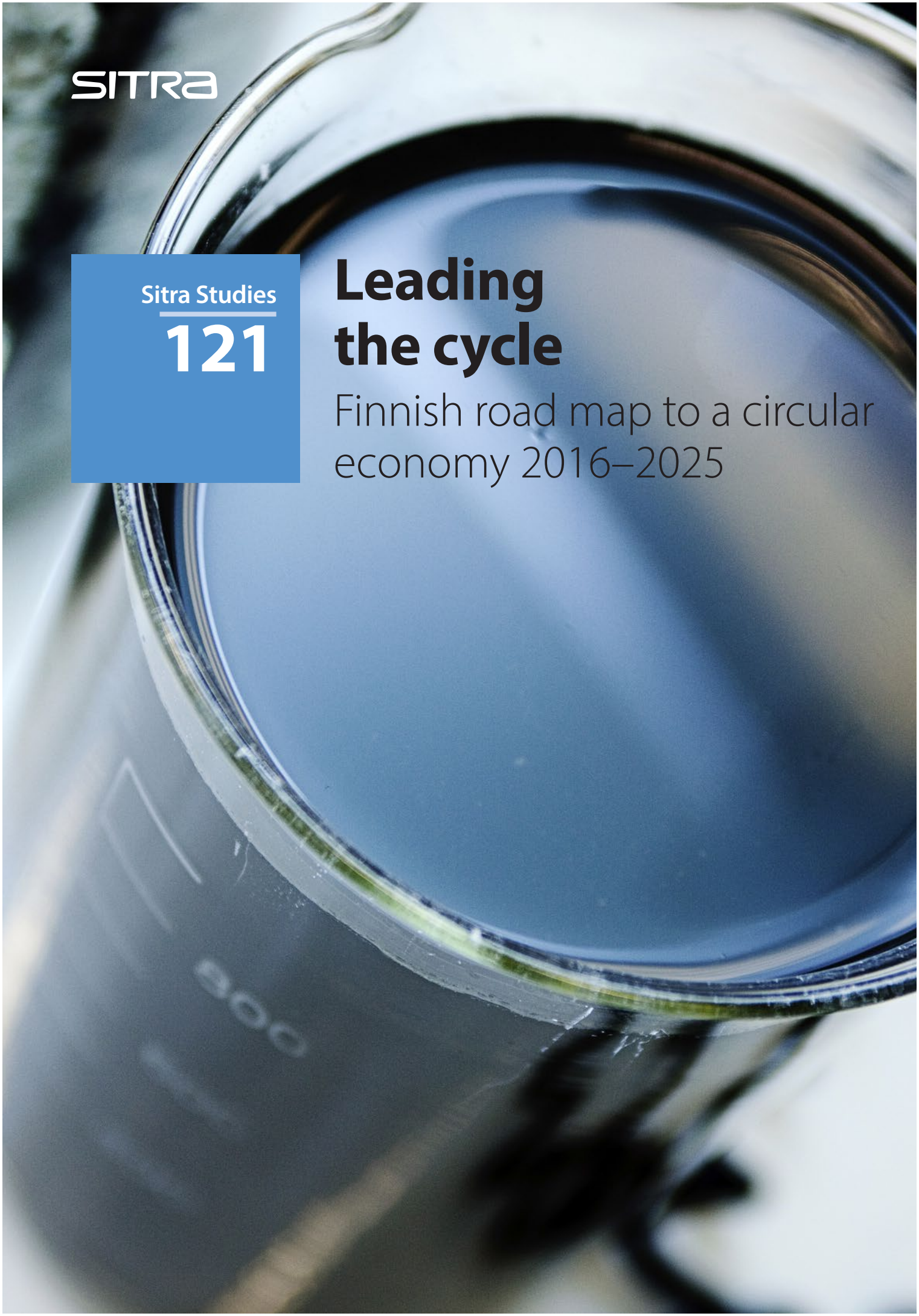

SITRA

Sitra Studies
121

Leading the cycle

Finnish road map to a circular economy 2016–2025

Leading the cycle – Finnish road map to a circular economy 2016–2025

Sitra Studies 121

ISBN 978-951-563-978-3 (PDF) www.sitra.fi
ISSN 1796-7112 (PDF) www.sitra.fi

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Infographics: Tero Harsunen, Zeeland Family

Sitra Studies - is a publication series for
the results of Sitra's future work and trials.

Summary

WHAT?
Finland's circular economy road map describes the concrete actions that can accelerate the transfer to a competitive circular economy in Finland. The road map highlights best practices and pilots that can be easily replicated and provide added value on a national scale.

WHY?
The world really needs pioneers as it searches for operating models for economic growth and increased well-being without over-consumption of fossil fuels and natural resources.

The driving force for the circular economy road map work was to turn the circular economy into a driver of growth, investment and export for Finland. According to cautious estimates, the circular economy is expected to provide Finland's national economy with 2 to 3 billion euros in added value potential by 2030 in the following areas: the machinery and equipment and forest industries, food waste reduction, altering the use of real estate, private consumption and second hand trade, and nutrient recycling.[1] The added value potential for the entire national economy is significantly higher. For the European economy, the net benefit of the circular economy has been estimated at up to 1800 billion euros by 2030. The circular economy also offers significant environmental and social benefits. In order to realise the benefits, identification and management of risks is an important element of circular economy solutions.

The circular economy represents a significant opportunity for increasing employment in Finland. According to a study performed by the Club of Rome, full adoption of a circular economy would create more than 75,000 new jobs by 2030.[2] Therefore, for a country seeking new growth, the circular economy represents a major opportunity that has already been identified: The Finnish government has set a target of making Finland a global leader in the circular economy by 2025. The road map clarifies the actions that will take us to this target. It also stimulates the implementation of the Government Programme and discussion and possible decisions concerning Finland's official positions.

HOW?
We invited Finns to participate in identifying the best pilots, trial ideas and practices. As a result, and the road map was compiled in an open process in which involved collecting hundreds of ideas, input and viewpoints from experts. The participants came from many different sectors, including trade unions, organisations and the corporate field, the Ministry of the Environment, Ministry of Agriculture and Forestry, Ministry of Economic Affairs and Employment, research organisations,

1 Sitra The opportunities of a circular economy for Finland Helsinki: Libris, 2014; Sitra, The economic value and opportunities of nutrient cycling for Finland Helsinki: Multiprint Oy, 2015.

2 Wijkman, Anders and Skånberg, Kristian, The Circular Economy and Benefits for Society: Jobs and Climate Clear Winners in an Economy Based on Renewable Energy and Resource Efficiency, The Club of Rome, 2015.

environmental organisations, consumers, and other stakeholders. Further background was provided by a report on international circular economy pioneers. This demonstrates that the content and production of the Finnish road map is unique in terms of its scope and practical nature. The road map encourages Finnish society to change and take risks – through fast trials, concrete pilots and long-term change policy.

THE CONTENT IN BRIEF

The target of the Finnish government and the road map is to make Finland a global leader in the circular economy by 2025. This mindset emphasises the state's role in facilitating a progressive growth platform that is favourable for the domestic market and companies and, on the other hand, a strong company, export and technology orientation combined with the search for comprehensive solutions and co-operation covering the entire value chain. A circular economy is not being created with only the domestic market in mind – the vast opportunities presented by the global market are the core of the road map's long-term vision.

Finland will seek a pioneering role by focusing on five interlinked focus areas: 1) a sustainable food system, 2) forest-based loops, 3) technical loops, 4) transport and logistics, and 5) joint actions. Synergies between these areas will also be taken into account.

The actions in the different focus areas of the road map are divided into three levels: policy actions, key projects and pilots. Out of more than 100 ideas, the pilots with the greatest opportunities for expansion and best supported the target were included in the project portfolio. The process of compiling the road map also identified areas in which Finland should be active but where the necessary initiatives haven't been clarified or responsible parties still have to be found. Sitra will publish a separate article about these on its website. Achieving systemic change requires a wide range of actions and many social changes. Finland's circular economy road map also aims to create and accelerate a broader "snowball effect".

The road map is designed to be agile and develop over time, focusing on practical actions and continuous systemic change in addition to assessing the actions in relation to the original aim of being a global circular economy leader. The content will be monitored, developed and updated during the process. Productive implementation of the road map will require active and diverse communications.

WHAT NEXT?

It is time to move from development and reports to action – the whole of society has to roll up its sleeves and get moving in order to achieve a circular economy. Road map implementation has already started, but systemic change requires supplementary actions, other initiatives that stimulate society and active companies. We want the entire country to get involved in creating best practices for the circular economy.

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Foreword

The world is currently looking for a new industrial base now that we are moving towards a post-petroleum era. International investors are pulling their money out of businesses with high climate risks. The circular economy plays a key role in preventing climate change and in the renewable energy revolution.

Sitra has played a key role in establishing the circular economy concept in Finnish society, and the breakthrough has happened quickly. Juha Sipilä's Government has set a goal to make Finland a global circular economy leader. The business sector has identified opportunities, which maximise the circulation and enhancement of products, components and materials as well as their invested value. It has been especially interested in how added value is created for products by means of services and intelligence based on digital solutions. And how can production and consumption generate as little surplus and waste as possible?

Even according to cautious estimates, the circular economy offers 2 to 3 billion euros of value potential in Finland alone by 2030. Sitra's estimate was made in co-operation with McKinsey (2014) and Gaia (2015) and following areas were studied for it: the machinery and equipment and forest industries, food waste reduction, altering the use of real estate, private consumption and second hand trade, and nutrient recycling. Similar estimates were later made for Finland by both the Club of Rome (2015) and a Finnish research consortium headed by SYKE (Finnish Environment Institute), VTT Technical Research Centre of Finland and the Thule Institute (2016). The circular economy represents a significant opportunity for increasing employment in Finland. According to the Club of Rome, full adoption of a circular economy would create more than 75,000 new jobs by 2030.

Sitra launched an initiative in spring 2016 to build a circular economy road map for Finland. The work was done under the direction of Sitra in collaboration with the Ministry of the Environment, Ministry of Agriculture and Forestry, Ministry of Economic Affairs and Employment, business life and other important stakeholders. With the road map, Finland will undergo a transition from being an adapter of the circular economy to a leader. However, this will require strong parliamentary consensus spanning multiple government terms.

The road map has been developed in an open process with broad stakeholder engagement. Policy measures, key projects and pilots have been created based on stakeholder consultations and working groups. However, Sitra made the final choices in any cases of conflict. Pilots in the road map are examples of phase one development trials that advance the circular economy. As a future-oriented organisation, Sitra has ensured that certain missing pieces of the whole puzzle have been identified, particular when looking into the far future. The road map actions will be supplemented during implementation. We encourage parties to propose

their own policy actions, pilots and key projects which they have found to be effective and have the potential for scaling up.

Unlike anything else in the world, the road map work has brought together over 1,000 participants in stakeholder events. In the road map tangible actions for growth, investments and exports are emphasised. The effort as a whole represents Finland's first steps toward a circular economy. Key projects and pilots are included in the road map because these are identified practices that advance the circular economy. Their impact is ultimately realised through scalability and replication at the national and international levels. However, as actions alone, they are insufficient. What is needed are supplementary actions taken in connection with implementation of the road map as well as comprehensive co-ordination between the actions. The road map challenges various operators to take supplementary actions to accelerate the transition.

The impacts of the circular economy affect Finnish society in a variety of ways. For example, innovations related to the circular economy are enhanced by creating and supporting the following arrangements, in which cities and municipalities assemble experts, companies and institutions build and realise concrete solutions in Finland. This will allow Finland to become a market leader and establish scalable comprehensive solutions ready to export to the world.

Special thanks go to Minister of Agriculture and the Environment Kimmo Tiilikainen for his support, Permanent Secretary Hannele Pokka for her wealth of ideas, and the prestigious 48-person core group, which was so closely involved in the work, for their inspired and expert contributions. We would like to thank Sitra specialists for their own strong contribution in making the road map a reality. We would also like to thank the more than 250 organisations and persons throughout Finland who submitted pilot proposals and comments. The work has already begun. We are now taking the next steps together toward effecting concrete and wide-ranging change on the way to a circular economy. Sitra is ready to accelerate the implementation of road map actions in its current operations as well as those in the future.

Helsinki, 21/09/2016

Mari Pantsar
Director, Resource-wise and carbon-neutral society theme, Sitra

Kari **Herlevi**
Senior Lead, Circular Economy

1 Road map

Introduction

A CIRCULAR ECONOMY STRIVES TO MAXIMISE the circulation of products, components and materials and the value bound to them as much as possible in the economy. In a circular economy, production and consumption create the smallest possible amount of loss and waste. Material efficiency leads to environmental benefits that a world striving to distance itself from overconsumption needs in order to ensure sustainable development. A circular economy also offers economic and social benefits. Added value is often created for products by means of services and digital solutions based on intelligence.[1] Thus, the circular economy means major changes in consumer behaviour. The driving force for the circular economy road map work is to turn the circular economy into a driver of growth, investment and export for Finland.

Estimates indicate that a circular economy would significantly increase employment in Finland. According to the Club of Rome, more than 75,000 new jobs would be created by 2030, especially in the areas of remanufacturing and recycling and in small and medium-sized technology and service sector companies. These are jobs that are difficult to outsource to other countries and which require a high level of competence.[2]

The social benefit is indisputable and that is why it is so important to act now. Sitra, the Finnish Innovation Fund has co-operated with the Ministry of the Environment, Ministry of Agriculture and Forestry, Ministry of Economic Affairs and Employment, business life and other important stakeholders to produce a circular economy road map for Finland. Hundreds of organisations participated in this extensive process. The road map describes the actions and pilot projects that will take Finland towards a circular economy. Achieving a world leader position requires implementation of the road map and a supplementary range of actions. We will need widely scalable solutions and concrete pilots, while keeping the focus on system-level change in society.

Towards systemic change

Moving to a circular economy means systemic change. This will require regular evaluation of road map projects and updating of the actions. Change requires high-level policy actions and agile pilots that can be launched immediately. We also need new initiatives to promote the circular economy and a sustainable society in order to make Finland a leading circular economy country in 2025.

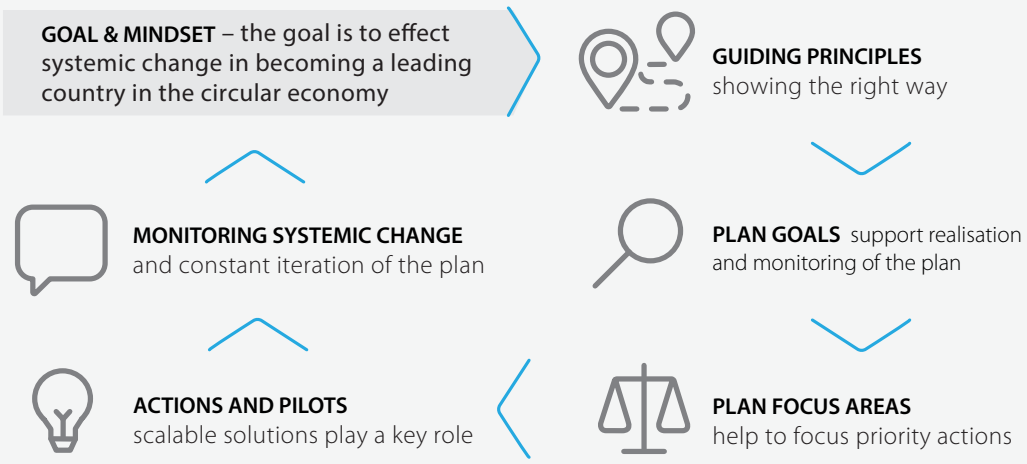
As a way of thinking, the circular economy is growing strongly globally. It is seen as a source of new innovations and becoming a world leader means that Finns need an up-to-date understanding of the international operating environment. The transition will above all require a new kind of open-minded co-operation, the desire to take policy and economic risks, and the boldness to export successes to the world.

1 EU EPRS

2 Ellen MacArthur Foundation, *Growth Within: A Circular Economy Vision for a Competitive Europe,* 2015.

Figure 1. The goal and mindset are the starting points for the road map

Source: Deloitte.



The goal and mindset are the starting points for the road map

The road map will make Finland a leading circular economy country by 2025. This change will emphasise the state's role as a facilitator and supporter, research, development and innovation activities, and a strong company, export and technology orientation combined with the search for comprehensive solutions and co-operation covering the entire value chain.

Guiding principles provide direction for the road map

Guiding principles have been set for the road map in order to ensure that society develops in the right direction during its implementation. Actions are assessed in relation to these principles and they are applied in all actions. The road map takes the balance between economic, social and environmental values into consideration. The guiding principles are described in detail in the background report.

Road map focus areas, actions and pilots

Finland will seek a position as a pioneer by concentrating on five focus areas. These are a sustainable food system, forest-based loops, technical loops, transport and logistics, and joint national actions. Finland's strengths and expertise, the importance of the focus to the economy and its significance in terms of realising the circular economy as a whole have been taken into account in the focus areas.

The road map actions have been divided into

- actions related to administrative requirements and policy actions,
- key focus area projects and
- focus area pilots.

The process also identified areas in which Finland should be active but where the necessary initiatives haven't been clarified or responsible parties still have to be found. Achieving systemic change requires a wide range of actions and many social changes.

Continuous monitoring of systemic change

The content will be monitored and updated during the process. Commitment from the key participants in the road map and an implementation model that concentrates on results is intended to ensure effective realisation of the targets and actions.

Finland's circular economy target

What does striving to be a global leader mean?

The participation of stakeholders has created a mindset for the road map. It combines a guiding role for the state, increased co-operation between companies and different stakeholders and pursuit of strong export growth as well as using the domestic market as a test platform for fast trials. The target state is based on opportunities arising from global trends and challenges, such as urbanisation, climate awareness, population growth and gentrification. It is also based on Finnish technology and digitisation expertise and the potential of a small country to increase collaboration across sectoral boundaries.

We want to make Finland a world leader in the circular economy by 2025 by:

- Creating **comprehensive circular economy solutions aimed at company and export growth:** Finnish organisations operating across sectoral boundaries will enable and implement a circular economy on a global level. The aim is to turn global problems and the satisfaction of basic needs into large and growing markets.
- Ensuring **domestic market functionality:** We will create an ambitious and enabling operating environment that encourages implementation of the circular economy by means of material-efficient and low-carbon solutions. The state will play a key role as an enabler and by determining the mindset and safeguarding continuity, but the choice of methods will be left for other operators.
- Starting fast with **quick actions and concrete trials and by mainstreaming the circular economy:** We will begin promoting a circular economy in Finland's areas of strength and by launching practical pilots. At the same time, we will create the foundation and enthusiasm for implementing broader based, long-term change policy.

What do we want to achieve by 2025?

The aim is for implementation of the circular economy road map to strengthen Finland's competitiveness, and to create new jobs and sustainable growth. This would bring at least three billion euros in added value to the national economy and also contribute to decoupling perceived well-being and economic growth from greenhouse gas emissions and increasing natural resource consumption. From the economic, environmental and society perspectives, the upper level targets can be summarised as follows:

Economy: The circular economy will be a new cornerstone for the Finnish economy

- The circular economy will improve the competitiveness of Finland and Finnish organisations, which will be visible as new companies and new business, increasing turnover and new innovations.
- Circular economy solutions will become an export advantage for Finland and the number of companies with a desire to internationalise will increase.
- Reformed funding models will support circular economy growth: Public procurement and new private and public sector co-operation and financing instruments, such as impact investment and co-operatives, will be used.
- Environmental benefits and an improved state of the environment will create new growth and business.

Environment: Finland as a model country for the challenge of scarcity

- Resource efficiency will improve significantly.
- Material cycle will become more efficient, non-renewable natural resources will be replaced by renewables and we will move towards a carbon-neutral and waste-free society.
- A circular economy will improve Finland's ecological sustainability.
- Control of environmental impacts, such as emissions and the pollution load, will improve.

Society: From adapter to pioneer

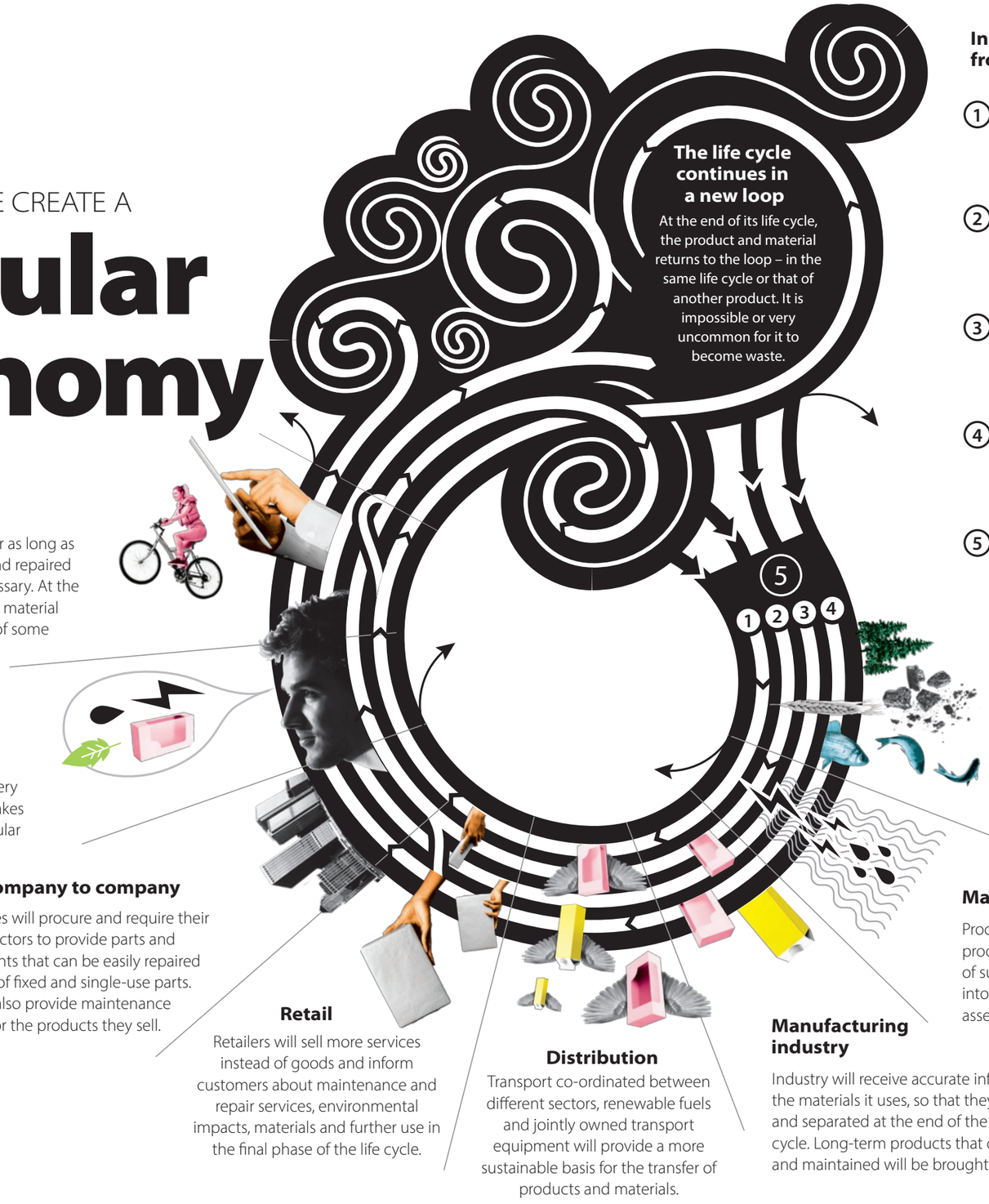
- The circular economy will be taken into account when determining the policy instruments for social actions. The public sector will participate in the circular economy breakthrough in a broad-based manner. So-called public-private partnerships (PPP) between the public, private and third sector[1] play a key role, as will a bold and enabling trial-oriented approach and investment in education.
- A circular economy will create well-being in Finland and promote the transfer to a service and sharing economy.
- People's awareness of the circular economy will increase and lead to a renewal of domestic market demand and focus on circular economy products and services.
- Consumers will adopt new consumption models, which will be visible as, for example, growth in the shared services offering and recycling services.

1 Public-private-people-partnerships refer to co-operation between the public, private and third sector. Companies create growth and jobs while the public sector can enable the piloting and scaling of this work.

THIS IS HOW WE CREATE A

Circular economy

IN FINLAND



Use

The product should be used for as long as possible, it must be serviced and repaired and parts changed when necessary. At the end of its life cycle, the parts or material can be reused in the life cycle of some other product.

Consumer

Demand creates a supply of sustainable products and commodities. Every consumption decision either takes us towards or away from a circular economy.

From company to company

Companies will procure and require their subcontractors to provide parts and components that can be easily repaired – instead of fixed and single-use parts. They will also provide maintenance services for the products they sell.

Retail

Retailers will sell more services instead of goods and inform customers about maintenance and repair services, environmental impacts, materials and further use in the final phase of the life cycle.

Distribution

Transport co-ordinated between different sectors, renewable fuels and jointly owned transport equipment will provide a more sustainable basis for the transfer of products and materials.

Manufacturing industry

Industry will receive accurate information about the materials it uses, so that they can be identified and separated at the end of the product's life cycle. Long-term products that can be repaired and maintained will be brought onto the market.

Material processing

Process planning will decrease the energy need for processing huge amounts of raw materials and the amount of surplus material. The use of side streams will be taken into consideration in, for example, environmental impact assessments and environmental permit processes.

Primary sector

The raw materials are capital for the primary sector. Sustainable solutions are dependent on the protection of raw materials. The aim of a circular economy is to keep Finland vibrant for people and nature.

Initially, Finland's circular economy will grow from the following five areas.

1. **Sustainable food system**
   Consumers choose food that has been produced through the wiser use of raw materials that starts in primary agricultural production. Emissions and resource consumption will be lower.

2. **Forest-based loops**
   Finland is a circular bioeconomy leader because of its forestry and forest industry. Global competitiveness will increase with new commercial products, services, co-operation models and digital technology.

3. **Technical loops**
   Minimising the use of virgin raw materials creates a competitive edge. At the same time, we will maximise the length of material and product life cycles and opportunities for reuse.

4. **Transport and logistics**
   Transport will develop into a seamless, smart system that uses fossil-free fuels. Mobility as a Service (MaaS), the sharing economy and optimised and clean transport will take mobility to a new level.

5. **Common action**
   Legislators, companies, universities and research institutes, consumers and citizens, and vibrant regions are all needed to achieve systemic change. Communication and diverse interaction are particularly important when implementing joint action.

Road map focus areas

A systemic change in the direction of a circular economy requires participation from all of society across sectoral and industry boundaries. The interfaces between different organisations and industries provide the most attractive opportunities for new operating methods and circular material flows. Now we need everyone to work together and change their way of thinking. Practical implementation of the road map and promoting Finland's export measures for a competitive circular economy will require focusing on what is most essential.

Four focus areas were selected for the road map, all of which have mutual synergies and those that apply to other loops. This is not a matter of industries, but a search for actions and pilots via the focus areas selected in this first phase. The fifth entity is joint actions. This includes initiatives that are essential to systemic change and apply to the entire society. The loops are closely linked to each other and an integral part of the surrounding society; legislators, companies, universities and research institutes, consumers, citizens and vibrant regions are all needed to achieve change. Communications and diverse interaction are particularly important when implementing joint actions.

A sustainable **food system**[1] has been identified as a loop in which Finland possesses strong expertise and wants to be involved in developing an even more sustainable overall system. The food system brings together a wide range of different sectors and industries and developing it can benefit strong areas that have already adopted a sustainable society culture of experimentation. For example, Finland has nutrient recycling expertise and experiments that also stand out on an international basis. Nutrient recycling has been highlighted on the political agenda in the current government programme. Digitisation, on the other hand, provides opportunities to scale Finland's internationally competitive food loop expertise into an export product. In a more sustainable food system, consumer choices will be more resource-wise than at present and they will be promoted through public food services. Emissions and resource consumption in food production will decrease and their formation will be transparent.

Forest-based loops and the related innovations have been identified as Finland's best area of expertise in the circular economy. This expertise originally developed within the framework of the conditions surrounding Finland's existing natural resources, as dictated by, among other things, efficiency and scarcity. The country learned to utilise side streams and other circular economy solutions long before the circular economy had even been recognised in Finland. In recent years, expertise has also developed in second-generation biofuels as a result of earlier biochemical innovations. In combination with resource scarcity, the digital revolution has turned bio-based materials into a topic of international interest on a completely new level, and Finland is at the forefront as an innovator. In terms of Finland's national economy and future, it is important to constantly strive to increase the manufacturing and added value of products and services derived from forest-based loops.

In the **technical loops** focus area, the principle is sustainable use of non-renewable natural resources, lengthening the product life cycle via maintenance measures, and determining how the waste produced during material processing and product manufacturing and the materials in the product at the end of its life can be returned to the loop. According to circular economy principles, material development and product design play a key role in this work. Technical loops overlap with organic loops. This is the case, for example, in eco-industrial parks where side streams from the process industry can be used in other industrial processes. Finland's strong technology expertise enables more efficient loops. The service economy and, for example, Internet of Things, also plays an important role in technical loops. We can lengthen the loops and maximise material value so that product intelligence increases and services are created from them.

The goal is for Finland to build its competitiveness by means of sustainable material use as follows: by minimising the need for virgin raw materials and maximising the length of the material and product loop as well as utilising opportunities for reuse. The same applies to the design of products manufactured from secondary materials. They must also continue to be repairable and recyclable. We cannot compromise on product and quality requirements in circular economy products.

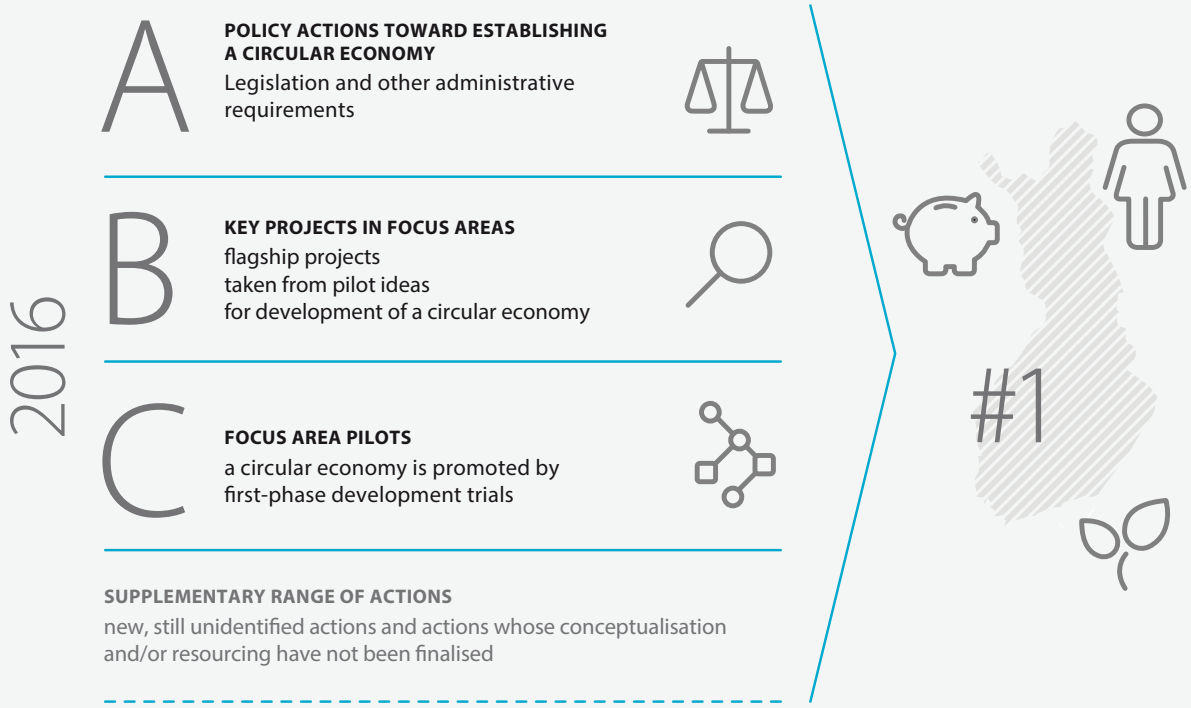
All industrial sectors, including mining, process, chemical and manufacturing, are participating in the technical loops area of circular economy work. New business opportunities will be created for, among others, companies specialising in side stream utilisation. Ensuring that supply meets demand and the role of material development and product design are absolutely essential in terms of achieving this change. Customers must demand products suitable for a sustainable circular economy and industry must offer them.

Transport and logistics have the strongest synergy with this focus area. Transporting people, things, raw materials, side streams and all kinds of materials is

1 Food system refers to all of the parties and resources associated with food production and consumption as well as the resource loop.

Figure 3. Division of road map actions

Source: Deloitte



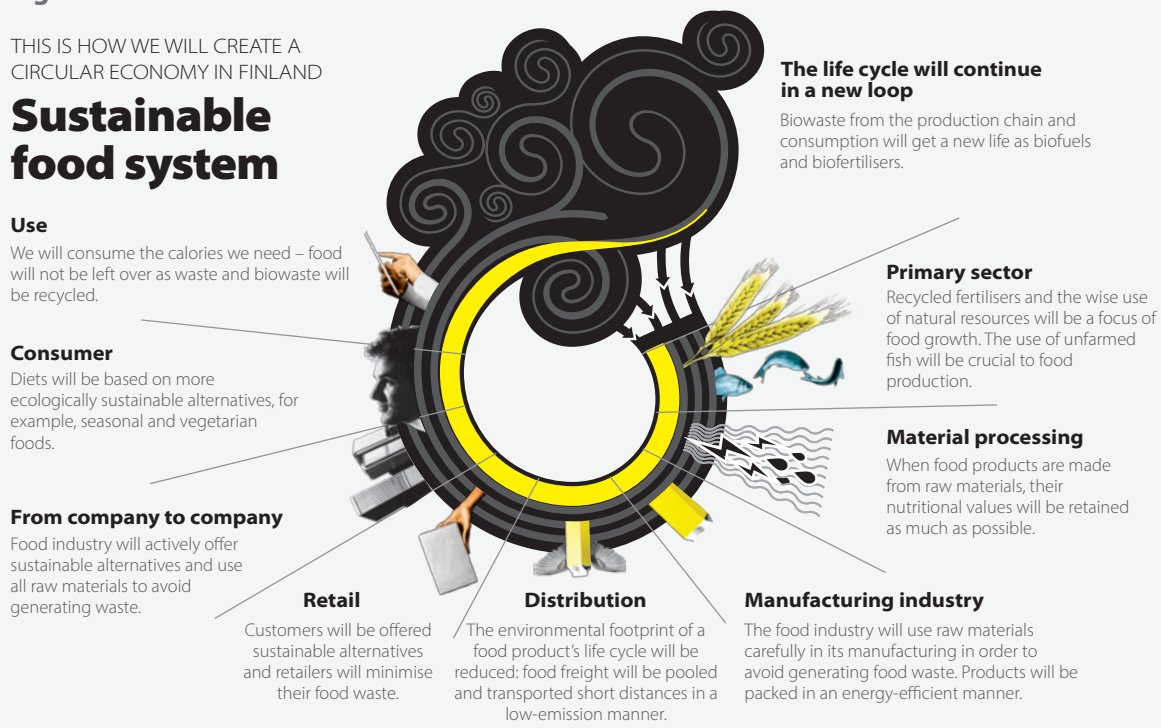
the requirement for the circular economy. Transport and logistics mean that the circular economy already influences sectors other than the companies linked to side and waste stream management. Other concepts linked to the circular economy include increasing return and collection of products and materials to the producer or retailer, which makes it possible to lengthen the product life cycles and recycle materials. Also linked to the circular economy are other reverse logistics solutions to raise the level of logistics capacity utilisation, replacement of fossil fuels with renewable and non-fossil alternatives, and optimisation of transport routes and material flows. Digitisation will be a key enabler as passenger transport moves towards smart, easy-to-use transport that is based on sharing and services (MaaS, Mobility as a Service) – and subsequently much more resource-efficient.

Road map actions

Within the five focus areas described earlier, the road map targets will be promoted by means of three different methods: policy actions, key projects and pilots. Policy actions cover the legislative changes identified in the process, such as finding ways to streamline, co-ordinate and improve cost efficiency and other administrative prerequisites for moving to a circular economy. Key projects are central to the focus area entity and they will either begin immediately or are already in progress. Pilots are phase one development trials that further the circular economy that can be implemented rapidly. Pilots make it possible to disseminate existing innovations and best practices. The road map actions will be supplemented during implementation.

Sustainable food system

Figure 4



The goal of the sustainable food system focus area is for Finland to be a model country for a sustainable food system and a global exporter of solutions – with cleanliness, safety and profitability at the forefront.

The process identified the following key policy actions for the focus area:

CREATING A MARKET FOR ORGANIC RECYCLED NUTRIENTS. In terms of recycled nutrient use, existing nutrients will be utilised to increase biomass and thus reduce the amount of nutrients entering waterways and causing eutrophication. Investigate opportunities to promote the use of recycled fertiliser via the blending obligation because, for example, the obligation to blend renewable and non-renewable fuels has clearly increased the market for biofuels. The investigation should take safety and soil impacts into account. To make export possible, it will be necessary to influence the EU's fertiliser regulation to ensure that recycling ingredients do not prevent CE marking for fertiliser products. Biomasses are a growing focus of the bioeconomy, so ensuring the overall availability of fertilisers will become even more important in the future.

MINIMISE FOOD WASTE BY ELIMINATING OBSTACLES AND CREATING INCENTIVES. Possible areas include eliminating logistics obstacles, implementing a grocery store food waste law with consideration to safety and efficiency viewpoints during its possible implementation, and supporting market-based solutions and voluntary development work. The aim is to reduce food waste throughout the food chain. This is a step towards the EU target of cutting store and consumer food waste in half by 2030.

SUPPORT FOR BIOGAS SYSTEMS AND OTHER RENEWABLE ENERGY SOLUTIONS IN AGRICULTURE IN ORDER TO REPLACE THE USE OF FOSSIL FUELS. Change agricultural subsidies, such as an energy tax refund to promote renewable energy. Expand the possibilities to use agricultural investment subsidies with regard to biogas plants. Shorten the processing periods for environmental permits for agricultural biogas and facilitate co-operation between farms that will make larger processing capacities possible for these biogas plants. Investigate the blending obligation that applies to gas and its capacity to promote demand for biogas produced by agriculture. Promote a distribution system and related solutions that enable more widespread use of biogas.

Key project: A regional sustainable food system

Local food producers and processors will organise themselves to produce foodstuffs and services for the needs of the public food sector and consumers in their region. Create and implement a regional sustainable food system model based on circular economy principles and innovative practices. It will be based on appreciation for local food and on developing a local food culture, also focusing attention on the cultivated land and its condition. Public food management will link producers, processors and consumers.

The primary aim is to increase consumers' understanding and appreciation of food production. A second aim is to enhance food producers' awareness of consumer needs and values, and thirdly to ensure all those involved in the sustainable food system have a greater understanding of sustainability and the impacts of food on the regional economy. Production will become more transparent and consumption will emphasise alternatives that save natural resources and reduce climate emissions.

The most beneficial option in terms of nutrient recycling would be to eat food with a low production intensity, and which makes effective use of recycled fertilisers or promotes nutrient recycling in its production.

In economic terms, the trial will create long-term markets for local producers and provide added value for the entire food system, for example, through product refining. Increasing nutrient and energy self-sufficiency will strengthen the regional economy and create a new types of business.

The key project will promote the circular economy target by improving domestic market functionality and mainstreaming the circular economy.

Owner: Ministry of Agriculture and Forestry

Other implementers: Local producers, Ministry of Agriculture and Forestry, The Central Union of Agricultural Producers and Forest Owners, provinces, towns and cities, joint municipal authorities, Ministry of the Environment, Motiva

The next actions: Finalising the funding base and project content, communicating with the regions about the project, application process

The sustainable food system focus area

Policy actions:	Create a market for organic recycled nutrients; Minimise food waste by eliminating barriers and creating incentives; Support biogas systems and other renewable energy solutions to replace fossil fuels in agriculture
Key project	**A regional sustainable food system**

Description of the pilot

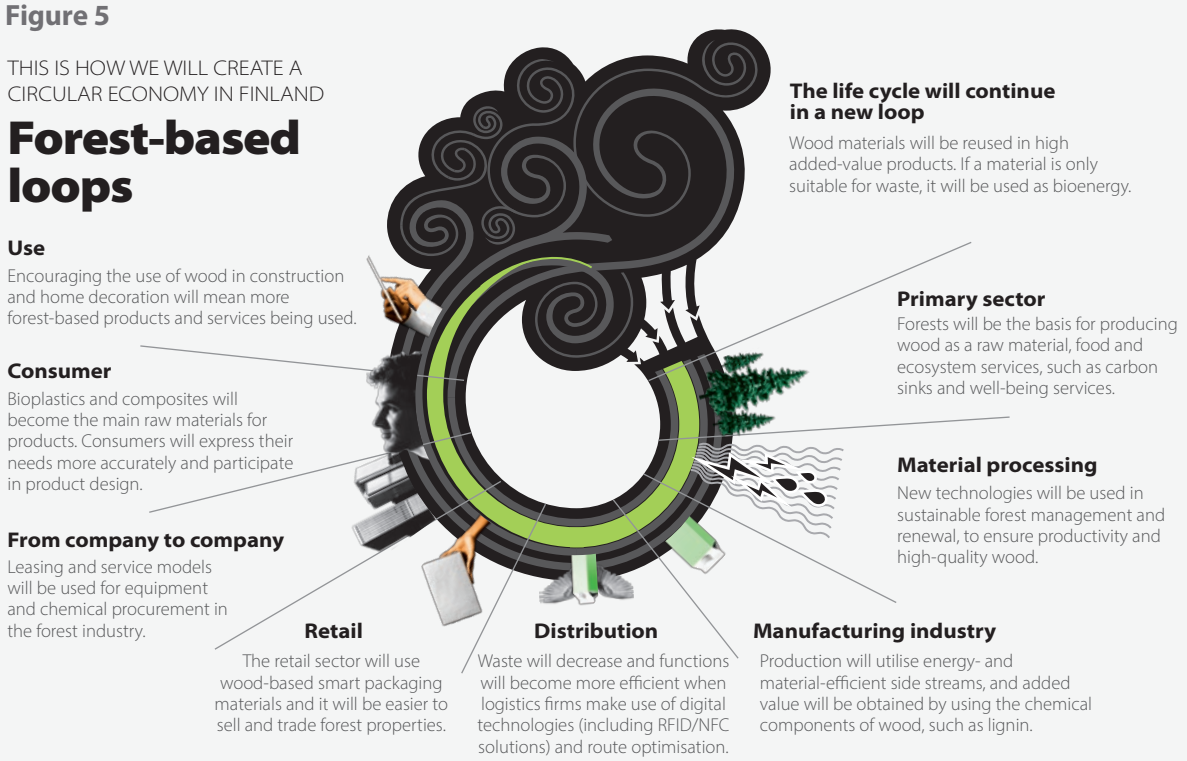
Waste food	**Logistics: Expanding the Yhteinen Pöytä (Shared Table) project to reduce food waste.** Yhteinen Pöytä has created a network and model for community food aid activities in Vantaa and more centralised distribution of waste food. The operating model saves effort and costs by centralising food transport and sorting and social sustainability by means of employment actions and a communal approach to meals. This model will be used elsewhere in Finland. **Owner**: Cities, Vantaa Parish Union, City of Vantaa, Motiva
Nutrient recycling	**Domestic fish and fish industry as the cornerstone for a competitive circular economy.** Promote nutrient recycling from the sea and waterways to the soil by means of, for example, selected fishing that targets the Cyprinadae family and using catches from fish stock management for human consumption and for processed products with higher added value. The actions strive to reduce the need for imported fish and feed and to create new business opportunities in the food chain for the domestic market and for export. Examples of this are the John Nurminen Foundation's Nitritrade programme and Lahti's Järvikalahanke (Lake fish project). **Owner:** John Nurminen Foundation / Lahden Ateria, fishers in the Lahti region, Lake Vesijärvi Foundation, Lahti environmental services, Päijät-Hämeen Kalatalouskeskus and Lahti Greens.

Nutrient recycling	**Thermal sludge processing and construction of the related pelleting plant.** Processing sludge thermally and then mixing it with the ash from burning biomass provides a suitable mix of growth nutrients for agricultural and forestry use. Pelleting the mixture produces fertilisers suitable for the existing spreading equipment. In order to enable export, it will be necessary to influence the EU's fertiliser regulation so that recycling ingredients are permitted in fertiliser products with CE labelling. The thermal sludge processing report will be financed by the Ministry of the Environment's Nutrients into recycling 2012–2015 (RAKI) programme. **Owner:** Outotec (Finland) Oy, Ecolan Oy and the city of Nokia/Verte Oy
	A biogas system and utilisation of food and fertiliser nutrients in symbioses. Effective nutrient recycling will improve soil productivity and well-being, save natural resources and reduce the amount of nutrients being flushed into the Baltic Sea. It will also increase the energy self-sufficiency of agriculture. Adaptation and adoption of operating models already in use, for example, Sybimar (utilisation of waste from fish production and greenhouse for biogas and biofuel) the Kirkkokallio area in Honkajoki (several companies in raw material- or energy-related symbiosis with Honkajoki Oy, which processes animal-based waste) or Jeppo biogas (symbiosis with Snellman's Lihanjalostus Oy) elsewhere in Finland. Also biogasification of fertiliser and use of its nutrients.
	More efficient collection and use of municipal biowaste. The recycling rate for municipal biowaste (including garden waste) is low, for example, only 36% in 2012. The remainder is disposed of as mixed waste and incinerated rather than being composted or used for biogas production. New cost-effective collection system and services will be piloted and waste producers' awareness of the benefits of recycling will be improved. The aim is to achieve a 60% recycling rate for municipal biowaste in 2022 in accordance with the working draft of the National Waste Plan. **Owner:** Towns and cities and waste plants, private waste sector operators
Diet	**Public procurements: encourage the use of sustainable food.** Make sustainable food that saves natural resources and reduces climate emissions a target in municipal public food procurement. Survey suitable producers and their offering as well as the special quality criteria and opportunities for co-operation. Develop co-operation, for example, regarding recipes, between kitchens and producers. **Owner:** Finnish Sustainable Communities and Municipalities (FISU), RANKU nutrient neutral municipalities
	Natural resource consumption calculators for consumers. Develop and disseminate free calculators that help illustrate the effects of consumer choices (for example, related to diet, transport, town of residence, leisure-time living) on natural resource consumption and the level of an individual consumer's or family's material footprint. **Owner:** For example, Lahti's Tonni lähti calculator and the Nutrient footprint calculator developed by John Nurminen Foundation, Finnish Environment Institute and Sanoma
	An open data competition for food and nutrients. Gets start-up communities, developers and students involved in brainstorming food system and agriculture ideas. Relevant information, for example, the National Institute for Health and Welfare's Fineli database and various Evira databases. Also development of open data interfaces, for example, ENVI-base or opening up company data. **Owner:** Possible implementers are Open Knowledge Finland, agricultural producers, retail companies, start-ups
	Promote communal food production, new ownership models and shared consumption. Enable transparency in food production and food chains, food sharing and an increase in appreciation for food. Guidelines and dissemination of new ownership models, such as co-operative farms. The educational perspective will also be considered.

Forest-based loops

Figure 5

THIS IS HOW WE WILL CREATE A CIRCULAR ECONOMY IN FINLAND



The target of the forest-based loops focus area is for Finland to be a circular bioeconomy leader because of its forestry and industry. New commercial products, services and co-operation models as well as the development and implementation of digital technologies will create global competitiveness.

The road map work identified the following key policy actions for the focus area:

MAKE THE MAIN TARGET OF THE NATIONAL FOREST STRATEGY MAXIMISING THE OVERALL VALUE OF FINNISH FOREST-BASED PRODUCTS AND SERVICES RATHER THAN THE AMOUNT OF WOOD. This addition to the strategy will encourage the development of refining activities with a higher added value in Finland. From the national economy viewpoint, raising value is more important than increasing the amount of wood.

PUBLIC PROCUREMENT WILL ENCOURAGE THE SELECTION OF WOOD-BASED PRODUCTS AND THOSE MADE FROM OTHER RENEWABLE RAW MATERIALS WHEN LIFE CYCLE ANALYSIS DEMONSTRATES THAT THEY ARE MORE SUSTAINABLE OVERALL. The actions include increasing awareness and changing attitudes in the units responsible for procurement in national and local organisations. Compile manuals about green public procurement that support the national targets on a procurement sector basis.

SUPPORT FOR INVESTMENTS AIMED AT DEMONSTRATING BIOPRODUCTS AND BIOSERVICES ON A COMMERCIAL BASIS. This will involve using tools, such as biorefinery competitions, that can support the demonstration of new production methods on a sufficiently large scale. The goal is to enable additional investments aimed at expansion.

CREATE INCENTIVES FOR DEVELOPING FINNISH WOOD CONSTRUCTION AND THE DESIGN WOODEN FURNITURE AND INTERIOR DESIGN SECTOR. Encourage long-lasting products with high added value for residential use in accordance with circular economy principles. Incentives can be created by, for example, investing in competence development, increasing awareness and developing the business of companies in the sector.

Key project: An international demonstration platform for new bioproducts

The key project will be used to build a consortium of companies of various sizes from many sectors, which will apply for international funding for a forest-based circular economy concept for producing new bioproducts (for example, from the EU's Horizon programme, European Fund for Strategic Investments (EFSI) and/or regional development and cohesion funds). The project will be responsible for building the consortium, concept development for the entity and co-ordination of funding applications.

The project will examine forest-based loops and value chains in a comprehensive manner and demonstrate new methods that comply with circular economy principles for manufacturing high added value bioproducts. Bioproducts and services will replace fossil and products and meet demand in completely new areas.

The project will demonstrate circular economy practices and solutions, such as

- the application of new service-based business models;
- optimal use of material flows in industrial symbiosis;
- automation and industrial internet applications in the forest industry;
- development of bio-based chemistry and biotechnology and entrepreneurship and innovation activities;
- forestry that observes circular economy principles.

Owner: Sitra

Other implementers: Finnish Forest Industries Federation, Chemical Industry Federation of Finland, Finnish Energy, Clic Innovation

The next actions:

- Form the project group (autumn 2016)
- Define the roles of the members (autumn 2016)
- Specify key project activities (autumn 2016)
- Apply for funding for demonstrations (spring 2017)
- Build a demonstration entity (2017–2018)

Forest-based loops

Policy actions

Making the main target of the national forest strategy the overall value of Finnish forest-based products and services rather than maximising the amount of wood; encourage the use of wood-based and other products made from renewables in public procurements; support for investments aimed at demonstrating bioproducts and bioservices on a commercial basis; create incentives to develop Finnish wooden construction and the design wooden furniture and interior design sector.

Key project

An international demonstration platform for new bioproducts

Description of the pilot

Industrial symbiosis

A showcase network that makes use of side streams. The forest industry produces large amounts of side streams that could be used to manufacture new products and increase the added value created from the forest. The use of side streams is already part of the circular economy to a certain extent and is strongly linked to energy production. Finland is a leading international expert in this area. Opportunities exist for competence demonstration and branding as well as for scaling competence and solutions and increasing co-operation.

Owner: Forestry, chemical and energy industry operators, Circular economy parks and regions, Finnish Forest Industries Federation, Chemical Industry Federation of Finland, Finnish Energy, VTT Technical Research Centre of Finland Ltd, Motiva

ECO3 An industrial-scale bio- and circular economy business environment. A regional cluster of companies that provides bio- and circular economy companies with opportunities for co-operation and demonstration functions. The core of the ecosystem will come from mutually supportive business actions. In addition, regional companies, universities and public sector organisations will work together, with a particular focus on developing new business functions, innovations, products and services at the domestic and international level.

Owner: City of Nokia, Verte Oy

New innovations

Building a packaging valley in Finland. The goal is to create a "Packaging Valley" in Finland, which would be a unique packaging sector ecosystem and the first of its kind in the world. Finland's forest industry, packagers, innovative small and medium-sized companies (SMEs), software development, interface design, security software and Slush/hackathon-type activities will be harnessed to further seamless co-operation between packaging digitisation and material development. The aim is to build a growth-driven, market-oriented ecosystem that has international links from the very beginning in order to create comprehensive concepts that are unique and Finnish.

Owner: Tekes, Pöyry

Development of a lignin ecosystem. Finland has a significant amount of competence and potential related to further development of a lignin market. We have raw materials, strong industrial players and high-level technology and research expertise. This lignin ecosystem project aims at further increasing the international role of Finnish companies and ensuring that competence and business continue to grow in the future. The goal of the project is to build a growth-driven, market-oriented ecosystem that has international links from the very beginning and covers the entire value chain, from lignin producers to refiners and international end users operating in different sectors.

Owner: Tekes, Pöyry

Cellulose from Finland / DWoC. Design Driven Value Chains in the World of Cellulose (DWoC) is a multidisciplinary research collaboration project aimed at finding new innovative applications for cellulose-based materials. The project combines design with technology competence. The goal of the project is to build a dynamic pulp-based business ecosystem that creates new products and business concepts.

Owner: VTT Technical Research Centre of Finland Ltd / Aalto University

Ecosystem services	**Forest ecosystem services – OPENNESS EU project.** Intangible value creation is a key factor in the circular economy, so strong integration and commercialisation of ecosystem services will open up new business opportunities. OpenNESS is a European research project that wants to link the concepts of ecosystem service and natural capital with the planning of land use and natural resource use. The project offers tested, practical and tailored methods for integrating ecosystem services into different sectors. The international project investigates how the concepts link to and support EU policies. It also assesses which factors will enable or prevent the maintenance and continuity of ecosystem services in the future. **Owner:** Finnish Environment Institute (SYKE)
New innovations	**Export support for innovative bioproducts and technologies.** The target will be countries that have a bioeconomy strategy and which are adopting circular economy principles (mainly western Europe, Japan, Korea, North America). Segments: fibre products, biochemicals and bioplastics and composites, side stream utilisation. There are several application areas. The focus will be on export development, capitalising companies with Finnish and international money and attracting investments to Finland. The aim is to develop significant business in Finland on the basis of the major R&D functions already performed. Refining bio-based raw materials into products with a higher refinement value, increasing product biodegradability and recycling and using more environmentally-friendly production methods instead of production processes that consume a lot of water, energy and raw materials all support circular economy targets. **Owner:** Finpro
Digitisation	**A biomass atlas.** The biomass atlas will be a browser-based online service that promotes sustainable use of biomasses. It will allow users to examine the biomasses that are available for use and their location on the map. The user can calculate the amount of biomasses on a designated area on the map, check limitations on use and model the effects of use on sustainable development. **Owner:** Ministry of Agriculture and Forestry, Natural Resources Institute Finland
Nutrient recycling	**Switching to the use of recycled nutrients in waste water treatment plants at forest industry plants.** All of UPM's waste water treatment plans will commit to using only recycled nutrients instead of mineral nutrients by 2030. UPM and BSAG actions are aimed at creating new recycled nutrient operators in Finland. Market needs will also promote technology development. **Owner:** UPM, BSAG, recycled nutrient suppliers

Technical loops

Figure 6

THIS IS HOW WE WILL CREATE A CIRCULAR ECONOMY IN FINLAND

Technical loops

The life cycle will continue in a new loop
Products will be dismantled and the components and materials used for another product's life cycle or recovered.

Use
Products can be serviced and repaired. Not all products are purchased new, and there is a wide market for used goods.

Consumer
No more unnecessary goods. Unnecessary items will be returned to the loop, and recyclable materials will be sorted. Joint use, renting and sharing will be everyday events.

From company to company
Companies will develop sustainable solutions and actively sell them to other companies.

Primary sector
Mines will minimise environmental impacts. Non-renewable natural resources will be used sustainably and side streams utilised.

Material processing
Returning different materials to the cycle at the end of their useful life will be taken into account in the material development and manufacturing phases.

Retail
Stores and retailers will sell sustainable goods and actively inform customers about them.

Distribution
Cargo transport systems will be integrated and less-than-full loads avoided. Transport systems will be energy efficient and low in emissions.

Manufacturing industry
Products will last longer and product design and manufacture will take into account reuse and recycling.

The goal in this focus area is for Finland to build its competitiveness by producing solutions that take into account sustainable use of materials and products, optimising the length of their loop, and enabling reuse in different phases of their life cycle. It is also important to ensure clean material loops at the same time. Lengthening product service life by means of service measures and updates made possible by the digital economy will increase cost effectiveness.

The process identified the following key policy actions for the focus area:

PROMOTE THE USE OF SECONDARY RAW MATERIALS, INCLUDING WASTE ACT INTERPRETATION AND STREAMLINING THE ENVIRONMENTAL PERMIT PROCEDURE. The goal is to utilise secondary raw materials, such as industrial side streams, as effectively as possible. This will be achieved by actively seeking uses for side streams instead of allowing them to become waste. Co-operation with industry, the authorities and experts will be developed in order to enable new, innovative solutions and methods of utilisation. The use of secondary materials will be promoted by means of public procurement and public infrastructure construction in particular.

USE OF THE SIDE STREAMS PRODUCED DURING THE PROJECT, SUCH AS SURPLUS SPOIL, WILL BE PLANNED AND DESCRIBED IN THE ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL PERMIT PROCESSES. Good practices, such as Helsinki's mass co-ordinator operating model will be disseminated.

INCLUDE ECODESIGN REQUIREMENTS IN PRODUCT DESIGN AND CONSTRUCTION AND IN THE MATERIAL DEVELOPMENT PHASE. Environmental impacts during the life cycle of a product and building will be taken into account during planning. The same applies to the design of products manufactured from secondary materials. They must also continue to be repairable and recyclable. We cannot compromise on product and quality requirements in circular economy products. Ecodesign will support circular economy solutions as well as the transition to a low-carbon and zero-waste loop. The European Commission strives to implement this development by means of guidelines for public building procurement (Green Public Procurement)[1].

1 http://susproc.jrc.ec.europa.eu/Efficient_Buildings/

Key projects in the technical loops focus area

Due to the scope of technical loops, this focus area has two key projects. The circular economy demo plant is linked to life cycle thinking. The Arctic industries ecosystem and Kemi-Tornio circular economy innovation platform is associated with industrial and construction material streams.

Key project: Circular economy demonstration plant

The project will develop the circular economy for electrical and electronic equipment: ecological planning (modularity, sustainability, reuse, energy and material efficiency), efficient collection and sorting (robotics, automation, markers, including identification of materials containing harmful chemicals), product refurbishing for reuse, production demolition and component utilisation, and use of materials by means of second-generation processing systems and technologies.

The circular economy plant concept being developed in the project is based on maximising the value of recovered materials (precious metals, rare earth metals, other critical materials and minerals). The demonstration plant will be developed into a service platform (Platform-as-a-service, PaaS), which can then be exported to regions where the safe, efficient and environmentally friendly recycling of waste electrical and electronic equipment waste (WEEE) is challenging (such as China, India, Africa, South America).

The project will make use of special competence that Finnish companies and research institutes have in recycling technologies and digital solutions. The plant will represent the best available technology (BAT). In addition to waste electrical and electronic equipment, other fraction such as industrial and electric car batteries, plastics and metals are interesting, as is the using solar energy and other cleantech when building the plant.

Key project owner: Federation of Finnish Technology Industries

Other implementers: Kuusakoski, ELKER, University of Jyväskylä, Jyväskylä Energy Group, City of Jyväskylä, Metropolia / Electria

The next actions: Assembling an implementation consortium and co-operation model (operating models, legal structures, funding, etc.) Scaling the processing system from laboratory conditions to the pre-manufacturing phase. Ensuring the supply of WEEE equipment for processing from consumer and corporate markets. Piloting new collection methods in co-operation with the producer/organisations.

Questions related to product life cycle (ecological planning, markers, product information management).

Key project: The Arctic industries ecosystem and Kemi-Tornio circular economy innovation platform

Digipolis - Kemi Technology Park has been co-operating with industry in Sea Lapland and Lapland for 20 years to systematically develop industry services across sectoral boundaries. Four years ago, industry and other stakeholders requested that a systematic process be launched to promote better utilisation of industrial and community side streams in the Kemi-Tornio region. The worked began immediately with an open and networked operating model in which information was shared as openly as possible. The work also involved experts from industry, educational institutes, sector research institutes and the authorities co-operating across industrial and sectoral boundaries. The work resulted in the creation of a systematic model for the process and tools needed to promote use of production and community side streams, industrial symbiosis and the circular economy in a company-oriented manner in a wide-ranging co-operation network.

The next phase will involve piloting and further development of the concept and tools on a broader basis in Northern Finland, Sweden and Norway. Since this work involves the forest, metal, mining and energy industries are all involved, it also has clear interfaces with the forest-based loops and transport focus areas.

Key project owner: Digipolis - Kemi Technology Park

Other implementers: Aalto University Clean Technologies research group, Motiva, Sitra, Tekes, the Ministry of Economic Affairs and Employment, Nordregio, Norden, Sintef, Federation of Finnish Technology Industries, Lapland University of Applied Sciences, Vocational College Lappia, Geological Survey of Finland, Regional Council of Lapland, Centre for Economic Development, Transport and the Environment, Finnish Environment Institute, University of Lapland, local governments and development companies in Lapland, Arctic Industry and Circular Economy cluster, Lapin kaivos- ja teollisuuspalvelutoimijoiden kehittämisverkosto, Agnico Eagle Finland, Ahma ympäristö Oy, Hannukainen Mining Oy, FQM Kevitsa Mining Oy, Metsä Fibre & Metsä Board Oyj, Outokumpu Stainless Oy, Waste Management of Gulf of Bothnia Ltd, Pohjanmaan Hyötykäyttö Oy / Esa ja Pojat, Pohjaset Corporation, SMA Mineral Oy, Stora Enso Oyj, Tapojärvi Oy, Ecolan Oy, Savaterra Oy, Kaidi Finland Oy

The next actions: Expand activities into regions near Lapland in Finland and the North Calotte region; a significant increase in development resources by means of deeper co-operation with core developer partners and new partnerships with Finnish and global pioneer companies. Create new international networks. Greater emphasis on supporting investments that promote a circular economy and tackling challenges.

Technical loops

Policy actions

Promoting the use of secondary raw materials, including waste act interpretation and streamlining the environmental permit procedure. The goal must be to utilise secondary raw materials, such as industrial side streams, as effectively as possible by actively seeking uses for side streams instead of allowing them to become waste; Use of the side streams produced during the project, such as surplus spoil, should be planned and described in the environmental impact assessment and environmental permit processes; Include ecodesign requirements in product design and construction and in the material development phase.

Key projects

Circular economy demonstration plant; Arctic industries ecosystem and Kemi-Tornio circular economy innovation platform

Description of the pilot

Industrial and construction material flows

Create regional markets for secondary materials. For example, a soil exchange for side streams from the mining industry, process industry and construction. The Helsinki Capital Region's UUMA programme will be utilised. The first action will be to organise a training seminar on the topic, where a working model for using secondary materials in infrastructure construction will be presented to key operators.

Owner: Motiva, Confederation of Finnish Construction Industries RT

Material efficiency agreements. Implement voluntary agreement activities for material efficiency in accordance with the applicable road map published in June 2016. Clearly linked the circular economy viewpoint to work and future pilots already being prepared by Motiva. It should be noted that a material efficiency agreement differs from energy efficiency in that material efficiency is often achieved in different phases of the value chain rather than at a single production plant. The agreement model should lead to clusters of different operators that jointly commit to certain circular economy goals, such as reuse of parts, life cycle services.

Owner: Ministry of Economic Affairs and Employment, industry unions, Motiva

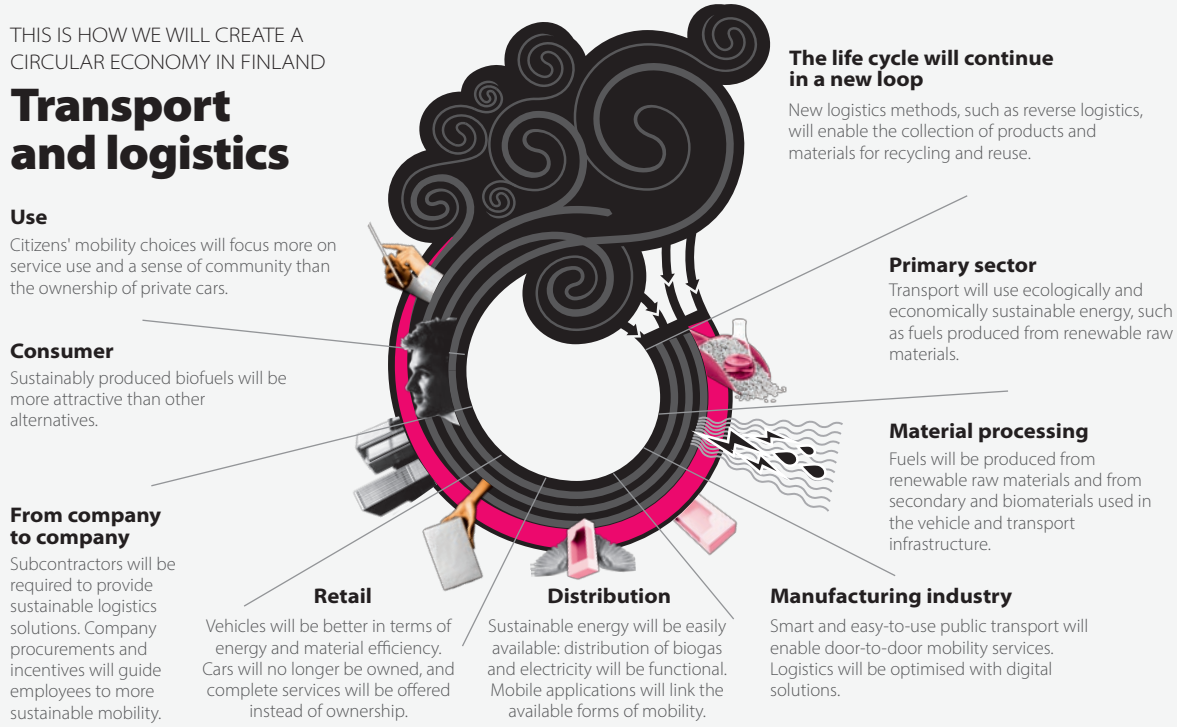
Use of secondary material in earthworks. The pilot will involve developing practical guidelines and an operating model for using secondary materials.

Owner: City of Lahti (owner), Ladec Oy, local companies

Industrial and construction material flows	**Industrial excess heat.** Lost heat accounts for 37% of Finland's industrial energy use. More than 54 TWh of heat escapes into the environment every year. Some 4 TWh of this excess heat produced by industry can be utilised in a profitable manner. The Kilpilahti industrial area is a major individual producer of excess heat and would be suitable as a pilot for developing utilisation solutions. Lost heat should be used as energy, for example, in food production and industrial processes. **Owner:** Posintra, Neste Jacobs and other companies in the region, Gaia Consulting
Construction and property use	**Resource-efficient construction.** Construction uses a huge amount of materials and masses for different products and surfaces. Choices of materials and products affect a building's service life and how it can be refurbished. In terms of the circular economy, town planning is the first decisive phase, because it can, for example, be used to steer construction efficiency and material choices. On the other hand, building and project planning can steer material flows at the work site, such as using masses at another work site, using excess material, minimising waste, using any demolition waste, etc. Realisation of this requires town planners, permit authorities, designers, customers and implementers share a commitment to anticipation. There is a shortage of circular economy solution implementers, but business opportunities exist. **Owner:** Possible implementers Green Building Council, Finnish Association of Civil Engineers, Motiva, universities, universities of applied science and organisations providing vocational continuing education.
Increasing knowledge	**The mark of a professional.** Training for vocational teachers in cleantech and circular economy themes. Teaching and education is also a part of knowledge production and shaping values and appreciation. For example, every person working at a construction work site must know how to implement the circular economy in their daily work. **Owner:** SYKLI Environmental School of Finland, Federation of Finnish Technology Industries
Construction and property use	**Technical departments in towns and cities can be circular economy enablers.** The technical department of a town or city is still seen as being quite limited, even though it plays a very important and growing role in city formation and construction. Towns and cities and especially their technical departments have the chance to be at the very heart of things if a change in basic operations can be achieved. **Owner:** Possible implementers: selected pilot towns and cities
B2B, consumer interface	**A circular economy shopping centre.** The question setting is "How can a single shopping centre be modelled from circular economy starting points?" For example, using digital applications to manage the synergies and material flows resulting from combining the logistics functions of different retail stores; procurement is also an interesting area; service economy pilots; producing added value for property developers. The Mylly Shopping Centre in Raisio could serve as a possible pilot site. Mylly is a pioneer in matters related to monitoring and using waste fractions and would be interested in studying how a shopping centre can operate in a circular economy framework. **Owner:** Possible implementer: Mylly Shopping Centre in Raisio. Other possible operators: Finnish Council of Shopping Centres, property companies, L&T, S Group, Kesko
Construction and property use	**Maximising use of the existing building stock and joint use of facilities.** In the Helsinki area alone, there are currently 1.25 million m2 of empty office space which cannot currently be converted for residential use because of planning regulations. Assuming that a third of this space could be converted by 2030, measured in rental income the value of such a conversion would be around EUR 255 million a year. The national economy would also save close to EUR 700 million if the costs of conversion were compared to the costs of new construction. (Source: Sitra: The opportunities of a circular economy for Finland (2014)) **Owner:** Possible implementer: Innovation competition for facility use, land use planning by towns and cities

Transport and logistics

Figure 7



The goal of this focus area is for Finland to be recognised as a country in which seamless, smart transport that is developing in a fossil-free direction and logistics form the cornerstone of the circular economy. Mobility as a Service (MaaS), sharing economy transport solutions, and optimised and clean transport will take the energy and resource efficiency of transport and logistics to a new level.

The process identified the following key policy actions for the focus area:

DEVELOP INCENTIVES AND POLICY INSTRUMENTS TO ACCELERATE A RADICAL CHANGE TOWARDS A MORE SERVICE-BASED TRANSPORT SYSTEM. Promote alternative forms of transport to replace private cars, such as compatible door-to-door mobility services (MaaS), smart and easy-to-use public transport, and the development and spread of new services, walking, cycling, ridesharing and car sharing. The goal is a manifold increase in the resource and energy efficiency of the transport system, where user-oriented, interlinked mobility services, including public transport, provide the foundation for smooth travel chains.

AMONG OTHERS, THE FOLLOWING METHODS can promote the transport change:

- bold development of public transport in urban areas and cities, including improving and optimising service compatibility
- promoting Mobility as a Service (MaaS) by opening up public transport and other service information and payment system interfaces and developing compatibility
- developing procurement competence, including various incentive models
- personal incentives to enhance the choice of alternative transport methods
- promoting a transport change by means of land use, transportation and housing agreements (LHT Network)
- increasing the number of parking places for shared cars by means of flexible town planning and developing the related co-operation;
- reducing subsidies that favour private cars.

DEVELOP TAX AND OTHER STEERING TO SUPPORT THE TERMINATION OF FOSSIL FUEL USE IN PRIVATE CARS BY 2040 AND PROMOTE THE IMPLEMENTATION OF BIOFUELS PRODUCED IN A SUSTAINABLE MANNER. The goal is to raise the share of electric, biogas and other fossil-free private cars to 25 per cent of new private cars by 2020 and to 50 per cent by 2025. The methods of achieving this goal include subsidies directed at fossil-free private cars and elimination of the tax on driving power as well as stricter emissions progression in car and vehicle taxes. Increasing the emissions component of the excise duty on fuels will favour low-emission fuels, such as sustainably produced biofuels.

Key project in the focus area: Promoting and prioritising Mobility as a Service (MaaS) in the Helsinki Capital Region.

The goal of the Smart & Clean project is to create a low-carbon and smart transport and mobility export concept for Finland. Over a 5-year period, 20-30 significant project entities will be created, with the themes of transport, construction, energy, waste and water sector and consumer cleantech. New type of co-operation (cities, companies, state) to accelerate the climate targets of cities and promote the circular and sharing economy. This will simultaneously produce international references for Finnish companies in the domestic market.

The role of the Smart & Clean project with regard to MaaS is to bring together and link different operators. Its task is to combine operators across administrative and sector boundaries and work actively to ensure that different operators open up their systems (for example, data and payment interfaces).

Transport plays a key role in several Smart & Clean project entities (for example, construction and housing, and consumer cleantech). Smart transport and mobility solutions and their implementers will be seamlessly integrated with the project entities.

The Smart & Clean project will help create a test platform an ecosystem based on open data and infrastructure. This will enable innovations related to smart transport and mobility and the development of new business. Smart & Clean will also bring existing transport pilot projects together under a common communications umbrella.

Owner: Smart & Clean Foundation

Other implementers: Helsinki Region Transport, VR, cities, Ministry of Transport and Communications, companies in the region

The next measures: identification and development of project entities

Transport and logistics

Administrative requirements	Develop incentives and policy instruments to accelerate a radical change towards a more service-based transport system. Develop tax and other steering to support the termination of fossil fuel use in private cars by 2040 and promote the implementation of biofuels produced in a sustainable manner.
Key project	**Promoting and prioritising Mobility as a Service (MaaS) in the Helsinki Capital Region.**

Description of the pilot

Energy	**Make Central Finland a model province for transport biogas.** Long-term collaboration in Central Finland has resulted in a biogas ecosystem: the region has several leading biogas companies as well as research and development activities. Public organisations in Central Finland are working together to develop biogas production and use, especially in the area of transport. Two new biogas plants will be completed in the region in 2017. Promoting the use of biogas outside the gas network requires a diverse range of activation measures, because the general public is not yet aware of the benefits and opportunities of biogas vehicles. Networking co-operation can provide the best outcome in terms of promoting this issue. A project that is still in need of funding will further diverse, activating and interactive communications and marketing from various operators to different target groups. The end result will be a joint marketing model and concrete products. **Owner:** Regional Council of Central Finland (owner), Central Finland Centre for Economic Development, Transport and the Environment, City of Jyväskylä, other towns and cities in the region, Jyväskylä Regional Development Company Jykes Ltd and other development companies in Central Finland **Other stakeholders:** biogas sector companies and organisations, education institutions, Jyväskylä University of Applied Sciences, Natural Resources Institute Finland **National stakeholders:** organisations in the sector
Regional trial	**Cities and towns show the way for sustainable transport.** Public procurements can play an important role in promoting the use of sustainable forms of transport. These include sharing concepts, more attractive public transport and Mobility as a Service (MaaS). For example, planning of the Engelinranta district in Hämeenlinna takes robot and shared cars into account as well as the seamless combination of ridesharing and cycling. Shared cars will decrease the need for parking places in the area and a mobile transport point will enable smooth changes from one form of transport to another. Progress in developing Mobility as a Service has been made in Turku, Kuopio, Savonlinna and Seinäjoki. The city of Tampere has encouraged its employees to use ridesharing more often. **Owner:** Hämeenlinna, Turku, Tampere, Kuopio, Savonlinna, Seinäjoki, other Finnish towns and cities, Motiva
Energy	**Use of high-blend biofuels in buses and the City of Helsinki fleet (BioSata).** The goal is to create a co-operation model that enables a gradual transition to high-blend biofuels in buses and the city of Helsinki (Stara) cars and machinery. This will reduce greenhouse gas emissions and the amount of local pollutants (NOx, PM). The intermediate goal is for biofuel to account for 50% of fuel used in 2017 and a 70-90% share by the end of 2019. The project constitutes an important international reference that encourages Finnish and international cities to move to low-carbon transport. **Owner:** Helsinki Region Transport (owner), STARA, Gasum Oy, Neste Oy, ST1 Oy, UPM Oy, Helsinki Capital Region Smart & Clean Foundation

Logistics	**Making water transport in the Saimaa region a resource-efficient alternative to land transport.** The goal is to find concrete methods that would make water transport in the Saimaa Canal and Vuoksi waterways a potential alternative to transport by land while still preserving the sensitive lake environment. Increasing the amount of water transport aims at achieving positive impacts (reaching the emissions targets set for transportation), optimising the use of logistics resources in the spirit of the circular economy, raising traffic safety (via reduced road transport), and promoting market functionality (water transport offers a competitive and realistic option). Eliminating bottlenecks can also open up other opportunities. The aim is to increase the number of water transport to and beyond the record level of 2004. Opportunities for growth in the share of water transport can be sought via actions of different types: • business economics: developing line service by means of "broker" activities (consolidation of smaller cargo loads into larger entities) • digitisation: smart waterway infrastructure (including smart signs and buoys, more detailed and illustrative information about waterways), a digital transportation chain (enables consolidation of cargo loads) **Owner:** Finnish Transport Agency (owner), business life and carriers in the Saimaa region
Alternative forms of transport	**Self-driving robot buses on the streets of Finland as part of service-based transport and logistics (SOHJOA project).** Easy-to-use solutions based on automation will play a key role in the circular economy as transport and logistics in the future becomes more service-based, and also radically more energy- and resource-efficient. From the perspective of transport automation developers, Finnish legislation is a real competitive edge. For the first time, the SOHJOA project will turn this legislative advantage into a benefit for companies that develop automation and for cities when autonomous small buses are tested in Finnish conditions. Trials will strive to determine the best applications for automatic buses in terms of smooth traffic flow and environmental friendliness, safety and the passengers' user experience. The first robot buses will be tested in Helsinki, Espoo and Tampere. For example, **the Aurora project** also promotes smart transport automation and develops the Mobility as a Service concept, with the goal of creating an internationally unique smart transport testing ecosystem for extreme Arctic conditions in the Fell Lapland region. **Owner:** Metropolia University of Applied Sciences (owner) **Other implementers:** Aalto University, Forum Virium Helsinki, National Land Survey of Finland, Tampere University of Technology, Demos Helsinki, Tekes, Finnish Transport Agency, Finnish Transport Safety Agency (Trafi)
Energy	**Using renewable energy to manufacture alternative transport fuels and creating a market for transport use of methane.** Goal: To eliminate use of imported fossil energy for transport and switch to domestic, renewable transport fuel. Lappeenranta University of Technology and VTT Technical Research Centre of Finland have built research equipment that solves the problem of renewable energy storage by converting solar or wind power into hydrogen and methane. The project will begin building a methanising plant as an innovative business trial, search for private distribution companies and other Finnish cities to ensure a larger market and user needs. At a later stage, the city of Lappeenranta can promote market creation by replacing its vehicle fleet with methane-powered vehicles, which would contribute to gradually reaching a 100% rate of renewable energy use. **Owner:** The city of Lappeenranta, a company to be established, an extensive stakeholder network

Common actions

The aim is for Finland to create an operating environment that enables and encourages a circular economy and thus accelerates systemic change towards a circular economy society.

The process identified the following key policy actions for the focus area:

A CIRCULAR ECONOMY WILL BE ACCELERATED BY MEANS OF FUNDING, EXPORT PROMOTION, AND CO-OPERATION BETWEEN THE PRIVATE AND PUBLIC SECTORS. In addition to the key projects in the Government's Bioeconomy and Clean Solutions strategic priority, existing public funding instruments such as investment subsidies granted by the state and Tekes programmes will be focused on projects that implement circular economy principles. All projects that receive public funding, such as construction and infrastructure projects, will comply with circular economy principles.

Finland will take full advantage of the opportunities offered by EU funding and the European Fund for Strategic Investments (EFSI) in its investment projects. In conjunction with implementing the road map, we will create risk financing, collateral financing and crowdfunding, and investment subsidy arrangements that support a circular economy. Investments by bank and institutional investors, such as pension funds, will be steered and utilised to promote circular economy solutions and companies so that there is better understanding and utilisation of their future earnings potential. A special network of financiers and investors will be created to support this goal.

The circular economy will also be one of the key themes for Team Finland's export promotion activities. Sitra will focus its piloting and trial funding on enabling the selected road map functions via, for example, its Circular Economy focus area and the Maatila 2.0 focus area that is currently being prepared.

PUBLIC PROCUREMENTS WILL FOCUS ON PURCHASING SOLUTIONS AND PRODUCTS THAT SUPPORT THE CIRCULAR ECONOMY. For example, purchasing sustainable services and using leasing and rental business models instead of buying products manufactured from non-renewable raw materials. The aim in sustainable procurements is to produce minimal or zero-waste and support recycling and use of secondary materials. This will be implemented in synergy with existing projects related to public procurements, the new procurement directive and the Act on Public Procurements. The organisations responsible for public procurement will integrate targets and principles that promote inclusion of solutions to support the circular economy with existing procurement processes. Examples of such organisations are ministries and the agencies and institutes operating under them.

Towns will include goals and principles to promote circular economy solutions in their local, service or procurement strategies. To support those responsible for procurements, a set of circular economy criteria and guidelines will be developed for including the circular economy and material efficiency in public procurements. Estimating life cycle costs is one example of things that will be included in the guidelines.

Finnish Sustainable Communities and Municipalities (FISU) and Carbon Neutral Municipalities (Hinku) can serve as trailblazers. For example, Lahti City Corporate Group has set a goal that one third of its procurements will contain new solutions based on the circular economy and resource efficiency by 2020. Whenever possible, these will be developed in co-operation with companies in the region and utilising the Smart & Clean project networks. The City Council of Lahti challenges all towns, property owners and companies along the Lahti-Helsinki railway track to open up their investments and procurements as product development targets for smart and clean solutions.

AN EDUCATION AND RESEARCH POLICY THAT ENABLES A CIRCULAR ECONOMY. Integrate the circular economy as a whole with education and research policy at all levels of education. Long-term attitude education aimed at influencing "the next generation". Another key element is training and continuing education for teachers: making a sustainable way of life and circular economy issues part of teacher education. Research funding will be directed at cross-disciplinary research projects that promote the circular economy.

ELIMINATING REGULATION BARRIERS AND CREATING INCENTIVES. In order to make the circular economy a growth driver, we need bold thinking and policy instruments that encourage reform. At best, policy instruments can have a stimulating effect on the economy. Environmental norms have been found to create profitable business. Norms provide pioneer companies with a competitive edge. A report commissioned from Pöyry by the Confederation of Finnish Industries states that a stimulating effect on the economy cannot, however, be achieved if the policy instruments are only based

on punishment and weaken the competitiveness of companies and citizens' purchasing power.

At this time, regulation is fragmented and consists of several different policy instruments, the impact of which has not been assessed. This may lead to unpredictable joint impacts. New policy instruments are applied without determining the need to continue the validity of the earlier mechanisms. An excess of policy instruments also increases the burden of regulation, which contributes to reducing cost efficiency[1].

The actions to streamline environmental procedures contained in the assessment report by the working group led by Minister Lauri Tarasti will be implemented as soon as possible. Promoting investments and streamlining permit processes are essential in terms of accelerating the circular economy[2]. Waste classification and the definition of a by-product will be developed at the EU and national level.

The use of different materials, regardless of the material and its intended use, is governed by several different sets of regulations that often have conflicting goals. On the one hand, the use of residual material is subject to the requirements of waste and chemical legislation but also to product legislation, for example, special legislation concerning fertilisers, building products or the sustainability criteria for biofuels as well as environmental protection legislation[3].

CHANGING THE FOCUS OF TAXATION. Tax guidance methods will promote the circular economy and use of secondary raw materials. A broader change in the focus of taxation will be examined, shifting it from the taxation of work and entrepreneurship to taxation that supports sustainable growth. Finland should work actively to ensure that EU decisions also move in the same direction.

GUIDELINES AND SYNERGIES WITH INITIATIVES IN OTHER PARTS OF ADMINISTRATION. Different administrative branches have several different strategies (for example, natural resources strategy, energy and climate strategy, bioeconomy strategy). There is a need to review and co-ordinate the entity across administrative branches and different strategies. The silos between energy policy and natural resources policy will be dismantled and the fact that the circular economy plays a key role in preventing climate change and in the renewable energy breakthrough will be taken into account. Different ministries share responsibility for developing the operating environment for a circular economy.

A DIGITAL AND SERVICE-CENTRED CIRCULAR ECONOMY. A circular economy will create well-being for Finland and promote the transfer to a service and sharing economy. For example, the existing tax credit for household expenses will be expanded and used as an incentive mechanism for things like repair services.[4] This will focus consumption on purchasing services to sustain the service life of a product rather than on purchasing a new one. Instead of products, people will purchase user rights and services and increase shared use.

CIRCULAR ECONOMY INDICATORS. Develop a comprehensive set of indicators that describe the development of Finland's circular economy. Utilise applicable elements of the green growth indicators specified in the VireAvain project. Finland wants to be a pioneer in terms of the development of indicators taking place in the EU. At best, the indicators will produce information concerning new perspectives on the circular economy, such as a sharing economy among consumers, circular economy resource loops and systemic changes. Circular economy choices often involve a variety of alternative consequences. A good set of indicators can make them easier to understand. The indicators are also part of the Findicator service that describes social development.[5]

1 Toward a bioeconomy: bottlenecks and focusing policy instruments, Government's Analysis, Assessment and Research Activities research project performed by Pellervo Economic Research. Kalle Määtä's presentation 23.8.2016.

2 Streamlining and increasing the efficiency of environmental permit procedures. An assessment of the implementation options. Minister Lauri Tarasti's working group, March 2015.

3 Waste, product and chemical legislation interfaces that affect the bioeconomy 12 November 2015. Joonas Alaranta, Elli Ryynänen.

4 Pöyry Finland Oy: Selvitys taloudellisten ohjauskeinojen mahdollisuuksista ja edellytyksistä Kiertotalouden edistämisessä loppuraportti EK:lle 23.6.2016

5 Findicator.fi - the society at large image (www.findikaattori.fi) Current information on key social phenomena in the form of indicators. Gaia: Miten kiertotalouden kehitystä mitataan. Sitran teettämä esiselvitys kiertotalouden kansallisen barometrin kehittämisestä 4.9.2015.

Common actions key project: World Circular Economy Forum 2017 and Finland as a circular economy host country

The World Circular Economy Forum 2017 will be held in Helsinki in 2017. After the event, Finland can profile itself as a circular economy host country by organising international circular economy forums at the EU level and on a larger scale. The starting point could be for Finland to hold a major international circular economy event at regular intervals.

The World Circular Economy Forum 2017 will be held at Finlandia Hall in Helsinki from 5 June to 6 June 2017. Sitra wants to speed up the global transition to a circular economy and profile Finland as a circular economy pioneer. The event looks for solutions for how the circular economy can be used to meet the UN's sustainable development goals by means of economic and employment growth in different parts of the world. The event is also part of the official programme for the Finland 100 centenary celebration.

The forum will bring together more than 1,200 participants from all parts of society and all over the world, including political decision-makers, business representatives, researchers, entrepreneurs, representatives of non-governmental organisations, and journalists. Several related events, such as a circular economy hackathon, will be held in addition to the two-day main event.

Finnish organisations: Sitra, Ministry of the Environment, Ministry of Economic Affairs and Employment; Koli Forum

The international partners for WCEF 2017 include: the Nordic Council of Ministers, World Resources Forum; European Environment Agency, United Nations Environment Programme (UNEP), International Institute for Sustainable Development (IISD).

The next actions: Continuation of WCEF 2017 event planning: identification and engagement of leading organisations for future "Finland as a circular economy host country" activities.

Common action

Administrative requirements	Public procurements should focus on purchasing new solutions and products that support the circular economy; An education and research policy that enables the circular economy; Dismantling regulation barriers and creating incentives; Changing the focus of taxation; Guidelines and synergies with initiatives in other parts of administration; A digital and service-centred circular economy; Circular economy indicators
Key project	**World Circular Economy Forum 2017 and Finland as a circular economy host country**

Description of the pilot

Market creation and export	**An economic steering toolbox for the circular economy.** Examine economic policy instruments to accelerate new circular economy solutions in order to support decision-making. The starting point for this work is the Pöyry report on economic policy instruments for the circular economy that was commissioned by the Confederation of Finnish Industries in summer 2016. **Owner:** Possible implementers are Sitra, the ministries, Confederation of Finnish Industries
Market creation and export	**A circular economy networking platform.** A circular economy networking platform aimed at companies and operating across industry boundaries, which will serve as a digital meeting place for companies, provide information and help (help-desk) and facilitate operational development and the search for new partners. The goal of this dynamic circular economy platform is to promote company networking across industry boundaries and finding new types of partners (companies, research institutes, etc.), thus accelerating the creation and growth of new circular economy innovations and business. The networking platform will be linked to a help desk provided by Motiva, which will offer information about things like funding, the operating environment and legislation. This will be realised by expanding Motiva's Finnish Industrial Symbiosis System (FISS) operating model to other regions and utilising the FISS regional network, pool of

	experts and the teollisetsymbioosit.fi website. The aim is for the platform to be a facilitator linking different organisations and opportunities. Its task will be to "identify, network and motivate". In order to build the service entity, a digital platform design/innovation competition will be organised for start-ups and growth companies (Confederation of Finnish Industries and other relevant operators). This means that the networking platform will be developed and maintained in a market-oriented manner and create new business in its own right. **Owner:** Confederation of Finnish Industries, Motiva and other relevant operators
Increasing knowledge, Market creation and export	**Circular economy consumer trials.** Make citizens and companies aware of the practical potential of the circular economy and opportunities to promote the circular economy via everyday choices. Implement practical action that contribute to creating a pioneer market and increasing demand. The operator can also combine, co-ordinate and create synergies and impact by means of communications and events taking place around the entire circular economy. **Owner:** Sitra / Resource-wise citizen
Regional trial	**Zero-waste area.** Planning and implementation of a zero-waste pilot. According to its strategy, the city of Turku wants to be carbon-neutral by 2040 and is planning a zero-waste pilot. Even now, landfill waste sorting accounts for only a marginal share of waste management in Turku and the city intends to invest more in exploiting materials and developing energy utilisation in line with circular economy principles. The goal of a zero-waste area is to reduce loss and increase material loop efficiency. The Southwest Finland regional circular economy road map scheduled for completion in late autumn 2016 can be used when planning the pilot. Similar efforts in other regions are also welcome and actions will be supported, for example, via the FISU network. **Owner:** City of Turku **Other implementers:** Finnish Sustainable Communities (FISU)
Market creation and export	**Finpro's growth programmes in the circular economy field.** From waste to energy and bioenergy. Mainly developing markets. The goal is to speed up and increase the international growth of companies throughout the industry value chain (raw materials, energy production and biofuels), primarily by means of export. The Finnish offering will cover the entire scope, from small off-grid solutions to large, centralised solutions. The aim is to identify entities and develop joint projects to provide more extensive coverage of the value chain. The increased global need for energy, food and water will spur growth in this sector. The energy sector is an important part of the circular economy and is strongly linked to other industries, such as agriculture, industrial production (for example, the food and beverage industry), construction industry (cement production), etc. Developing the energy sector will strengthen the circular economy significantly. **Owner:** Finpro
	Funding for new circular economy business models. Financing instruments and actions to support leasing solutions (for example, capital-intensive (CAPEX) business and "balance sheet challenge" – a need for co-operation models and partners) Examining and testing financing models, for example, in co-operation with pilot companies and banks on the basis of the ING bank report.
Increasing knowledge, Market creation and export	**Establishing a centre of expertise unit for carbon circular economy in Finland.** The aim is to develop carbon circular economy expertise with consideration to carbon loops in technology and natural systems. The task area covers the study of biomass and carbon extracted from sources other than the air or flue gas, and the carbon flows and storages related to its use (for example, as fuel for electricity, heat or transport and as a raw material for wood processing, chemical industry and construction products). Carbon loop measurement methods and in-depth competence should also be developed so that they better support CO2 emission reductions and the development of business solutions related to carbon sinks and carbon storages. **Owner:** Organisations interested in developing this matter: Climate Leadership Council, University of Helsinki, Finnish Environment Institute

Operative road map goals

In order to further systemic change, we need policy actions, implementation of key projects and pilots in all focus areas and other actions to promote change.

Progress in an individual focus area requires implementation of policy actions, key projects and pilots in that focus area.

A - Policy actions

- Planning and analysis related to implementing the policy actions began in 2016.
- Planning, assignment of responsibilities and analysis work will be completed by the end of 2017.
- A total of 300 million euros has been allocated to Bioeconomy and clean solutions focus area outlined by Juha Sipilä's Government. All projects financed within the scope of that focus area must take circular economy principles into account.
- The policy actions that progress to implementation will be completed in 2017–2019, with regard to all changes that are possible in practice. The remaining will be implemented according to the schedule allowed by legislation (legislative amendments, regulations and guidelines).
- Ensuring continuity: next Government committed to promoting circular economy

B – Key projects

- Implementers for key projects have been identified during 2016
- Funding has been secured by the end of 2017
- All key projects have been launched in 2017.
- All key projects completed and goals achieved by 2025.

C – Pilots

- Implementers for pilots have been identified during 2016
- Funding has been secured for pilots by the end of 2017
- 50 per cent of pilots have been launched by the end of 2017
- 70 per cent of pilots have been launched by the end of 2018
- 90 per cent of pilots have been launched by the end of 2020
- The launched pilots have been completed and promote the transfer to a circular economy by the end of 2025

Administrative requirements, key projects and pilots will be assessed and updated continuously and, if necessary, change as implementation of the road map proceeds. The effect of changes will be taken into account during monitoring.

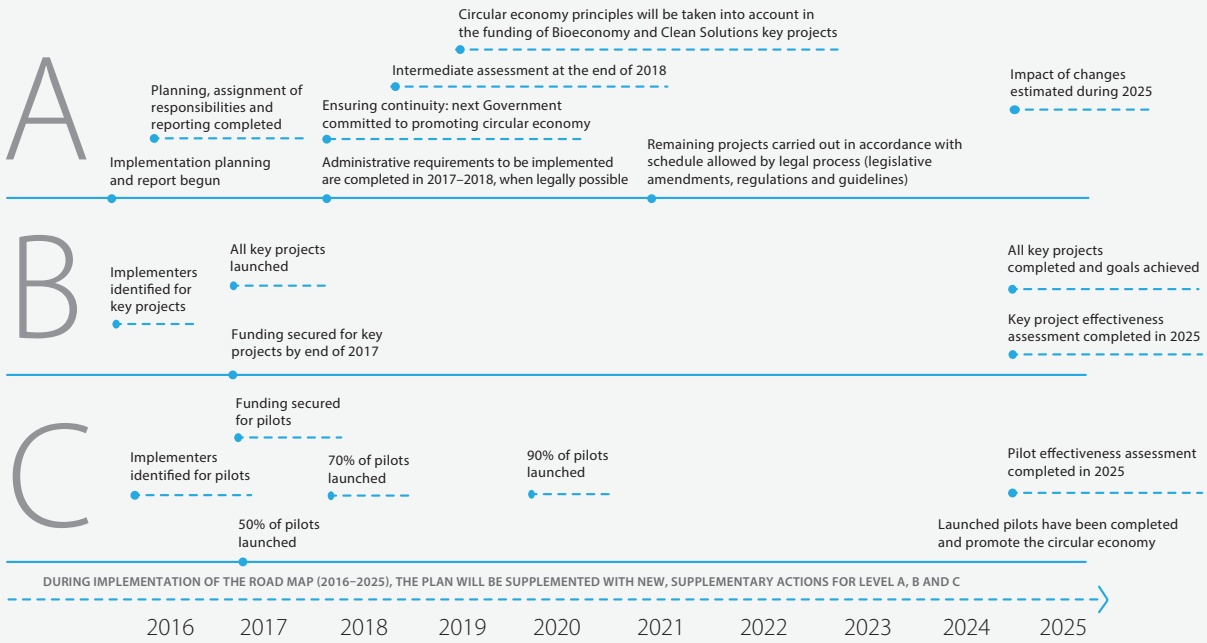
Road map progress and impact assessment

The road map actions will be implemented simultaneously on three levels: policy actions, key projects and pilots.

Post implementation assessment of the road map's impact on competitiveness, growth and jobs, including assessment of the impact of the policy actions, key projects and pilots will be carried out in 2025. An intermediate assessment will be performed at the end of 2018 in order to ensure the right direction of the road map.

1 Key project goals and a more detailed description of their impact in the *Road map actions* section of the road map.

Figure 8. Schedule for actions



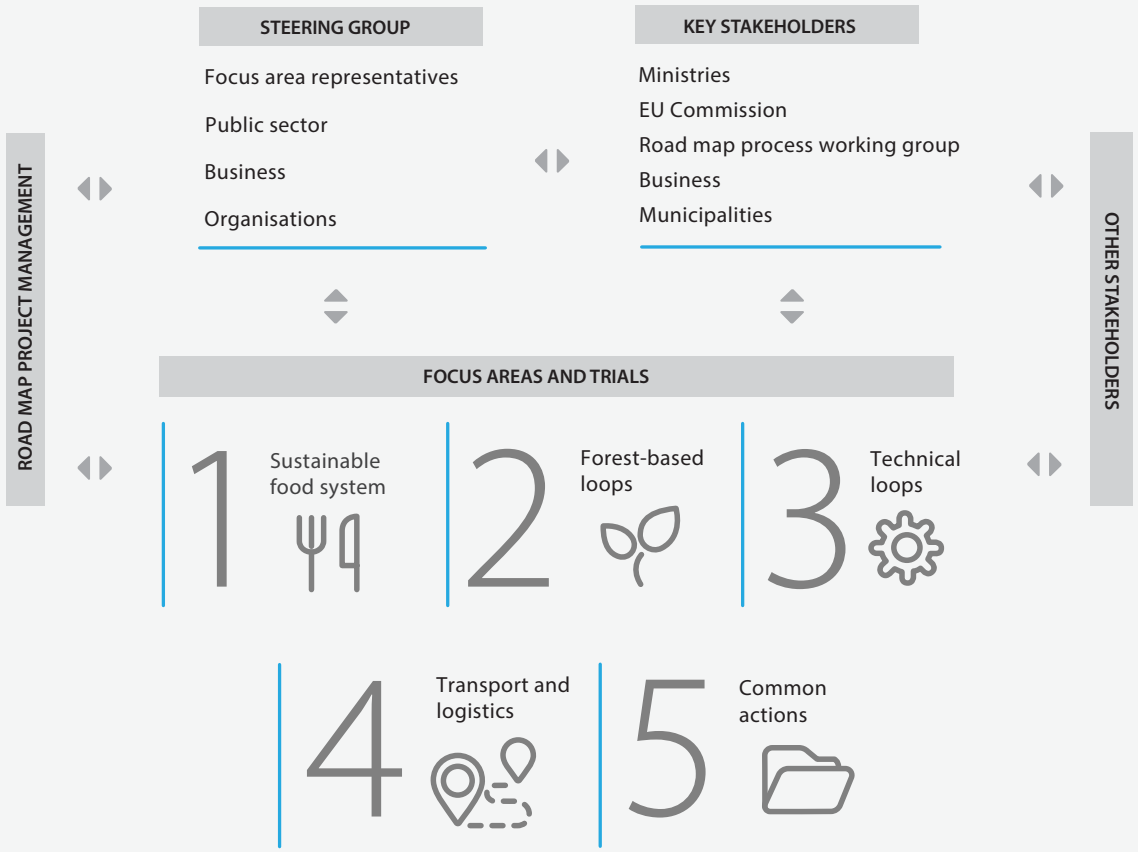
Road map implementation

During the launch phase of the road map (until the end of 2017), the focus will be on resourcing and implementation of trials in the focus areas, furthering the first policy actions, and clarifying the goals.

- The steering group, key persons in the focus areas and project administration will meet from two to four times a year to examine road map implementation and the future direction – progress will be compared with the systemic change goals and the operating environment.
- The project administration will assess the situation regarding road map implementation and prepare the steering group meeting.
- All organisations involved in the road map, including key stakeholders, will also meet once a year at a seminar, which will review road map progress, collect input on road map renewal and plan the future.
- The main responsibility for road map implementation lies with the owners of the actions and pilots, who can ask for assistance from stakeholders, the steering group, project administration and their networks as needed. They can also meet when necessary.
- The project entities in the focus areas are dynamic – new projects will be added as implementation of the road map progresses, and there may also be changes in the targets of the focus areas.
- The road map, including its implementation model, will be checked and adapted as needed.

Figure 9. Circular economy implementers in Finland

Source: Deloitte



Steering group:

The steering group is a guiding and advisory body. For example, it is responsible for discussion concerning changing the target of focus areas. It supports achievement of road map goals and utilisation of the results. The steering group promotes road map progress with assistance from high-level external stakeholders and international co-operation. The composition of the steering group takes into account the broad-based nature of the circular economy by including the focus areas and representation from the private and public sectors.

Stakeholders

Stakeholders support road map operators as needed and provide input on road map content, for example, in the form of new trials or policy guidelines.

Focus areas

Road map actions and projects will be carried out under the focus areas. The key persons in the focus areas have a comprehensive picture of the projects in the area; they serve as sparring partners, mentors and leaders and promote it through their networks. The key persons will be selected in 2016.

Project administration

The project administration monitors road map progress and supports the owners of the pilots and actions, the key persons in the focus areas and co-operation between the areas in addition to surveying funding opportunities.

The project administration is also responsible for road map communications and facilitation and presents the results to the steering group.

2 Background report

Introduction

The circular economy is attracting an increasing amount of interest in Finland and internationally. The circular economy means an economy in which all resource use is planned sustainably. A transfer to this kind of economy will require profound changes in society[1]. Finland has set the highest possible circular economy target: it wants to become a global leader.

In line with that goal, Finland should become the number one country in terms of a circular economic model, sustainable resource use and exporting circular economy products and services to the world as part of a solution to global problems. In order to make this goal tangible and reachable, Sitra has carried out extensive background studies and stakeholder dialogue in which the representatives of hundreds of different organisation have expressed their views on the content of the global leader goal and how to reach it. The result of this process is the circular economy road map and its background report.

The background report highlights the international state of the circular economy and examples of actions: pioneer countries, their commitments and EU-level targets. One of the central aims has been to understand how Finland is positioned in 2016 in relation to the global leader target that was set. The report provides a cross-section of the current state of the Finnish circular economy and the strengths that stakeholders believe should be the foundation for the journey towards the global leader goal.

The background report shows that the world does not have a clear circular economy pioneer. Many ambitious projects can be found regionally, circular economy visions have been developed and road maps exist, but none of the national road maps has been able to comprehensively link system-level change visions with practical actions.

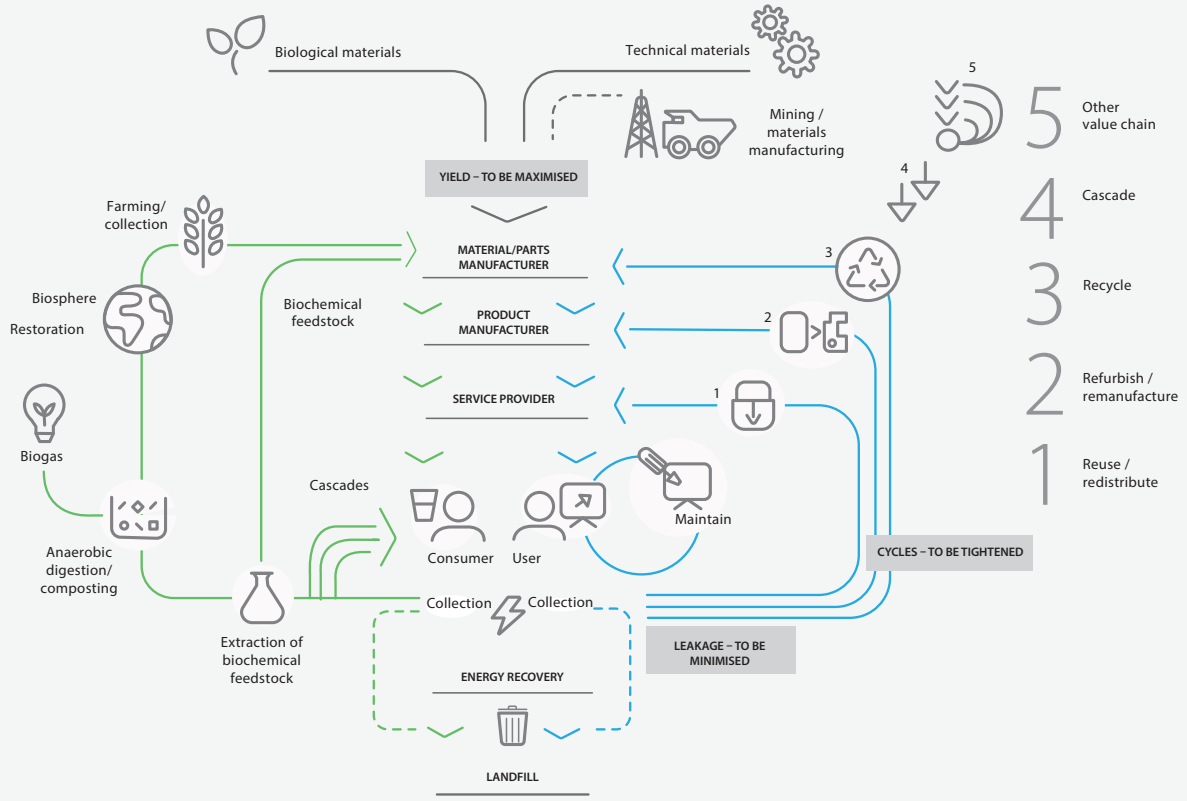
The outcome of the background report and hundreds of stakeholder discussions was a circular economy road map: a circular economy mindset that makes the global leader goal more tangible, guiding principles – and a package containing dozens of practical actions. In light of this background report, Finland's circular economy road map is unique in terms of the extent of stakeholder participation, the high level of the social goals and the practical nature of the road map actions.

The road map was created in co-operation and similarly it can only be implemented by means of wide-ranging social collaboration. Sitra encourages all Finns to join this journey towards the world's most circular economy.

1 Sitra *The opportunities of a circular economy for Finland* Helsinki: Libris, 2014.

Figure 10. The circular economy's three central factors to increase and maintain value in technical and biological loops. According to the road map principle, we must also strive to replace technical materials with new and innovative bio-based materials.

Source: Sitra



What is a circular economy?

In a circular economy, products will be designed to enable their reuse and recycling, renewable resources will be favoured, services will replace products, and energy production will be based on renewable energy sources[1]. Realisation of a circular economy will require significant changes at the social level and also in the choices made by private citizens and consumers[2]. However, the opportunities for economic, ecological and social well-being are so great that commitment to a circular economy is gaining social momentum in Finland and around the world.

The need for sources of new and sustainable growth in Finland, the EU and globally has increased during the recent periods of economic instability. Finland's current Government Programme sets the goal of becoming a leading circular economy country by 2025.[3] This goal is based on estimates of the major economic opportunities offered by the circular economy and on the need to reduce dependence on resource use that is ecologically and economically unsustainable[4]. At the European Union level, the Circular Economy Package published at the end of 2015 clearly outlines the EU's target level: the circular economy is one of the EU's brightest focus areas in the future.

Global megatrends, such as urbanisation, population growth, instability in the global economy, gentrification, a decrease in resources as consumption increases, and the current and future effects of climate change support the need for systemic change in society. It is these challenges that put the circular economy high on international

1 Sitra *The opportunities of a circular economy for Finland* Helsinki: Libris, 2014.

2 Prime Minister's Office, *Circular economy in Finland – the operating environment, policy instruments and simulated effects by 2030.* 2016.

3 Prime Minister's Office, *Finland, a land of solutions – Strategic Programme of Prime Minister Juha Sipilä's Government,* Government Publications, 29 May 2015.

4 EU, *Scoping study to identify potential circular economy actions, priority sectors, material flows and value chains,* Luxembourg: Publications Office of the European Union, August 2014.

agendas; a circular economy is a system-level description of the kind of economy that makes it possible to deal with these challenges in a sustainable manner.

As a term, circular economy is often used in conjunction with closely related concepts, such as bioeconomy, cleantech and sustainable development. Circular economy refers to an economy in which resource use is planned to be sustainable. Bio-based loops and thus the bioeconomy can be considered one part of the circular economy. Cleantech is a range of clean technology solutions running through different sectors. Cleantech products and services are often developed according to circular economy principles and promote those principles.

A circular economy is not to mean efficient material recycling. It is more. It also refers to enabling sustainable economic growth by optimising natural resource consumption, thus changing production chains and consumption models and redesigning industrial systems[1]. Another concept linked to the circular economy is service economy[2], which focuses on offering solutions rather than manufacturing goods[3]. The greatest value potential for the circular economy comes from servicing, reusing and remanufacturing equipment, because raw materials only account for part of the costs and value of products[4]. This is where the circular economy provides its most important solutions: optimising the use of natural resources and utilising and maximising production chains and product value[5]. In addition to maintaining value, the circular economy also favour renewable sources of energy and choices that comply with sustainable development on a broader basis. The importance of increasing and maintaining value is emphasised in technical loops that bind non-renewable natural resources.

1 EU, *Scoping study to identify potential circular economy actions, priority sectors, material flows and value chains,* Luxembourg: Publications Office of the European Union, August 2014.

2 In this context, service economy means an economy in which the relative importance and share of service in a product offer is greater than previously.

3 Prime Minister's Office, *Circular economy in Finland – the operating environment, policy instruments and simulated effects by 2030.* 2016.

4 Sitra *The opportunities of a circular economy for Finland.* Helsinki: Libris, 2014.

5 Prime Minister's Office, *Circular economy in Finland – the operating environment, policy instruments and simulated effects by 2030.* 2016.

Circular economy throughout the world

In global terms, the circular economy is a very current them that has been estimated to have major economic opportunities: the global value of the circular economy market is more than one thousand billion dollars[4]. The private, public and NGO sectors are all working internationally to promote initiatives to eliminate obstacles and create new solutions that would accelerate the transition to a circular economy.

The current state of the circular economy

At the OECD, UN and EU level, the circular economy is gradually being seen as a means of speeding up society's move to a more resource-efficient system, thus improving competitiveness and responding to global environmental challenges[4]. China and the USA, which are the world's largest greenhouse gas emitters and resource consumers, have also recently recognised the opportunities of the circular economy.

The **EU** is known for having stricter environmental regulations than those in competing market areas[1]. In 2015, the European Commission presented a Circular Economy Package[2] that aims for improved cost-efficiency, better balance of current accounts, increased self-sufficiency, new jobs and achieving climate targets[3]. A central part of the EU's approach is emphasising ecodesign rather than merely setting recycling targets. The EU has taken a holistic, system-level approach to the circular economy. The entire economy has to be planned according to circular economy principles in order to truly achieve a circular economy. The broad-based proposals in the Circular Economy Package contain incentives and reformed regulation to accelerate the circular economy, such as:

- extensive commitments on ecodesign;
- development of strategic approaches on plastics and chemicals;
- a major initiative to fund innovative projects under the umbrella of the EU's Horizon 2020 research programme;
- targeted actions in key focus areas (plastics, food waste, construction, critical raw materials, industrial and mining waste, consumption and public procurement).[4]

The European Parliament will vote on the Circular Economy Package and its proposals for improvement at the end of 2016. The European Parliament has proposed stricter terms for the Circular Economy Package sections listed below[5]:

- the Parliament proposes a 70% recycling target for municipal waste by 2030;
- a proposed extension in producer responsibility: in the future, the Parliament's proposal would make producer responsibility compulsory for packages, electrical and electronic equipment, batteries and accumulators, and vehicles, and recommended for all products
- supporting the operating requirements for the bioeconomy, especially by means of separate biowaste collection
- a reduction target for waste production, food waste and waste that ends up in the sea

In addition to the Circular Economy Package, the EU has over the past five years implemented a Roadmap to a Resource Efficient Europe and a seventh framework programme. Since these actions are binding to all EU countries, they have the potential to make a major impact both inside and outside the EU in light of the economic position of the EU. The value of the circular economy in Europe alone is estimated at up to 570 million euros annually[6].

1 Ministry of Economic Affairs and Employment, Metallurgical industry in Finland: past, present and future 2015.

2 EU, Closing the loop – An EU action plan for the Circular Economy COM 2015/06149, Brussels, December 2015.

3 Stahel, W. R., Circular economy. Nature, 2016; (531): 435–438.

4 Ministry of Economic Affairs and Employment, Metallurgical industry in Finland: past, present and future 2015.

5 EU, Briefing: Circular Economy Package, Four Legislative Proposals on Waste, summer 2016.

6 EU, Scoping study to identify potential circular economy actions, priority sectors, material flows and value chains, Luxembourg: Publications Office of the European Union, August 2014.

Circular economy throughout the world: circular economy visions of different countries

Source: circular economy websites from each country

#	COUNTRY	VISION	FOCUS AND GOALS
1	DENMARK	*"BECOMING THE STATE OF GREEN"*	• Environmental focus, vision does not focus on the circular economy per se, but more broadly on resource wisdom • Top goal: Denmark has decided to be the first country in the world to transition into an economy that is entirely independent from fossil fuels by the year 2050
2	HOLLAND	*"A GLOBAL HOTSPOT FOR CIRCULAR ECONOMY IN 2016"*	• The vision is campaign-based and tied to Holland's EU Presidency in 2016 • The focus of the campaign and approach is particularly on success stories and events. In addition to this, a programme for promoting a circular economy has been launched in Holland, focusing on, for example, improving the technological requirements for circular economy, eliminating barriers and increasing knowledge and awareness • Waste and eco-planning are the focus of regulation
3	SCOTLAND	*"MAKING THINGS LAST"*	• Scotland is focusing its circular economy strategy on four different areas: 1) Food and drink; 2) Remanufacture; 3) Construction and the built environment; and 4) Energy infrastructure • Waste management is a key focus uniting all four areas: Scotland's goal is that 70% of all waste generated will be recycled by the year 2025
4	CANADA	*"A STRONGER, CLEANER ECONOMY THAT BUILDS A BETTER FUTURE FOR ALL CANADIANS"*	• The circular economy roadmap in Canada: "Smart Prosperity" (2016) • A holistic and broad focus: "smart welfare" means a healthy economy, a healthy environment and high quality of life, into which top goals and methods are incorporated; e.g. "In 2020, Canada will be seen all over the world as a model country, which combines environmentally-friendly economic management with economic success"
5	LUXEMBOURG	*"A KNOWLEDGE CAPITAL AND TESTING GROUND FOR THE CIRCULAR ECONOMY"*	• A circular economy roadmap commissioned by the Luxembourg Ministry of the Economy in 2014; the primary focus is economic competitiveness, employment and improving the state of the environment • In particular, the roadmap describes the potential of the circular economy quite comprehensively in different areas and from different viewpoints. However, the actual goals are primarily at the top level; the roadmap identifies the need for more detailed roadmaps and goals
6	SWEDEN	*"SWEDEN WILL BE A WORLD LEADER IN THE INNOVATIVE AND SUSTAINABLE INDUSTRIAL PRODUCTION OF GOODS AND SERVICES"* [1]	• Sweden does not currently have an actual roadmap or vision for a circular economy. It aims to realise its "Smart Industry" vision through four main areas: 1. Industry 4.0 (Exploiting the potential of digitalisation) 2. Sustainable production 3. Industrial skills boost (Ensuring industrial competences) 4.Test bed Sweden (Creating attractive innovations)
7	JAPAN	*NO ACTUAL VISION, BUT JAPAN IS CONSIDERED A RECYCLING PIONEER IN THE WORLD.*	• Japan currently does not have an actual circular economy roadmap or vision. Japan is a pioneer in recycling, as there is very little space and a lack of raw materials in the country • Japan has focused its efforts particularly on waste management regulation, and the country has enacted revolutionary waste legislation, which often takes the entire product lifecycle into consideration. For example, each person purchasing a vehicle in Japan is required to pay for its recycling
8	AUSTRALIA	*NO ACTUAL VISION, BUT STRATEGIC STEPS HAVE BEEN TAKEN TOWARD THE CIRCULAR ECONOMY IN THE STATE OF SOUTH AUSTRALIA.*	• The new Waste Strategy 2015–2020 focuses on the recycling of landfill waste as well as material and resource efficiency. • Newly formed state government organisation Green Industries SA, whose purpose is to monitor implementation of the waste strategy. • The new Climate Change Strategy, so that the state can achieve its zero net emissions target by the year 2050

1 "Sverige ska vara världsledande inom innovativ och hållbar industriell produktion av varor och tjänster."

Along with EU-level actions, several European countries have developed a national circular economy vision, focus and targets. **SWEDEN'S** vision is to be a world leader in the industrial production of innovative and sustainable goods and services, a target that it intends to achieve via four main areas: Industry 4.0 (exploiting the potential of digitisation), sustainable production, industrial skills boost (ensuring industry competence) and test bed Sweden (creating attractive innovations)[1].

SCOTLAND'S vision is not as concrete as Sweden's, but it has more detailed strategic areas. Scotland's vision is *"Making things last"*. Its circular economy strategy focuses on four different areas: Food and drink; Remanufacture; Construction and the built environment; and Energy infrastructure[2]. Waste management is a key focus uniting all four areas: Scotland's goal is that 70 per cent of all waste generated will be recycled by 2025, which is an ambitious target in international terms.

A third example of an EU country that has taken a step towards a circular economy is **LUXEMBOURG**. Its vision is to be a knowledge capital and testing ground for the circular economy. In order to bring about this vision, the Luxembourg Ministry of the Economy commissioned a circular economy roadmap in 2014. The primary focus of the road map is economic competitiveness, employment and improving the state of the environment[3]. However, the goals of the road map have been described in an abstract manner.

THE UNITED STATES does not have national policy targets to promote the circular economy, but several measures have been launched at the state and local level. This is an important step because long-term state and local measures and provisions in the United States are typically scaled for national legislation as well. For example, in 2013 New York City Council approved a law banning the use of single-use polystyrene food and drink packages in restaurants and grocery stores[4]. Boulder, Colorado has a "Green Building and Green Points" programme requiring that at least 50 per cent of construction waste be recycled and at least 65 per cent of demolition waste measured by weight be diverted from landfills[3].

CHINA'S approach to the circular economy is broad-based at the commitment level. China passed a law on promoting the circular economy in 2009, which focuses on reducing resource use, reuse and recycling China had a circular economy development strategy and action plan between 2011 and 2015 According to experts, the circular economy in China is in practice more a topic of interest than a target of action. However, the Ellen MacArthur Foundation forecasts that China will become a major player among circular economy countries in the future[5].

SOUTH AUSTRALIA has taken the first strategic step towards a circular economy. Waste management has been improved and 75–80 per cent of landfill waste is currently recycled. Greenhouse gas emissions have reduced to below the 1990 level even though the economy has grown more than 60 per cent over the same period. Nearly 40 per cent of the state's energy also comes from wind and solar energy. South Australia has recently taken important steps towards a circular economy:

- The new Waste Strategy 2015–2020 focuses on the recycling of landfill waste as well as material and resource efficiency;
- newly formed state government organisation Green Industries SA, whose purpose is to monitor implementation of the waste strategy.
- the new Climate Change Strategy for South Australia so that the state can achieve its zero net emissions target by 2050.[6]

Green Industries SA has assessed the opportunities that transferring to a circular economy represents for South Australia. The intention is to use the assessment they commissioned from the Australian Academy of Science and research and consulting companies in the South Australia's Waste Strategy 2015–2020. The report demonstrates that in comparison to the linear scenario a circular economy could create 25,700 more jobs by 2030. A circular economy could also reduce greenhouse gas emissions in South Australia by 7,700 tons (carbon dioxide equivalent), which represents a 27 per cent decrease in comparison with the linear model.[5]

Although the circular economy is a hot topic internationally, current state-level commitments, targets and action plans do not reveal a single holistic, system-level pioneer country that is striving for change. Countries are promoting the circular economy via high-level targets or a few focus areas, but as yet there does not appear to

1 Regeringskansliet, Näringslivsdepartementet, Smart industri - en nyindustrialiseringsstrategi för Sverige, 2016.

2 Zero Waste Scotland, (website), 2016 (visited in April 2016)

3 EU, Scoping study to identify potential circular economy actions, priority sectors, material flows and value chains, Luxembourg: Publications Office of the European Union, August 2014.

4 New York City Council, Local Law 2013/142 to amend the administrative code of the city of New York, in relation to restrictions on the sale or use of certain expanded polystyrene items, 2013.

5 Vol, Julia, Ellen McArthur Foundation, telephone interview, 11 March 2016.

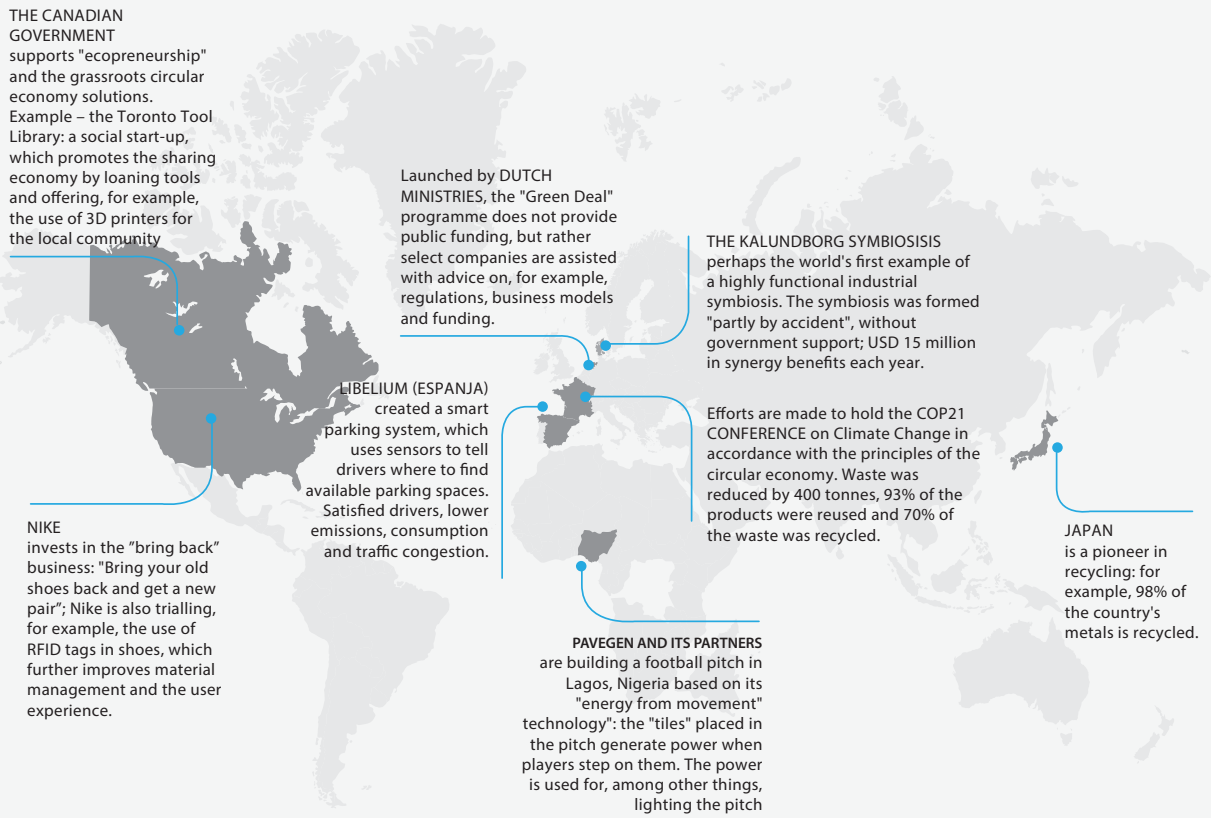
6 The Office of Green Industries South Australia, Creating Value. The Potential Benefits of a Circular Economy in South Australia, August 2016.

be any road map that combines systemic change with practical actions. The most interesting examples are typically found at the regional or corporate level.

International comparison is important in order to understand the ambitious nature of **FINLAND'S** leading country goal and the conditions for achieving it. When the background study began, Finland did not even have its own circular economy road map. Just like the international example, Finland's circular economy trials have focused on the regional and local level and on innovation activities at companies. A study that compared the circular economy innovations of large Finnish companies and international circular economy pioneer companies[1] showed that very similar innovations stand out in Finland and in leading circular economy companies. Traditional process and product development innovations dominate the innovation field. The requirement for a circular economy – exploiting networks when implementing a circular economy – was emphasised around the world and in Finnish companies. The only notable difference was related to a fundamental earnings logic change in the direction of a circular economy: leading international companies have taken larger development steps towards reforming their entire earnings model.

Figure 11. Circular economy throughout the world: examples

Source: Deloitte



1 Deloitte, Ten Types Categorisation. Mapping Top 30 Finnish Firms and Circular Economy Classics against Deloitte's Ten Types of Innovation Framework, 2015.

Opportunities

An operating model in line with the circular economy offers the opportunity for more sustainable business and society. At best, the circular economy produces economic, ecological and social well-being.

Economic opportunities

- Circular economy innovations create opportunities for new business growth.
- A circular economy business model provides the chance to earn more from a product that is manufactured only once.
- Industrial symbiosis increases resource efficiency and improves competitiveness.
- Reuse of materials reduces the cost of materials.
- Better availability of raw material means smaller price fluctuations.

Environmental opportunities

- The greatest environmental benefits come from replacing material loops with more sustainable and energy-efficient loops.
- A circular economy uses the earth's limited resources (metals, minerals, energy sources, water, timber stocks, rich soil, clean air and biodiversity) in a sustainable manner.
- Reducing the use of natural resources decreases the environmental impacts of that use.

Social opportunities

- New business models that observe circular economy principles can create jobs because products are increasingly offered as services.
- Growth in the national economy and export increases society's tax income and allows the allocation of more resources to education and healthcare.
- Sharing products and services rather than owning them will ensure more equal availability and provides savings for households.
- Product as a service concepts can improve the customer's service experience as the seller becomes responsible for ownership-related maintenance.
- Sharing products and services increases the sense of community and reduces loneliness locally and globally.

Sources: Sitra, Prime Minister's Office, Finland's Commerce Committee, Deloitte

Challenges

Although the long-term benefits of transferring to a circular economy can be demonstrated, there are short-term obstacles to the transition phase. The following typical challenges to a circular economy have been identified:

- the complexity and rebound effect of promoting systemic change (for example, the savings obtained from improving the resource efficiency of individual parts can eventually lead to more production and material consumption):
- economic challenges (circular economy business may be unprofitable in the short term);
- imperfect markets (a lack of the necessary products and infrastructure, competition, knowledge and/or incentives on the market);
- imperfect regulation (inadequate legislation and/or implementation);
- social factors (insufficient knowledge and skills related to the circular economy);
- as a result of the above, inadequate waste sorting, the difficulty in obtaining suitable financing, and a lack of harmonised procedures in different areas.

These factors have different effects depending on the sector and value chain. Dealing with these obstacles requires many types of actions at the EU, state, regional and local level. One of the key focuses of the EU's Circular Economy Package the identification and elimination of significant bottlenecks that affect several value chains and operators.

Sources: Confederation of Finnish Industries, EU

Both opportunities and challenges have been identified at the EU level in particular. European countries will be competing with Canada, Japan and, in the future, possibly with the United States and China for the position of global circular economy leader. However, the circular economy entity is much more than individual projects and will require in-depth changes as well as quick, encouraging success stories. Another key factor will be the importance of networks and broad-based social co-operation in order to achieve system-level change. At present – perhaps because of the need for system-level change – no single country stands out as a clear leader and pioneer. The position of global leader is still open.

Starting points for the circular economy in Finland

The circular economy is a hot topic globally and Finland has also recognised the opportunities that it presents. Prime Minister Juha Sipilä's government selected the circular economy as one of its key projects in the current Government Programme, in addition to which the bioeconomy and clean solutions is one of the main themes in the Government Programme[1]. The Government Programme provides a strategic circular economy target for the next 10 years:

Finland is a pioneer in the bioeconomy, a circular economy and cleantech. By developing, introducing and exporting sustainable solutions we have improved the balance of current accounts, increased our self-sufficiency, created new jobs, and achieved our climate objectives and a good ecological status for the Baltic Sea.

Several ministries and different administrative branches have launched circular economy initiatives within the scope of the Government Programme. For example, the Ministry of Economic Affairs and Employment, Ministry of the Environment and Ministry of Agriculture and Forestry have been involved in developing this national circular economy road map, and the Ministry of Agriculture and Forestry has launched a nutrient recycling experimentation programme, bringing 12 million euros for the development and testing of innovative technologies and logistics solutions[2]. However, promoting the circular economy is not only limited to administration. For example, the Confederation of Finnish Industries, Federation of Finnish Technology Industries, Chemical Industry Federation of Finland, and The Central Organisation of Finnish Trade Unions SAK have all been active participants in considering the impacts and opportunities of the circular economy with regard to their own stakeholders. The corporate world is also involved as an important element in growth. From small start-ups to top listed companies, the Finnish corporate field already includes leading global circular economy companies and innovations.

1 Prime Minister's Office, Finland, a land of solutions – Strategic Programme of Prime Minister Juha Sipilä's Government, Government Publications, 29 May 2015.

2 Ministry of Agriculture and Forestry, *Making use of agricultural nutrients,* (website), 2016, http://mmm.fi/ravinteetkiertoon, (visited in August 2016)

Guiding principles

The guiding principles of the circular economy road map ensure that the principles, framework and rules used to strive for are clear when the road map is implemented, ensuring that Finland will achieve the global leader role. The principles serve as a mean of steering individual projects and pilots and monitoring implementation of the entire road map.

1. Complete solutions to achieve systemic change

- The circular economy road map strives to support the systemic change towards a circular economy that is required to achieve the goal of being a global leader.
- A circular economy requires complete solutions. Rather than focusing on partial optimisation, road map trials and pilots aim to bring the widest possible range of operators together to create new circular solutions.

2. The circular economy will bring positive environmental, economic and social impacts[1]

- Reducing the ecological footprint[2] (including greenhouse gas emissions) and increasing the ecological handprint[3] are key circular economy goals.
- The circular economy provides more extensive support for achieving national sustainable development targets and economic performance, because it improves the sustainability of society with regard to environmental, economic and social well-being – the focuses of these three areas vary in different circular economy operating methods and trials.
- The potential of the circular economy for the Finnish economy is expected to be some 2–3 billion euros per year by 2030 with regard to only the specified sectors, and positive impacts are also sought in employment, security of supply, investments and competitiveness.
- The circular economy meets people's basic needs and improves well-being and the prerequisites for a local economy in Finland and elsewhere, and additional benefits can be pursued in areas such as the Finland brand and tourism.

3. Value from different circular economy operating methods – focusing on the principle of highest value and servitisation

- The circular economy seeks growth from increasing value and sustaining the highest possible value for as long as possible.
- The value of materials and products is retained for as long as possible by means of efficient, innovative loops; materials are used according to the principle of highest added value and product value and life cycle is increased via servitisation.

4. A circular economy favours renewable raw materials and energy – the value of non-renewables is maintained and utilised as well as possible

- Increasing the use of renewable raw materials is one of the principles of a circular economy. A circular economy also supports an energy system based on sustainable, renewable sources of energy.
- Emphasising renewables also supports the reduction of import dependency in Finland.

5. A circular economy supports competitiveness – a reduction in import dependency and new export advantages.

- The domestic market functions as a test environment and brings credibility to commercialisation of the circular economy. Creation of a circular economy does not only target the domestic market – the global market represents greater opportunities, and international co-operation is a requirement for success in the private and public sector.
- The road map aims strives to develop a progressive domestic market and mainstream the circular economy in the consumer interface; at the local level, a circular economy has positive effects on employment and well-being.

6. The circular economy will be accelerated by means of existing strengths, fast trials and market forces.

- The road map will be built on identified, existing strengths such a high level of education, strong competence in, for example, bio-based loops, the "healthy understanding of scarcity" still recognised by Finns, and the agility made possible by a small country.
- Existing circular economy solutions must be highlighted by means of more extensive communications and commercialisation – better utilisation of earlier work will create a circular economy brand for Finland and inspire new innovations.
- In addition to strengths, the road map will be built for concrete trials.

1 The positive impacts require the ability to manage any health and environmental risks associated with reuse and recycling.

2 Ecological footprint measures the size of the land and water area required to produce the food, materials and energy we consume and process the resulting waste.

3 Ecological handprint measures the positive impact that we produce for the environment and serves as a supplementary indicator for the footprint.

- The administration will create the framework for a circular economy market and it will be accelerated by market forces.

7. The circular economy is a broad entity that combines old and new concepts – rather than being seen as conflicting the key is to find ways to exploit the somewhat fragmented "project jungle" and clarify a common direction.

- The road map is based on a way of thinking in which the circular economy, cleantech, bioeconomy and green economy do not conflict with each other; the work aims at systemic change that is promoted by these concepts.
- The content of the road map will be constructed and monitored in light of the principles listed above, using quantitative and qualitative indicators based on those principles.

Operating environment: the impact of key forces of change on the Finnish circular economy

Political environment

The political environment has a primarily positive attitude toward the circular economy and its opportunities The Government takes a positive attitude towards the EU action plan for the circular economy[1]. Prime Minister Juha Sipilä's Government has included circular economy targets in its government programme. Funding is available at the EU and national level. In Finland, the circular economy is seen as a wide-ranging opportunity; along with waste policy, it has links to the sharing economy[2], bioeconomy, cleantech, controlling climate change and a resource-efficient economy. However, a lack of bold, concrete and clear policy decisions is considered to be a challenge in terms of transferring to a circular economy[3].

Economic environment

The potential of the circular economy and Finland's strengths favours the circular economy despite challenges related to the national economy. The economic situation will remain challenging at the EU level and especially in Finland – Finland has fallen behind (10–15%) the leading countries in terms of competitiveness and export is not at the desired level[4]. Finland is experiencing a major change, but the new direction is still open. This makes the circular economy an economically interesting option: the potential value of the circular economy is estimated at 2–3 billion by 2030[5]. Finland has clear strengths related to the circular economy and examples of top-level operators in companies of different sizes, but it also faces challenges. Short-term economic pressures, a somewhat weak risk-taking ability and lack of consumer understanding complicate the move to a circular economy[6].

Social environment

Increased unemployment, population ageing and a declining dependency ratio are putting pressure on Finnish society[7]. An outstanding education system, safety, an advanced recycling culture, a good level of environmental protection, the natural understanding of scarcity that is characteristic to Finns and derived from recent history, resource efficiency, and an awareness of quality are examples of strengths from the circular economy perspective. Finns have recently shown a strong interest in adopting the sharing economy trend, examples of which include the Restaurant Day concept developed in Finland and the strong penetration of social media sharing services. A small, "law-abiding" population and the fact that different parties in society have a well-functioning dialogue based on a high level of trust mean that the transformation would be easier than in many other countries[5].

1 Finland's Commerce Committee, *Statement of the Commerce Committee TaVL 5 /2016 vp - E 88/2015 vp.,* March 2016.

2 Kodin kuvalehti magazine, *Luovu ja lainaa: Jakamistaloudessa omistaminen ei ole tärkeintä,* (website), 2013, http://suomenkuvalehti.fi/jutut/kotimaa/talous/luovu-ja-lainaa-jakamistaloudessa-omistaminen-ei-ole-tarkeinta/, (visited in August 2016)

3 Circular economy interviews, 2016.

4 Prime Minister's Office, Circular economy in Finland – the operating environment, policy instruments and simulated effects by 2030. 2016.

5 Sitra The opportunities of a circular economy for Finland. Helsinki: Libris, 2014; Sitra, The economic value and opportunities of nutrient cycling for Finland Helsinki: Multiprint Oy, 2015.

6 Circular economy interviews, 2016.

7 Statistics Finland, Share of young people in the population is in danger of diminishing further, (website), 2015, http://www.stat.fi/til/vaenn/2015/vaenn_2015_2015-10-30_tie_001_fi.html, (visited in August 2016)

Technological environment

Technology is an important enabling force for the circular economy and one of Finland's clear strengths. Finland is a leader in terms of technologies related to energy efficiency and Finland has strong engineering competence. Finland also has high-level competence in digitisation, the Internet of Things and design, and a growing number of technology companies that create enabling solutions across sectoral boundaries. The rapid and broad dissemination of knowledge via, for example, social media reinforces emerging phenomena like the circular economy and sharing economy[1].

Legislative environment

In order to reach the target state, the legislative environment should be changed to more strongly enable a circular economy – in certain areas, the current legislation and regulation slow the transition to a circular economy. Studies show that legislation (for example, taxation, product and waste provisions) are a key factor in the circular economy[2]. The EU Commission has made a commitment to promote the circular economy and remove barriers to it by approving a circular economy package in 2015. This package is intended to promote waste management and bioeconomy legislation throughout the EU region[3]. The right mindset already exists: Finland has in its key projects committed to promote the dismantling of unnecessary regulations and promote climate targets[4].

Ecological environment

Natural resource scarcity, safeguarding biodiversity, growing environmental hazards and the continued increase in demand as well as unequal and unfair distribution of resources are some of the greatest challenges faced by mankind. Change will be essential in the future[5]. A circular economy makes it possible to reduce resource use (water, soil, materials), greenhouse gas emissions and the need for energy[6], and thus also support achievement of the UN's sustainable development targets. In relation to its population, Finland has plenty of natural resources and, for example, significant domestic food production and consumption enable the creation of a circular economy models that would affect the entire value chain[5]. All in all, positive environmental impacts are an important outcome of the circular economy, and thus the circular economy can be seen as one of the key solutions to global environmental problems[4].

1 Sitra The opportunities of a circular economy for Finland. Helsinki: Libris, 2014; Sitra, The economic value and opportunities of nutrient cycling for Finland Helsinki: Multiprint Oy, 2015.

2 Ellen McArthur Foundation, Delivering the Circular Economy – A Toolkit for Policymakers, 2015.

3 EU, Closing the loop – An EU action plan for the Circular Economy COM 2015/06149, Brussels, December 2015.

4 Prime Minister's Office, *Circular economy in Finland – the operating environment, policy instruments and simulated effects by 2030.* 2016.

5 Sitra *The opportunities of a circular economy for Finland.* Helsinki: Libris, 2014.

6 Confederation of Finnish Industries, *Jyri Häkämies: Kiertotalous kirittämään Suomen talouskasvua.* (Website), 2016, http://ek.fi/ajankohtaista/uutiset/2016/02/19/jyri-hakamies-kiertotalous-kirittamaan-suomen-talouskasvua/, (visited in April 2016).

Figure 12. The current operating environment.

Source: Sitra, Finnish Government, Statistics Finland, Government Programme, preliminary road map interviews, background report for the road map project

Interviews: the views of key stakeholders concerning the current and target state

Understanding of the current and target state of Finland's circular economy was enhanced by means of stakeholder interviews. The interviews highlighted the fact that key stakeholders consider the goal of being a global circular economy leader to be both worthwhile and possible for Finland. Finland already has well-functioning circular economy concepts and top-level competence. Nearly all of those interviewed emphasised the opportunities of the circular economy and the positive economic, environmental and social consequences. The greatest differences in opinion concerned waste incineration and bioeconomy sustainability, but otherwise the interview subjects had very few conflicting views.

The most important economic opportunities were considered to be those arising from global megatrends, which are related to sustainably resolving the consumption and environmental problems caused by urbanisation, population growth and gentrification – meeting people's basic needs on a global basis and sustainably by applying circular economy principles.

Visions of the current state

The interviewees were nearly unanimous in their opinion that Finland has outstanding starting points for a circular economy. Finland is already a leading circular economy country in several areas, but it has not necessarily been able to communicate about this success and fully exploit the benefits of solutions already created in terms of marketing. The circular economy has been included in the government programme and selected as one of the Government's key projects. According to the interviewees, this is a sign of a wake-up On the other hand, several of the interviewees would like to see the Government take a broader approach rather than focusing only on nutrient recycling.

Finland's strengths in the current state include product development, ICT expertise and material efficiency; operating culture (including "scarcity in the DNA", trust, safety) and reasonable raw material resources. Weaknesses were found in decision-making, leadership, risk-taking ability, consumer understanding, commercialisation, branding, and a lack of in-depth co-operation inside sectors and at their interfaces between them.

Finland's weakness was perceived as the fact that, despite a small population, Finnish operators are not able to exploit co-operation and the creation and export of common complete solutions in the same way as, for example, countries in Central Europe. This means that small Finnish companies are lost among large European consortia when it comes to EU funding and export promotion. According to the interviewees, gaining access to global markets and EU funding will require more functional co-operation among Finnish organisations.

A lack of decision-making and risk-taking ability was seen as perhaps the greatest challenge in the current state. Although there is clear evidence of economic benefits and environmental challenges, awareness has increased significantly and some solutions are close at hand, it is still difficult to give up old structures and models. Rather than making bold decisions, organisations settle for compromises, formal reports and the role of follower.

Visions of the target state

Based on the interviews, the goal is to make Finland a model country for managing the scarcity challenge and one which exports complete solutions to the world. The big problems and markets lie elsewhere; a progressive domestic market is seen as a growth platform that provides credibility for export. Focusing and development of the broadest possible control of value chains were considered important. This means pursuing a pioneering approach, especially in Finland's traditional strengths, with the bioeconomy and engineering competence. The interviewees considered it important for the circular economy to produce positive environmental, social and economic impacts; the emphasis varied depending on who was interviewed. The target state will be described in more detail in section 4.

Vision on reaching the target state

The target state requires far-sighted changes from administration and other sectors as well as trials, education and grassroots activities. The interviews emphasised that the state's role as an enabler is important in terms of reaching the target state and, for example, public procurement can provide strong support for circular economy solutions. The state's role lies in creating an optimal growth and operating environment without strong, restrictive legislation and also without subsidies that distort the market. The state should provide direction and foresight – a clear definition of the target while allowing companies to choose the methods of reaching it. A market economy should be the driver of the circular economy – the interviewees had different views concerning the sufficiency of this.

Among other things, the interviews identified the creation of an enabling operating environment, removing obstacles and bold decision-making. The creation of circular economy networks was considered very important in order to be able to exploit the advantages of a small country adequately and more effectively than at present. We need system-level change policy and an open-minded experimentation approach and education, which in turn requires co-operation between and inside the sectors. Synergies should be sought by rationalising the "project jungle". The continuous creation of reports should be avoided and replaced by a move to fast trials and scalable solutions.

Based on the interviews, the following cornerstones were selected for the road map work: identification of fast, practical trials and enabling actions and the need for a systemic, holistic, long-term change.

Circular economy road map: work phases

The Government Programme makes Finland's top-level target clear: to become a global circular economy leader by 2025. This Government Programme target sets the direction and an ambitious level for circular economy work. The key observation in the international review presented earlier in the report is that, despite broad international interest, there is still a limited number of leading international operators and examples. This is particularly true with regard to holistic circular economy thinking that applies to the entire society, and the group of leading operators does not really include countries that combine practical actions.

The goal of Sitra's circular economy focus area and the work done to prepare this circular economy road map was to define the key practical actions and steps toward the global leader target in broad-based stakeholder co-operation.

The road map was produced under the direction of Sitra in collaboration with the Ministry of the Environment, Ministry of Agriculture and Forestry, Ministry of Economic Affairs and Employment, business life and other important stakeholders *(appendix: Members of the working group)*. The content of the road map is based on

- a background report concerning key international examples and important forces of change for Finland;
- an extensive stakeholder interview package;
- three round table discussion events;
- open hearing of stakeholders and stakeholder event;
- continuous collection of information and stakeholder communication.

Phases of road map work

The road map work began with a background report that included the international review mentioned earlier and an analysis of the forces of change affecting the current and target state of the circular economy and Finland's strengths and weaknesses as it moves toward the target state. A summary of the analysis is presented in the section: *Operating environment: the impact of key forces of change on Finland's circular economy target.*

Figure 13: Creation of the road map in numbers

Source: Sitra

A total of 63 people were interviewed during the project. The interviewees represented a broad range of stakeholders and most of them also participated in the three round table discussions. The purpose of the interviews was to survey the views of the interviewees and their organisations concerning the actions required to transfer to a circular economy and the role played by the organisations in the transition. The interviews were carried out in conjunction with meetings. The road map working group (appendix: Members of the working group) met three times during the spring of 2016.

Actions and owners were gathered for the road map by means of hearing a large stakeholder group. Broad-based idea collection resulted in some 250 action proposals, ideas and comments and was carried out by means of a web-based questionnaire and open stakeholder event. Finland's circular economy road map, which is presented in section 4, was compiled on the basis of the interviews, round table discussions, stakeholder event and continuous discussions.

Toward the target: Finland is a circular economy leader in 2025

The following road map target scenarios were selected: "Policy steering makes Finland a leader in environmental performance" and "Internet of Things and circular economy solutions as export advantages". In practice, this means settling on a target state that emphasises complete solutions, export and the opportunities of digitisation. Like the interviews, the round table discussions also indicated that the state's role as a public sector enabler was considered important. By implementing the right kind of regulation to facilitate a circular economy, the state can accelerate Finland's transition to a circular economy by encouraging circular economy solutions and "punishing" those that are not sustainable. The participants wanted to make emphasising complete solutions and technology part of the target state because it enables the combination of different things and puts Finland's strengths and unused opportunities in the focus. This vision also means putting companies at the forefront, which was considered important.

This choice reflected the need for systemic change. Partial optimisation will not allow Finland to transfer to a circular economy and become a global leader, and a holistic approach that covers different sectors of society is needed. In order to achieve the target state, we need a combination of significant administrative actions and concrete pilot measures. In addition to providing environmental and efficiency benefits, striving for the target state will be an important economic export opportunity for Finland. Based on the round table discussions and interviews, we can set our ambitions high, because there is an expectant atmosphere surrounding the global circular economy. The position of circular economy leader is still open and right within our reach – now it's time to roll up our sleeves and get to work.

Appendix: Working group

MEMBERS OF THE WORKING GROUP (DEPUTY MEMBERS IN BRACKETS)

Pia Björkbacka, Business Policy Expert, Central Organisation of Finnish Trade Unions SAK
(Maija Heikkinen, Senior Advisor, Environment, Finnish Forest Industries Federation)
Jyrki Heilä, Managing Director, Biovakka Oy
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Tuula Honkanen, Managing Director, Päijät-Häme Waste Management Ltd
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(Tiina Kaskiaro, Product Group Manager, Confederation of Finnish Construction Industries RT)
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(Kaarina Kolle, Climate and Energy Policy Officer, WWF Finland)
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(Per Mickwitz, Research Director, Professor, Finnish Environment Institute)
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Kai Mykkänen, Minister for Foreign Trade and Development, Ministry for Foreign Affairs of Finland
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Also involved in different phases of the process were Sitra's Senior Advisors **Timo Mäkelä** and **Oras Tynkkynen** and Leading Specialist **Jaana Pelkonen**.

Riikka Poukka, Kimmo Salakka, Daniel Kaufmann, Nina Vikkula and **Mathieu Hestin** from Deloitte acted as consultants during the process.

The world is currently looking for a new industrial and economic base now that we are moving towards a post-petroleum era. International investors are pulling their money out of businesses with high climate risks. The circular economy plays a key role in preventing climate change and in the renewable energy revolution.

Finland's circular economy road map describes the concrete actions that can accelerate the transfer to a competitive circular economy in Finland. The road map highlights best practices and pilots that can be easily replicated and provide added value on a national scale. In the road map tangible actions for growth, investments and exports are emphasised.

Policy measures, key projects and pilots have been created based on stakeholder consultations and working groups. The effort as a whole represents Finland's first steps toward a circular economy. The road map simultaneously challenges various operators to take supplementary actions to accelerate the transition.

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Sitra is actively shaping the future by studying, examining and selecting partners from various sectors to participate in open-minded trials and reforms. The aim of future-oriented work is Finland as a successful pioneer in sustainable well-being.

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