Ministry of Economic Affairs and Employment, the Ministry of Agriculture and Forestry, the Ministry of the Environment and Tapio Oy. The activities of the team are guided by the strategy's coordination secretariat in accordance with the strategy steering group's policies.

The communications team will be supplemented, as necessary, by communicators from organisations with responsibilities in the implementation of the strategy, for example other ministries and administrative sectors.

Communications experts from the national bioeconomy panel's organisations also support communications. They implement the purpose of the panel to strengthen dialogue with the strategy's stakeholders.

Communication creates synergies with the Government's other strategies and programmes related to the bioeconomy. These include Finland's Climate Strategy and Energy Strategy, the Strategic Programme for the Circular Economy, the Plastics Road Map, the Climate-friendly Food Programme and the National Forest Strategy 2025.

The Biotalous.fi website launched in 2012 in connection with the preparation of the first Bioeconomy Strategy is maintained by Tapio Oy and serves as the communication channel for the bioeconomy. Its editorial council's members include the Ministry of Economic Affairs and Employment, the Ministry of Agriculture and Forestry and the Ministry of the Environment.

6 References

The Government Report on the Agenda for Sustainable Development (Agenda 2030) https://julkaisut.valtioneuvosto.fi/handle/10024/162575
National Forest Strategy 2025 update https://julkaisut.valtioneuvosto.fi/handle/10024/161386
EU Biodiversity Strategy for 2030 https://op.europa.eu/en/publication-detail/-/publication/31e4609f-b91e-11eb-8aca-01aa75ed71a1
Climate and Energy Strategy
The Government's Sustainability Roadmap https://julkaisut.valtioneuvosto.fi/handle/10024/163068
A new direction: Proposal for a strategic programme for the circular economy https://julkaisut.valtioneuvosto.fi/handle/10024/162654
Low-carbon road maps for sectors https://tem.fi/julkaistut-tiekartat
Updated EU Bioeconomy Strategy https://op.europa.eu/en/publication-detail/-/publication/edace3e3-e189-11e8-b690-01aa75ed71a1/language-en/format-PDF/source-149755478
Scenario for sustainable growth in the Finnish bioeconomy
Analysis of the bioeconomy's operating environment
Comparative report on bioeconomy strategies in different countries https://jukuri.luke.fi/handle/10024/547015
Natural Resources Institute Finland: The bioeconomy in numbers https://www.luke.fi/avoin-tieto/biotalouden-katsaukset/biotalous-lukuina/
IPCC (2018) Global Warming of 1,5°C https://www.ipcc.ch/sr15/
Prime Minister Marin's Government Programme: https://valtioneuvosto.fi/marinin-hallitus/hallitusohjelma
The Finland we want by 2050 - Society's commitment to sustainable development https://kestavakehitys.fi/documents/2167391/2186383/FINAL+Kest%C3%A4v%C3%A4n+kehityksen+yhteiskuntasitoumus+20+4+2016.pdf/d2d827e7-033a-4d2b-9239-aed6605a12c4/FINAL+Kestävän+kehityksen+yhteiskuntasitoumus+20+4+2016.pdf (kestavakehitys.fi)
Arasto A., Asikainen A. and Kaukovirta A. Finnish bioeconomy on the global product market 2035. https://www.vttresearch.com/sites/default/files/2021-02/Bioeconomy-products-2035-whitepaper-VTT-Luke_1.pdf
Bio-based industries consortium: SIRA Strategic research and innovation agenda. https://biconsortium.eu/sites/biconsortium.eu/files/downloads/SIRA-2017-Web.pdf
SusChem:Strategic Innovation and research agenda. Innovation priorities for EU and global challenges. http://www.suschem.org/highlights/suschem-sira-2019-technology-priorities-towards-2030-for-a-better-future-of-europe
CLIC Innovation: Strategic research and innovation agenda. Forest-based circular bioeconomy. https://clicinnovation.fi//wp-content/uploads/2020/11/CLIC-Bioeconomy-SRIA.pdf
Forest-based sector technology platform. Strategic research and innovation agenda 2030 of the European forest-based sector, https://www.forestplatform.org/wp-content/uploads/2020/05/SIRA_2030.pdf
Sustainable economic growth and our future wellbeing https://julkaisut.valtioneuvosto.fi/handle/10024/162870

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