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Futures review of the Ministry of Agriculture and Forestry

COMPETITIVE ADVANTAGE FROM CLEAN FOOD AND RESPONSIBLE BIOECONOMY AND CIRCULAR ECONOMY

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Competitive advantage from clean food and a responsible bioeconomy and circular economy

Futures review of the Ministry of Agriculture and Forestry 2018

Ministry of Agriculture and Forestry, Helsinki 2018

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Abstract

The futures review of the Ministry of Agriculture and Forestry 2018 is part of the joint foresight work of the Finnish Government. As the basis for their foresight reports, the ministries joined their forces to establish a set of change factors to describe the relevant changes and uncertainties in the operating environment of the future. The Ministry of Agriculture and Forestry has selected six change factors that are expected to cause the most significant changes in the operating environment of the Finnish bioeconomy and circular economy based on food and natural resources over the next decade. These change factors are: i) climate change, ii) fast development of technologies, iii) competition for depleting natural resources, iv) transition of the global economy, v) change in values and attitudes and vi) population structure and urbanisation.

The ministry engages in policy preparation and development relating to the future on an ongoing basis as part of its regular tasks. The foresight report 2018 does not deal with matters that are already being addressed and promoted in any case, but the focus is on objectives and proposals for measures that are relevant to respond to challenges and opportunities in the near future. These have been compiled under four themes, with more detailed targets and measures presented under each of them. The themes are 1) Competitive advantage from clean food and water, 2) Responsible and competitive natural resource economy, 3) Increased multiple dwelling and successful regions and 4) Spatial data boosts a digital society. The first part of the review presents measures of a more general nature that are important to respond to future changes.

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Tiivistelmä

Maa- ja metsätalousministeriön tulevaisuuskatsaus 2018 on osa valtioneuvoston yhteistä ennakointityötä. Ministeriöt ovat yhteistyössä työstäneet tulevaisuuskatsauksien pohjaksi joukon muutostekijöitä, jotka kuvaavat tulevaisuuden toimintaympäristön keskeisiä muutoksia ja epävarmuuksia. MMM on katsaukseensa valinnut kuusi sellaista muutostekijää, joiden arvioidaan eniten muuttavan suomalaisen ruokaan ja uusiutuviin luonnonvaroihin perustuvan bio- ja kiertotalouden toimintaympäristöä seuraavan vuosikymmenen aikana. Muutostekijät ovat i) ilmastonmuutos, ii) nopea teknologinen kehitys, iii) kilpailu ehtyvistä luonnonvaroista, iv) globaalin talouden murros v) arvojen ja asenteiden muutos sekä vi) väestörakenne ja kaupungistumiskehitys.

Ministeriössä tehdään jatkuvasti tulevaisuuteen varautumiseen liittyvää politiikkavalmistelua ja kehittämistä osana normaalia työtä. Vuoden 2018 tulevaisuuskatsauksessa ministeriö ei niinkään käsittele asioita, jotka ovat jo hoidossa ja joita edistetään joka tapauksessa, vaan on haluttu keskittyä sellaisiin tavoitteisiin ja toimintaehdotuksiin, jotka ovat oleellisia lähitulevaisuuden haasteisiin ja mahdollisuuksiin vastaamiseksi. Nämä on koottu neljän teeman alle ja jokaisen teeman kohdalla esitetään yksityiskohtaisempia tavoitteita ja toimenpiteitä. Teemat ovat 1) Kilpailuvalttina puhdas ruoka ja vesi, 2) Vastuullinen ja kilpailukykyinen luonnonvaratalous, 3) Monipaikkaisuus lisääntyy ja alueet menestyvät ja 4) Paikkatiedot vauhdittavat digiyhteiskuntaa. Katsauksen alkuun on kerätty yleisempiä toimia, jotka ovat oleellisia tuleviin muutoksiin varautumiseksi.

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Referat

Jord- och skogsbruksministeriets framtidsöversikt 2018 är en del av statsrådets gemensamma framsynsarbete. Ministerierna har tillsammans tagit fram en del förändringsfaktorer som ligger till grund för framtidsöversikterna och som beskriver de centrala ändringarna och osäkerhetsaspekterna i omvärlden i framtiden. Jord- och skogsbruksministeriet har valt ut sex förändringsfaktorer som under det följande årtiondet mest väntas ändra omvärlden för den finska bio- och cirkulärekonomi som grundar sig på mat och förnybara naturtillgångar. Förändringsfaktorerna är i) klimatförändringen ii) den snabba tekniska utvecklingen iii) konkurrensen om de sinande naturresurserna iv) den globala ekonomiska omvälvningen v) förändringen i värderingar och attityder vi) befolkningsstrukturen och urbaniseringen.

Ministeriet arbetar kontinuerligt med politisk beredning och utveckling som hänför sig till beredskap för framtiden. I framtidsöversikten 2018 behandlar ministeriet inte frågor som redan är under arbete och som ändå kommer att drivas framåt, utan ministeriet har velat fokusera på sådana mål och förslag som är väsentliga när det gäller att svara på utmaningarna och ta tillvara möjligheterna i den nära framtiden. De här har samlats under fyra temaområden och under varje temaområde finns mer specifika mål och åtgärder. Temaområdena är 1) ren mat och rent vatten som en konkurrensfördel 2) ansvarsfull och konkurrenskraftig naturresursekonomi 3) multilokaliteten ökar och regionerna är framgångsrika 4) geografisk information sätter fart på det digitala samhället. I början av översikten finns allmänna åtgärder som är väsentliga med tanke på beredskapen inför framtida förändringar.

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FOR THE READER

The world is changing, whether we like it or not. While the future may seem daunting at times, it offers more opportunities if we prepare together for what is to come. This futures review will help us to tackle the changes, challenges and new initiatives that are significant for our administrative branch and develop our activities in a way that is even more sustainable and successful.

Our objective is clear: The Bioeconomy "2.0". This is the new programme on the bioeconomy and circular economy based on demand-driven services, new value-added products and innovations. For the purposes of the programme, Finland's most prominent competitive advantages include clean food and water, responsible and intelligent use of natural resources, and an innovative spatial data ecosystem.

The Bioeconomy "2.0" programme is supported by the basic functions of the administrative branch of the Ministry of Agriculture and Forestry. Food security, food safety and a competitive domestic food system, securing emergency supplies and access to clean water, management of animal and plant diseases, ensuring the sustainability of the natural resource economy and economic activities depending on it, and enhancing the viability of rural areas are becoming even more important. Digitalisation and the dramatic increase of the role of information mean that it is extremely important to promote the joint use of reliable basic registers, spatial data and natural resource information within the Ministry's sphere of operations.

This futures review is a projection to the near future of societal scenarios and questions that require political decision-making, to serve as the basis for socio-political discussion. In practice, many phenomena and changes penetrate the entire society and the solutions to these require close cooperation between the ministries. The Government's joint foresight activities chart the future of Finland up to the 2030s[1]. The futures work enables us to pre-

1 http://vnk.fi/futures reviews

pare for different kinds of development paths and consider the best solutions to support future decision-making. Together the ministries have established 15 drivers for change, i.e. the key changes and uncertainties in the operating environment of the future for decision-makers and members of the public.[2]

The Ministry is carrying out policy preparation and development work related to preparedness for the future as part of its normal activities. The futures review of the Ministry of Agriculture and Forestry 2018 is not concerned with issues that will be promoted in any case, but the focus is on objectives and proposals for measures that are the most relevant for responding to the challenges and opportunities of the near future.

June 2018

Jaana Husu-Kallio
Permanent Secretary

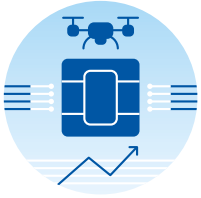
2 http://vnk.fi/en/ministries-joint-foresight-activities

1 Drivers for change in the administrative branch of the Ministry of Agriculture and Forestry

There is a large number of global drivers for change affecting Finland's future with an intensity and speed we can hardly influence, which means that we must adapt to their consequences. They should be seen as not only threats but also a source of significant new opportunities. As the basis for its futures review, the Ministry of Agriculture and Forestry has identified six main drivers for change which will occur independently of the Ministry's administrative branch and which have been projected to cause the greatest changes in the operating environment of the Finnish food and natural resources sector during the following decade. These drivers for change are **i) climate change, ii) technological revolution, iii) sustainability of natural resources use, iv) transformation of the global economic system, v) changes in values and attitudes, and vi) population structure and urbanisation.**

Climate change

Finland's climate is estimated to warm by up to 2–6 degrees by the end of the century. Changes in weather and hydrological conditions and the occurrence of ice cover and ground frost have impacts on e.g. the timing and volumes of floods as well as soil bearing capacity. Climate change has a direct impact on the operating conditions of agriculture, forestry and fisheries. On one hand, it causes more risks while, on the other, with skilled adaptation it also means new opportunities. Global warming changes the habitats, variety and genetic diversity of both wild and commercial animal and plant species, and Finland's vegetation zones will move further up north. Globally, climate change will also cause drought and changes in ecosystems. Finland could play a significant role in finding solutions to the problems resulting from these.



Technological revolution

The fast advancing technologies may lead to changes that are difficult to predict but which may suddenly transform the activities of entire sectors of industries and society. The changes are particularly related to the development of information and digital technology, where learning machines and artificial intelligence are currently at the heart of research. Autonomous systems and robotics using the results of this development will transform the struc-

tures, production chains, methods and business logics of both the natural resource economy and food production. The role of the sharing and platform economies in producing new types of added value is growing fast. Service business, knowledge and different kinds of applications are becoming more and more important.

Sustainability of natural resources use

Because of the growing scarcity of natural resources at the global level, more efficient approaches to exploiting the resources are needed. However, the depletion of non-renewable natural resources creates a demand for sustainably produced alternatives made from renewable raw materials. Together with technological development, these will reshape the basic structures of the natural resource economy. Despite the improvement in resource efficiency, the impacts of climate change, including drought, erosion and decrease in the arable land area, will weaken access to food and increase uncontrollable human migration as well as global crises and conflicts.

Transformation of the global economic system

The convention-based international system will waver as new, regional centres of power are emerging. In addition to the traditional state actors, new economic players and networks will exercise more and more power in exploiting natural resources and steering the global economy, thus changing the forms of global governance relating to these. As a small open economy, Finland's economic growth significantly depends on the development of the global economy and trade. Digitalisation, robotics, artificial intelligence and other technological development will change the global value and revenue chains and influence the world's economies.

Changes in values and attitudes

A global change in mind-sets will also reflect on Finland. Digital devices are transforming the ways in which information is used for having influence, which impacts on values and attitudes at a fast pace. Providing citizens with correct, research-based and validated information will be increasingly challenging. In view of the rapid changes in public opinion, values and consumer habits, the administration must also have the ability to react and change.

Population structure and urbanisation

The global urbanisation trend is also seen in Finland. Even if the competitiveness, profitability and growth of the natural resource economy and food chain is increasingly based on the utilisation of new technology, primary production will still take place in rural areas. Rapid urbanisation means a stronger role for cities as drivers of the economy, but new technologies will also produce new opportunities for rural areas. As rural areas become even more sparsely populated, the economic foundation for maintaining the infrastructure, including the road, water supply and sewerage and telecommunication network, will be eroded, which in turn will pose major challenges to rural development. The sources of employment and livelihood will change, and the population will no longer be divided into producers and consumers based on the traditional model in any types of region.

1.1 The Ministry of Agriculture and Forestry promotes the bioeconomy and circular economy of the future

The rapidly changing world and international development challenges stress the need to replace non-renewable raw materials and energy with renewable solutions of a responsible bioeconomy and circular economy. Clean, high-quality and safe food and water and responsible and intelligent use of natural resources will become increasingly important. These lay the foundation for growing and increasingly international business activities as well as the development, stability and wellbeing of society.

The core tasks of the administrative branch of the Ministry of Agriculture and Forestry will grow in importance, including food security, food safety and a competitive domestic food system, the security of supply and access to clean water, keeping animal and plant diseases under control, the sustainability of the natural resource economy and the competitiveness of economic activities based on this, and the viability of rural areas. High-quality spatial data and its analysis play a key role in the development of technological solutions for the future. Due to digitalisation and the dramatic growth in the significance of information it will become even more important to promote the joint use of reliable basic registers, spatial data and natural resource information as part of the Ministry's sphere of operations.

Finland is a responsible global player that is committed to the implementation of the 2030 Agenda for Sustainable Development. In view of the increased global competition, central government has a growing role in removing the barriers for free competition and in facilitating the bioeconomy and new innovations, business models and means of value creation. Enabling government interacts closely with the private sector and understand the accelerating development as well as the challenges and opportunities it brings. As we aim

for the economic optimum, limited resources can be allocated effectively while creating an internationally competitive operating environment for a renewable and increasingly international bioeconomy and coordinating sustainable development and risk management.

The current tasks of the Ministry of Agriculture and Forestry and its administrative branch provide an obvious foundation for implementing the next stage of the bioeconomy and circular economy. The Bioeconomy "2.0" is the working title of a programme to promote demand-driven services in the bioeconomy and circular economy and the emergence of new value-added products and digitalisation and innovations, and to ensure the access to biological resources.

1.2 The target state for the Ministry of Agriculture and Forestry in 2030: The Bioeconomy "2.0"

In 2030, the rural areas of Finland are viable. The bioeconomy produces significant added value to the entire country in an economically sustainable manner. The implementation of the Bioeconomy 2.0 era is under way, comprising a functioning national food system and a responsible and competitive natural resource economy which readily incorporates the idea of a circular economy.[3] There has been a genuine systemic change in the sustainable use of natural resources: renewable resources are primarily used instead of non-renewable energy and raw material resources. Environmental values and wellbeing are key drivers in the use of natural resources. New technologies enable new solutions and emerging industries based on the bioeconomy. All this is led by market-driven solutions, while the state enables structural change, product development and creating new innovations. A diverse selection of services and products with high added value is on the market. The focus of the bioeconomy has shifted from a supply-based production of biomasses to demand-driven services and value-added products. Finland has significant competence in solving global challenges, and we are among the world leaders in foresight work and practice-oriented approaches to the bioeconomy that combine expertise from different sectors. The world's most innovative and secure spatial data ecosystem has been developed in Finland. The system makes reliable basic spatial data of the new generation available for effective use by all actors.

3 The circular economy is discussed in the chapter *A carbon neutral circular economy society* of the futures review of the Ministry of the Environment 'Building sustainable living environments'.

The transformation of the familiar operating environment and responding to the new demands requires the following **cross-sectoral measures common to the themes of this futures review by the Ministry of Agriculture and Forestry:**

TO ACHIEVE THE TARGET STATE WE MUST

- **Ensure competence.**[4] Rural areas and all sub-sectors of the bioeconomy, including the food and natural resource sector, require competent workforce to develop. The changing operating environment, new ways of value creation, and measures related to improving the energy, material and resource efficiency of operations require new knowledge and skills and a reform of the competence system. On the other hand, the internationalisation and renewal of the sector create increasingly versatile career opportunities. Besides additional resources, active and regular consultation with actors in the field is needed when planning vocational basic and further education and training so that their content is tailored to suit the changing operating environment. The availability of competent workforce is strengthened by agile and flexible models for basic and further education.
- **Strengthen the knowledge base.** Research knowledge must be at the heart of decision-making and operations. Allocating additional resources to research, development and innovation will return the investment through increased business, export opportunities, a safer and more secure operating environment and better wellbeing. The current and new innovation environments and centres of expertise based on public-private cooperation must be developed that boost the progress of the sector. Strengthening the knowledge base on the use of natural resources, state of the environment and climate change adaptation and utilising long time series in planning are prerequisites for the responsible use of natural resources and safe and secure communities. Cooperation between the Ministry and national funding organisations must be promoted and, with particular emphasis on developing functioning interfaces to research and innovation funding. Special attention must be paid to the effectiveness and exploitability of information.
- **Develop the activities towards the "enabling governance" approach.** Both supplementary and completely new business is constantly emerging in the sphere of operations of the Ministry of Agriculture and Forestry. An operating model must be created by which public financing and administrative measures boost the private sector and capital to making even better use of the national and international business opportunities based on sustainable growth. Models that may be worth experimenting include financing arrangements similar to effectiveness investments, compensation and joint financing as well as innovative utilisation of procurements. Public administration must contribute to ensuring effective governance processes and incentive models as well as make sure that the legislation on the sector facilitates the introduction of new technologies and practices.

4 More on competence issues in the futures review of the Ministry of Education and Culture.

- **Make full use of the opportunities brought by digitalisation and the public sector and other information resources.**[5] Farmers, forest owners, entrepreneurs in the fisheries sector, and fishers and hunters have access to a digital operating environment which they can use to manage 'own data', utilise modern planning and calculation methods, and smoothly manage contacts with both the administration and various types of companies and organisations. Electronic information and services supporting leisure time activities, nature tourism, gathering wild products and other nature-based wellness services are widely available. Companies and other organisations can make use of the increasingly accurate information resources and interfaces of the public sector in a controlled manner, and construct value-added services that enhance and supplement the public services. If necessary, these players can also see to operations related to public services. Regulation is adopted to clarify the distribution of duties between the public and private sector in producing and utilising data. The public sector must have sufficient competence in digitalisation and the services based on it, and development resources which allow easy and open experimentation with and assessment of new operating models and technologies, including the suitability of artificial intelligence for different processes.
- **Exert influence in international contexts.** We have assumed an increasingly active role and are showing initiative in international cooperation related to the bioeconomy and the sustainable use of natural resources, and are developing timely and anticipatory ways to influence the EU's decision-making and targeting of research funding.
- **Maintain basic infrastructure that is in good condition and works well.**[6] Good and functioning infrastructure is a key condition for inhabitants, communities and companies, enabling them to operate in rural areas. The condition of roads and reliable, fast and stable broadband connections are decisive, not only in terms of the operating opportunities for companies but also for the access to services and safety of inhabitants. The condition and functioning of the water supply and sewerage infrastructure, structures in water bodies and drainage are essential for the operating conditions of economic activities and society. In addition to physical structures, up-to-date information services and warning systems needed for both operative tasks and decision-making must be ensured.

5 More on the conditions for a data economy and trust in digital services in the chapter Finland as a pioneer in the data economy of the futures review of the Ministry of Transport and Communications.

6 More on the conditions for a data economy and trust in digital services in the chapter *Finland as a pioneer in the data economy* of the futures review of the Ministry of Transport and Communications.

2 The themes of the futures review

The futures review of the Ministry of Agriculture and Forestry has been divided into three themes: 1) The beginning of the era of the Bioeconomy 2.0, 2) Increased multiple residence and successful regions, and 3) Spatial data boosts a digital society. The Bioeconomy 2.0 theme is divided into two subthemes: "Competitive advantage from clean food and water" and "A responsible and competitive natural resource economy".

As an introduction to each theme, a few drivers for change that particularly impact on that theme are presented, followed by a discussion on the challenges and opportunities related to these and setting of a target state to be reached by 2030. Last, the particular measures needed to achieve the target state are presented.

2.1 The beginning of the era of the Bioeconomy 2.0

WHAT IS MEANT BY THE BIOECONOMY AND CIRCULAR ECONOMY?

The bioeconomy refers to an economy that uses renewable natural resources to produce food, energy, products and services. The bioeconomy aims is to reduce dependence on fossil fuels, prevent depletion of ecosystems and to promote economic growth and create new jobs, in line with the principles of sustainable development.

The most important renewable natural resources in Finland are the forest, soil, arable, aquatic and marine biomass, i.e. organic matter, as well as fresh water. Ecosystem services include all services provided by the natural environment, including the sequestration of carbon dioxide and opportunities for recreation. A key element in the bioeconomy is that natural resources are not wasted but they are being used and recycled effectively.

The bioeconomy and circular economy supplement and support each other. In the circular economy resources are retained within the economy for as long as possible. In the circular economy, production and consumption create as little loss and waste as possible. A transition to the circular economy requires changes in the entire value chain from product design to new business and marketing models as well as consumer behaviour.

Source: Sustainable growth from bioeconomy. The Finnish Bioeconomy Strategy (2014).

From the perspective of the bioeconomy, the key drivers for change are **climate change**, **sustainability of natural resources use**, **changes in values and attitudes**, and **technological revolution**. **Political changes and different kinds of crises** increase uncertainty. The future of food production is also shaped by factors such as population growth, various kinds of conflicts and epidemics.

Changes in weather and hydrological conditions and biodiversity as well as risks related to extreme events, animal and plant diseases, forest damages and invasive alien species challenge the bioeconomy not only to adapt but also to utilise the opportunities arising from developments such as the loss of ice cover and increased growth of forest stands. The use and management of forests, soil, peatlands and water resources will gain an even more prominent role in climate change mitigation and adaptation.

The global challenge is to ensure food security and water supply and sewerage to the growing population, which also reflects on the domestic food security. Poor access to food and the lack of job opportunities especially in the rural areas of the developing countries are among the basic causes for internal and external migration. If left unsolved, these problems may result in unprecedented migration flows with profound impacts on Finland as well.

Technological revolution and the increase in the volume and accuracy of spatial and natural resource data, robotics, artificial intelligence, and the platform and service economy will generate entirely new business opportunities for the bioeconomy, including the development of products and services and using them for tangible and intangible purposes. The systemic change also increases the opportunities in risk management at different regional levels.

Urbanisation is a global trend. The decrease in rural population undermines the preconditions for maintaining the infrastructure, which may pose a risk to food production. On the other hand, new technologies, production methods and services will make production more and more automatic, improve profitability and introduce entirely new means for creating value.

2.1.1 Competitive advantage from clean food and water

WHAT IS MEANT BY THE FOOD SYSTEM?

The food system is the complete system of food production and consumption which consists not only of the actors in the food chain, but also of the private and public sector bodies and institutions that in one way or another participate in the operations of the system. The food system is a conceptual tool which helps describe the total structure, its parts and operations with all the various links and interactions between them.

Source: Government report on food policy Food2030. Finland feeds us and the world (2017).

Opportunities and challenges

The growth in the demand for food and clean water and changes in consumer habits create opportunities for the food system. Consumer awareness is increasing and they have growing demands as to the quality, origin, ethical aspects and environmental friendliness of food. Safe, healthy and tasty food and clean water are sources of human health, wellbeing and gratification.

Animal and plant health are of a high standard in Finland, the use of medicines is low and the status of animal welfare is high. According to the One Health principle, all stakeholders work together for reducing antimicrobial resistance and upholding the effectiveness of antimicrobial medicines. The demand for healthy and high-quality food is growing. Local food and organic products are appreciated and wild natural products further diversify the product selection. Antibiotic-free production and high-quality, sustainably produced raw materials, the traceability of food as well as clean and abundant water resources are Finland's strength in the international market. The expertise within the Finnish food system is of top international standard and should be better utilised in exports and marketing and in building beverage and food brands. The food system presents opportunities for new success stories when more effort is put in improving competence, marketing and brand development.

Food tourism is one of the most rapidly growing areas of the tourism business. It should be further developed to increase interest in Finnish food and beverages and improve the profitability of the food and tourism sectors. New cultivation and farming methods, such as recirculation aquaculture systems and vertical farming, are also successful export products for countries where arable land or clean water are scarce. There is major growth and export potential in the competence and technology related to aquaculture and clean water. There is also great potential in making better use of Finnish wild fish.

Finland's location in the north and the country's natural conditions pose a major challenge to the competitiveness of its primary production. Production costs are high, the profitability of primary production is low, and financial risks are difficult to manage. Despite the risks, food production adapted to the northern conditions, a strong technological competence, and the utilisation of digitalisation together with Finland's abundant and clean water resources create opportunities for an economically, environmentally and socially sustainable primary production. Certain conditions for food production will improve in the northern regions as a result of climate change. However, climate change will also increase the frequency of extreme weather events, plant and animal diseases and invasive alien species, thus increasing the need for risk management and preparedness. Risk management requires the capacity to change the practices fast and in the right direction.

In 2030

Primary production is profitable, competitive and ecologically sustainable. Animals are in good health and their welfare is in order, efforts to combat animal diseases have been successful and antimicrobial medicines are rarely needed. Effectiveness and productivity are high in all parts of the food system. National food security is guaranteed and all citizens have access to good nutrition. Effective climate change mitigation and adaptation measures have been introduced without compromising food security. Efforts to combat plant pests are efficient and plant varieties suitable for the Finnish conditions are available. The potential of waters and wild natural products have been effectively utilised.

The farm is a modern unit that produces ecosystem services where farmers make use of new technology in the production and for controlling emissions. The preconditions for food production, cleanliness of water and productivity of arable lands have been secured. The added value of the fish catches is high and aquaculture production has multiplied. The opportunities for organic production have been utilised in all food production sectors. Resource efficiency and the circular economy are everyday practices in the food system.

The food system is economically, socially and environmentally sustainable, and competitive in the global market. It constitutes an interesting, consumer-driven development platform for other sectors, including environmental technology, robotics, health sciences and logistics. There are significant export operations relating to competence and high value-added products processed from clean raw materials. There is a significant market for Finnish drinking water and strong, solution-oriented competence in the water sector.

The food system has access to a digital operating environment and platforms where information generated from different operations can be managed and utilised regardless of the production sector. The digital operating environment enables the creation of new services, traceability of operations and development of consumer-driven business models both nationally and internationally.

TO FULLY UTILISE THE OPPORTUNITIES OF THE FOOD SYSTEM WE MUST

a. Improve the profitability and competitiveness of business related to the food system as follows:

1. Financing for the structural development of agriculture and fisheries and the introduction of new technology stays at least at the current level.
2. An overall reform of the structural support systems is implemented to develop the operating conditions for economic activities by means of an effective, consistent and simple aid scheme.
3. Sufficient resources are secured for the office of the food market ombudsman.
4. Cooperation between different ministries is promoted by establishing joint objectives and measures to further enhance the Finnish food system, including improving the status of producers in the food system.
5. Veterinary services are secured in connection with the reform of the Veterinary Services Act.
6. Conditions for developing a secure, consumer-driven food system are secured e.g. by seeking solutions to organising short distribution chains cost-effectively.
7. Incentives are created for farmers to increase soil carbon, protect biodiversity, ensure nutrient recycling and manage the soil water balance for the next EU programming period.
8. Competence in exports related to the food system and access to clean water and the export of competence is strengthened by continuing to fund the education programme on food exports and utilising the high quality and safety of food and water in marketing. The opening of new market areas is promoted and sufficient resources for the development of exports are secured.

b. Improve the sustainability and resource efficiency of business related to the food system as follows:

1. Renewable and decentralised energy production is promoted by facilitating the permit procedures and requirements for small biogas plants and supporting the decentralised production and distribution of transport biogas.
2. The circular economy is promoted by targeting investments to cross-sectoral systems, continuing the funding mechanism for experimentation to develop new solutions, preparing horizontally a national nutrient recycling programme, and utilising the side streams of different processes open-mindedly but safely, including by using waste from the food system to feed insects.
3. Business opportunities and cooperation related to drinking water are promoted. The compilation of accounts relating to water bodies, water ecosystems and water loading is continued and holistic solutions and cooperation between companies to improve water security are promoted[7].
4. Objectives are set and incentives created for promoting animal welfare and reducing the use of antimicrobial medicines, including by creating quality labels for welfare and for antimicrobial-free production.
5. Sectors are guided to innovate and to introduce alternative production and treatment practices to reduce the need for using antimicrobial medicines and to maintain their effectiveness.

7 Water security refers to an ability to guarantee sustainable access to a sufficient amount of water with acceptable quality, prevent water pollution and water-related catastrophes and protect ecosystems in an atmosphere of peace and political stability.

2.1.2 A responsible and competitive natural resource economy

WHAT IS MEANT BY A SUSTAINABLE NATURAL RESOURCE ECONOMY?

In this context, a sustainable natural resource economy refers to the responsible utilisation of renewable natural resources based on forests, fish, game and water in the bioeconomy and circular economy, thus safeguarding ecosystem services, good soil condition and biodiversity, creating wellbeing, and enabling profitable business opportunities also for future generations.

Opportunities and challenges

Many of the UN Sustainable Development Goals (2030 Agenda) are connected to sustainable and intelligent utilisation of natural resources. Global competition for depleting natural resources and growing demand for sustainably produced raw materials and other materials mean major opportunities for the natural resource economy. Both the climate objectives and changes in the production and consumption practices lead towards a transition from non-renewable to renewable resources, and accelerate the realisation of a circular economy and the development of resource efficiency. Biomasses already play a significant role in the implementation of the targets set for climate and energy policy, and they will be even more important in the future.

Thanks to the abundant and sustainably managed natural resources, competence of a high standard and industrial strengths, Finland has great potential to respond to the growing demand for renewable resources and related services. The growth of the forest resources allows to increase the sustainable use of wood raw material without reducing carbon sequestration in forests. The demand for and competitiveness of new high value-added products manufactured from wood and other biomass is growing fast, including textiles, plastic replacements and health products. Global trends in tourism – uniqueness, proximity to nature, high quality and sustainability – are among the greatest opportunities for Finland, particularly in the context of nature tourism, fishing, hunting and wilderness recreation.

Water plays a key role in all forms of primary production, industrial processes and wellbeing. In the international context significant additional inputs in the promotion of the UN's Sustainable Development Goals will create new, international business and export opportunities for Finland. There is a growing international demand especially for comprehensive solutions based on the use of spatial data relating to saving and recycling water, water supply and sewerage, use of forest and water resources data, water resources management and flood risks.

The fast development of technologies and changes in operating practices resulting from this mean new opportunities for the natural resource economy to promote both sustainable growth and wellbeing. The opportunities lie in different parts of the value network, particularly as we move from a producer and biomass driven natural resource economy towards consumer and service driven business models. Technological advancement will lead to an exponential growth in the volume and accuracy of information, and the utilisation of information offers major opportunities for the expansion and internationalisation of the entire natural resource sector. The openness, ownership and management of information will be the key questions to be addressed better and more profoundly than before.

Conflicting goals may undermine the usability of natural resources and realisation of the related business opportunities. The state of natural resources and the operating practices used in the Finnish natural resource economy are poorly known abroad, and the lack of information and varying interests of countries may from the Finnish perspective lead to harmful and conflicting decisions in the preparation of international agreements or EU legislation, which may impact on the development of a natural resource economy. Constant dialogue and development of operations is needed concerning environmental objectives such as biodiversity and state of waters, international agreements, and multidimensional values and attitudes associated with the utilisation of natural resources.

Objectives and key actions
In 2030

The overall sustainability of the natural resource economy is a competitive advantage which is transparently verified. A responsible and competitive natural resource economy is a source of growing wellbeing and a significant part of the national economy. Natural resources are managed and utilised sustainably and diversely, and different interests are reconciled. The state of the environment is good and the loss of biodiversity has been halted.

Finland is a pioneer in the utilisation of technology and new means of value creation as well as producing solutions in a consumer and service driven natural resource economy. This is seen e.g. in Finland's status as a leader in managing global forest resour-

ce data and provision of services related to this. New bioeconomy and circular economy solutions will increasingly substitute for products manufactured from non-renewable raw materials. The recycling of energy, fibre, nutrients and water works effectively. Both supplementary and brand new business activities are constantly emerging in the natural resource economy. The key principle guiding the development is increasing the total value of the value chains based on the utilisation of natural resources with as little environmental impact as possible.

Nature-based entrepreneurship and the benefits it brings to wellbeing and health have become an internationally recognised brand.[8] Finland is a leading society in the blue bioeconomy, i.e. sustainable utilisation of water and aquatic natural resources. The risks related to climate change are under control and the sector is prepared to both adapt to and utilise the changes in the climate.

TO FULLY UTILISE THE OPPORTUNITIES OF THE SUSTAINABLE USE AND MANAGEMENT OF RENEWABLE NATURAL RESOURCES WE MUST

a. Improve the operating conditions for sustainable and customer-driven business activities related to the natural resource economy as follows:

1. Production methods, products and means of value creation are developed that increase the added value of products, sequester carbon and do away with the fossil economy. Business and service models suitable for the international market are developed for the use and management of natural resources and the productisation of ecosystem services.
2. The attractiveness and welfare effects of nature are productised into competitive tourism and recreation services. Needs for developing services are determined from the perspective of legislation, infrastructure and funding and the operating environment is changed to make it more favourable to the growth of service entrepreneurship.
3. Incentives are provided for the private and public sector to collaborate in building Finland into a leading society in the sustainable use of water and aquatic natural resources in line with the national development plan.
4. The activities of the game husbandry and wilderness recreation organisations of local administration (game management associations, fisheries regions) and those organising voluntary work in the third sector (partners to a joint water area, hunting societies, fishing societies) are supported and their continuity is ensured.

8 The health benefits of living environments are also examined in the futures review of the Ministry of Social Affairs and Health.

b. Ensure the development of the natural resource economy based on strategies and programmes:

1. In cooperation with the forest industry, development measures are implemented for achieving a competitive operating environment, active, sustainable and diverse use of forests and reform of the forest sector, and the implementation of the 2025 National Forest Strategy, the Forest Biodiversity Programme for Southern Finland (METSO), and the Energy and Climate Strategy across administrative borders is strengthened.
2. Measures of the National Energy and Climate Strategy are implemented and the implementation of the National Climate Change Adaptation Plan is strengthened.
3. Next-generation ecosystems are developed for forest resource and other natural resource data which fulfil the needs for information of the increasingly digital society and support opportunities such as those offered by the platform economy. Digitalisation is implemented and ground rules established for it in close interaction with companies and the civil society.
4. Cooperation between the industry and research is improved by implementing the Finnish-Swedish BioInnovation Programme.
5. Strategic guidelines are drawn up to ensure the competitiveness of the value chain of the fisheries sector when preparing the national programme for the European Maritime and Fisheries Fund during the next programming period.
6. A national change programme is prepared in extensive interaction, reconciling the changing needs of the use, management and protection of waters, risk management in the changing climate, and the role of hydropower suitable for capacity control in the electricity generation system. The programme includes the financing solutions, procedures and revision of water legislation to reform the fisheries obligations.
7. Measures are taken concerning the recovery of migratory fish populations by making use of the most recent research knowledge, competence and technology, as well as river basin-wide collaboration forums for the responsible use and management of modified water bodies.
8. A joint project is prepared that involves a broad range of stakeholders to improve the status of wetland nature values, particularly declining waterfowl populations, and to create a network of wetlands.
9. Comprehensive management of game populations is developed to make use of the wellbeing and livelihood opportunities related to hunting while minimising the damage caused by the species and the disease risk related to them. Hunting opportunities are secured as broadly as possible in connection with changes concerning land use.

2.2 Increased multiple residence and successful regions

Drivers for change with particular impact on multiple residence

Technological revolution will challenge and change established operating models and ways of working. Fast, reliable and secure telecommunications are vital for the growth and development of business in all regions. **Transformation of work** is a profound, intergenerational technological, economic and societal change towards an increasingly diverse and versatile world of work. Competence, education and learning of new contents is the foundation for coping with the transformation of work.

70 per cent of Finland's population are currently living in cities and urban-adjacent areas. **Urbanisation** and the concentration of the population in the largest centres undermines the economic dependency ratio in sparsely populated areas, which makes it more difficult to ensure the access to services and weakens the competitiveness of the areas.

Finland has excellent competence related to Arctic resilience, which is why the growth of the economic and geopolitical role of the Arctic region will boost the competitiveness of northern Finland, in particular.

Opportunities and challenges

Different types of rural areas possess many kinds of strengths and opportunities. In spite of the challenges, rural areas are recognised as a key source of wellbeing and national competitiveness. The stronger societal significance of rural areas stems from global changes and the merging of societal functions, players and finances through which rural areas are more closely integrated into national and international networks. Many important export products will continue to be produced in rural areas.

The diversity of regions is an advantage for Finland. The rural areas, the archipelago, small centres and urban regions need one another. Identifying the strengths of different types of regions allows making the best possible use of their potential and opportunities for co-

operation. Because of the cooperation between the Arctic regions and global geopolitical change, the northern regions are becoming more and more significant.

Despite urbanisation[9], changes in the ways people work also increase living and working in multiple locations. Digitalisation further reduces the dependency of jobs, studies and hobbies on a specific place by creating new opportunities for residence, business and competence building independent of location. Digital services are also available in rural regions as long as telecommunications are in order.

In the changing world of work, rural residents with a wide variety of skills are the ones who will succeed, as earning a living from multiple sources comes naturally in rural areas. These areas have a special role in promoting the bioeconomy: a competitive and sustainable food chain and the sustainable utilisation of natural resources enable the success of the regions. In particular, the migration of young people and women to growth centres for work and studies weakens the dependency ratio and distorts the population structure in certain areas. On the other hand, studies show the rural regions can be more attractive if fast telecommunications and necessary services are provided, particularly as a place of living and work for young people, highly-educated people and women[10]. Immigrants can also be seen to offer opportunities to strengthening the viability of rural areas. [11]

The fragmentation of work, concerns relating to earning a living and growing inequality may lead to a democracy deficit, increased passivity, social distrust, and the polarisation of attitudes.

Objectives and key actions

In 2030

Cities and different types of rural areas are active players in networked, versatile and well-functioning interaction. Place-based development and policy take account of the resources and operating opportunities of the region. Interaction between regions has been strengthened by preparing joint objectives and competence maps based on the strategies for intelligent specialisation of the regions.

9 The connection between urban and rural areas is also discussed in the futures review of the Ministry of Economic Affairs and Employment under the theme *The role of cities in the new county environment*, the chapter *Sustainable urban development* of the futures review of the Ministry of the Environment, and the chapter More effective urban policy of the futures review of the Ministry of Transport and Communications.

10 The chapter *Ensuring the quality and coverage of telecommunications networks* of the futures review of the Ministry of Transport and Communications also stresses the need for fast telecommunications.

11 Immigration is also discussed in the futures review of the Ministry of the Interior under the theme *Migratory movements are reshaping society.*

Finland has a well-functioning basic infrastructure and fast telecommunications; the development and utilisation of novel service solutions as well as the platform, sharing and circular economy have expanded the competence and economic base of the regions. New kinds of service opportunities generated in cooperation between the public, private and third sector and service solutions tailored on the basis of the special characteristics of the regions lay the foundation for functioning local services and the tourism industry.

The regions are able to make full use of multiple residence and diversity of people and companies as well as global networking. Active networking of different sectors has increased synergies between companies and created new jobs.

TO FULLY UTILISE THE OPPORTUNITIES OF REGIONAL DEVELOPMENT WE MUST

a. Take determined action to increase the use of e-services, including advice and training and access to functioning, stable and sufficient telecommunications (100 Mbit/s) in rural areas is secured.

b. Develop place-based policy and taxation and support solutions to create tailored solutions for different types regions while taking into account the capital, natural resources, culture and traditions, communities and competence, existing infrastructure, services and their combinations in the regions.

c. Strengthen community-driven local development by promoting cooperation and new cooperation models between different types regions (rural and urban areas) and actors (the public, private and third sector)

d. Systematically use rural proofing as part of the preparation of decision-making and implementation of decisions at different levels of the administration in a manner that allows to pay attention to the special characteristics of the rural region and the impacts of the decisions.

2.3 Spatial data boosts a digital society

Drivers for change with particular effect on spatial data

Both the volume of data and the significance of its use keep growing. The effective use of data, automation, robotics and artificial intelligence as well as clean technology are already transforming the world, and the **technological revolution** may well continue to accelerate and its effects on the society multiply even within a short period of time.

One of the attributes of spatial data is location. The location attribute enables to broadly combine and analyse all kinds of information connected to specific sites, regions and transport routes. Digitalisation and the dramatic development of technology create new tools and circumstances for utilising location data, as well as new opportunities and needs. This development will exponentially increase the utilisation of data and, in particular, the spatial attribute included in the data. The growth in the use of artificial intelligence, robotics and the Internet of Things will increase the use of spatial data in almost all sectors and in people's daily lives. Many other drivers for change, including **climate change** and **urbanisation**, will generate new needs to analyse and predict place-based data to minimise e.g. the vulnerability caused by weather and other climate risks.

Opportunities and challenges

The main characteristic of spatial data is that it enables various types of activities. These include transport and navigation, effective development of the bioeconomy, management and sustainable use of natural resources, precision farming, and predicting the spread of diseases and preparation for these. The first steps are being taken in automated transport, mobility as a service and the automation of freight logistics. Even more accurate, up-to-date and high-quality spatial data and positioning services are needed in order for them to work in a way that is reliable and safe.

Decisions must be made on the basis of reliable information. Increasingly significant parts of information include a spatial attribute, which has a key role in the efficient utilisation of information. For example, harmonised, reliable and constantly updated information on

addresses and entrances of buildings is a critical safety and security factor and the foundation for many services.

Finland's basic register system is highly advanced and of good quality. For example, the management and services of the real estate information system and upcoming information system for financial and technical information on residential properties and housing companies will secure the functioning of a national ownership and deposit system and the information needs of the digitalising society. A topographic data system will secure the foundation for positioning for various functions. The quality, security and interoperability of the basic registers will ensure the functioning of the society and advancing digital services. In future, the focus should be on cooperation across administrative sectors on the different functions related to basic registers.

Current challenges include the varying quality of data due to fragmented data management and maintenance processes, insufficient combinability of data, and producing a sufficiently accurate and reliable positioning service. There are also unnecessary overlaps in the production and management of spatial data. Organisations and structures as well as responsibilities built in silos take much more time to change than operations and technology.

Objectives and key actions
In 2030

The world's most innovative and secure spatial data ecosystem has been developed in Finland that provides effective access to reliable, basic spatial data of the new generation to all stakeholders. The applications making use of spatial data and the technology used in these, including artificial intelligence, robotics and the Internet of Things, have enabled a variety of new activities and innovations. High-quality spatial data and its analysis are a key part of predicting the impacts of climate change, promoting the bioeconomy and monitoring the use of natural resources. Companies are constructing value-added services that improve and supplement public administration services and, where necessary, measures related to these. The management and trade of real property and housing-company shares are based on securely managed basic registers, which also serve as the foundation for new business and added value.

TO FULLY UTILISE THE OPPORTUNITIES OF SPATIAL DATA WE MUST

a. Develop the regulation applied to determine the basic spatial data that is the responsibility of the public administration and the related basic services and determine the parties responsible for these operations.

b. Determine the obligations under which actors in public administration produce the basic spatial data for which they are responsible and the related basic services in a way that they are interoperable in accordance with the mutually agreed international standards and public administration recommendations.

c. Develop increasingly accurate spatial data and reliable and accurate positioning.

d. Develop cooperation between the state and the municipal sector.

e. Develop a joint national address information system and a cross-sectoral process for maintaining this.

f. Take even better account of the society's comprehensive security in managing data.

g. Implement the goals of the Report on Spatial data policy in broad cooperation and develop a joint spatial data platform for public administration.

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