National Programme for Sustainable Growth in the Transport Sector 2021-2023

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Abstract

The transport sector is undergoing significant changes, the key drivers of which include urbanisation, emission reduction targets, innovations and technological development in the sector, as well as companies' business opportunities in global markets.

The National Programme for Sustainable Growth in the Transport Sector for 2021–2023 is a package that has been prepared in collaboration between the public and private sectors and the relevant research community. The programme aims to reform the transport sector and to promote export-driven growth in the sector through ecological, cost-effective and socially sustainable solutions. The programme's main objective is to make use of the export potential in the sector and, by 2025, establish 5 to 7 active business ecosystems in Finland and create 10,000 jobs to promote sustainable growth.

The programme consists of a shared target state and vision up until 2030. It describes the expertise and operational environment, determines the measures to be taken in the coming years, and lays out a framework for the programme's implementation and monitoring.

The programme includes ten strategic measures under the following three headings:

I Operational environment for sustainable growth
II Scalable sustainable solutions for export markets
III Continuing ecosystem-oriented cooperation

Through all these measures, the programme aims, in an orderly manner, to develop expertise and collaboration within the sector and, by means of ecosystem-oriented work, to reach potential benefits. The principal toolbox consists of a wide variety of tools offered by digitalisation, fossil-free fuels for all movement and transport, and various cross-sectoral innovative products and services.

Keywords transport, growth, economic and industrial policy, ecosystems

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Kuvailulehti

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Liikennealan kestävän kasvun ohjelma 2021–2023

Valtioneuvoston julkaisuja 2022:8

Julkaisija Valtioneuvosto

Tekijät Laura Eiro, ITS Finland ry, Marko Forsblom, ITS Finland ry, Natalia Härkin, työ- ja elinkeinoministeriö, Saara Reinimäki, liikenne- ja viestintäministeriö, Tiia Orjasniemi, liikenne- ja viestintämisteriö, Helinä Teittinen, liikenne- ja viestintäministeriö

Kieli suomi **Sivumäärä** 77

Tiivistelmä

Liikenneala on merkittävien muutosten keskellä, joiden keskeisinä ajureina toimivat kaupungistuminen, päästövähennystavoitteet, alan innovaatiot ja teknologinen kehitys sekä yritysten markkinamahdollisuudet globaaleille markkinoille.

Liikennealan kestävän kasvun ohjelma 2021–2023 on julkisen ja yksityisen sektorin sekä tutkimusalan yhteistyössä valmistelema kokonaisuus. Ohjelma tavoittelee liikenteen toimialan uudistumista ja alan vientivetoisen kasvun edistämistä ekologisilla, taloudellisilla ja sosiaalisesti kestävillä ratkaisuilla. Ohjelman päätavoitteena on realisoida toimialan vientipotentiaali ja synnyttää Suomeen 5–7 aktiivista liiketoimintaekosysteemiä sekä 10 000 kestävän kasvun työpaikkaa vuoteen 2025 mennessä.

Ohjelmaan on luotu yhteinen tavoitetila ja tulevaisuuskuva vuoteen 2030, kuvattu alan osaaminen ja toimintaympäristö, määritelty toimenpiteet lähivuosille sekä organisoitu ohjelman täytäntöönpano ja seuranta.

Ohjelma sisältää kymmenen strategista toimenpidettä seuraaviin kokonaisuuksiin:

I. Toimintaympäristö kestävälle kasvulle
II. Skaalautuvia kestäviä ratkaisuja vientimarkkinoille
III. Jatkuva ekosysteeminen yhteistyö

Kaikki toimenpiteet tähtäävät toimialan osaamisen ja yhteistyön systemaattiseen kehittämiseen sekä ekosysteemisellä työllä hyötyjen saavuttamiseen. Keskeisinä työkaluina ovat digitalisaation laaja keinovalikoima, fossiilittomat käyttövoimat kaikissa liikkumisen ja kuljettamisen muodoissa sekä erilaiset sektorirajat ylittävät tuote- ja palveluinnovaatiot.

Asiasanat liikenne, kasvu, elinkeinopolitiikka, ekosysteemit

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Presentationsblad

4.1.2022

Program för hållbar tillväxt i transportsektorn 2021–2023

Statsrådets publikationer 2022:8

Utgivare	Statsrådet		
Författare	Laura Eiro, ITS Finland rf, Marko Forsblom, ITS Finland rf, Natalia Härkin, arbets- och näringsministeriet, Saara Reinimäki, kommunikationsministeriet, Tiia Orjasniemi, kommunikationsministeriet, Helinä Teittinen, kommunikationsministeriet		
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Referat

Transportsektorn genomgår stora förändringar och de viktigaste drivande faktorerna i dessa förändringar är urbaniseringen, målen om minskade utsläpp, innovationer inom sektorn och den tekniska utvecklingen samt företagens möjligheter att marknadsföra sig på de globala marknaderna.

Programmet för hållbar tillväxt i transportsektorn 2021–2023 är en helhet som beretts i samarbete mellan offentliga och privata sektorn samt forskningsområdet. Avsikten är att programmet ska åstadkomma förnyelse av transportsektorn och främja exportdriven tillväxt i sektorn genom ekologiska, ekonomiska och socialt hållbara lösningar. Huvudsyftet med programmet är att realisera sektorns exportpotential och skapa 5–7 aktiva ekosystem för affärsverksamhet i Finland samt 10 000 arbetsplatser inom hållbar tillväxt före 2025.

Det har skapats en gemensam målbild och framtidsbild för programmet och de sträcker sig fram till 2030. I programmet finns en beskrivning av kunnandet inom sektorn och sektorns verksamhetsmiljö, och åtgärder för de närmaste åren har fastställts samt verkställandet och tillsynen av programmet har organiserats.

Programmet innehåller tio strategiska åtgärder som ingår i följande helheter:

I. Verksamhetsmiljö för hållbar tillväxt
II. Skalbara, hållbara lösningar för exportmarknaderna
III. Kontinuerligt ekosystemsamarbete

Syftet med alla åtgärder är att systematiskt utveckla kompetensen och samarbetet i sektorn samt uppnå nytta genom ekosystemarbete. De viktigaste verktygen är digitaliseringens stora metodarsenal, fossilfria drivkrafter i alla former av resor och transport samt olika produkt- och tjänsteinnovationer som överskrider sektorsgränser.

Nyckelord	transport, tillväxt, näringspolitik, ekosystem		
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PREFACE

Transport is a sector of commercial activity with particularly intense pressure to change. At the same time, the opportunities are also immense. Zero-fossil motive power, automation and digitalisation of transport will change traditional models of operation radically. Utilisation of data, new technologies and artificial intelligence along with innovative, user-driven services based on them will create new business and opportunities for companies to grow. More importantly, they will also make moving both people and goods more flexible, seamless and sustainable.

Achieving emission reduction goals requires the transport industry to evolve. We would be wise to implement the changes in such a manner that they create new business to meet international demand. Finland has excellent preconditions for creating circumstances where service structures developed through information technology knowhow create new international business. Finland's success is linked to the internationalisation of our companies.

These opportunities for growth and employment are sorely needed in this age when we look for the means to achieve sustainable recovery. Financial recovery, industry evolution and strengthening future competitiveness are, most importantly, supported by investments in green growth and digitalisation, as well as research, development and innovations. In the EU recovery packages, digital growth and the green transition are seen as crucial enablers of financial renewal and sustainable growth.

In recent years, Finland has conducted systematic collaboration to develop the operating environment of the industry and to accelerate the business ecosystems, especially within the framework of the National Growth Programme for the Transport Sector. The next step is to turn more companies and industry ecosystems into global success stories.

The National Programme for Sustainable Growth in the Transport Sector continues this work, promoting closer collaboration between the private and the public sector. The challenges and the opportunities of the transport sector are typically so vast that no single company or operator can respond to them. Collaboration across the industry and ecosystem thinking are required. Join us in the implementation of the growth programme to build the success story of Finland's transport sector.

Mika Lintilä

Minister of Economic Affairs and Employment

Timo Harakka

Minister of Transport and Communications

ABSTRACT

Premise

National Programme for Sustainable Growth in the Transport Sector 2021-2023 continues where the previous National Growth Programme of the Transport Sector left off: it promotes company-driven innovation development, internationalisation and sustainable and export-focused growth within the transport sector. A functional, efficient and productive transportation system is a key part of national competitiveness and comfortable everyday life of citizens. Transport is a key driver of national economy. In 2019, approximately 31,000 companies operated in the traffic sector and its supporting industries, employing approximately 175,000 individuals. In addition to this, the sector has a large number of companies that are not considered transport companies in the traditional industry sector categories. These include software companies that develop smart traffic solutions, IT houses that work with traffic control systems, and a number of new operators, such as companies that offer traffic automation, recharging and MaaS services. The estimated turnover of companies operating in the transport market was €71 billion in 2019. The transport sector is undergoing considerable technological, economic and social change, and its evolution is largely based on new opportunities opened by electrification, servitisation and digitalisation. The global transport market is estimated to grow from the 2017 figure of nearly 15,000 billion USD to more than 26,000 billion USD by 2030, forming approximately one fifth of the global economy.

Commitment and objectives

The primary goal of the National Programme for Sustainable Growth in the Transport Sector is the promotion of investments within the industry and supporting company- and export-driven growth through collaboration of the public and the private sectors based on ecologically, economically and socially sustainable solutions. The aim is to realise the export potential of the technology and service solutions of the transport sector.

The focus of the growth programme is on sustainable growth solutions built through ecosystem collaboration. The intention, however, is not to focus on individual transport projects, the overall development of the transport industry or questions of transport policy. Instead of transport policy, the focus of the growth programme is closer to innovation and business policy.

The aim of the National Programme for Sustainable Growth in the Transport Sector 2021-2023 is to help generate five to seven active international transport industry ecosystems and 10,000 sustainable jobs by 2025. The programme establishes a shared commitment across the sector and presents a vision for 2030, describes the current expertise and the current operating environment of the sector, defines key actions required within the next few years, and organises the implementation of programme actions and active monitoring of its progress. The programme is also used to build a national framework for digitalisation, RDI activities, investments and the allocation of public acquisitions within the transport sector. It promotes Finland's position as an internationally established pioneer of high-level expertise, research, innovations, investments and new business in the transport sector. Its key notions include leveraging the national market in developing the expertise of the companies and to produce market reference projects based on customer needs.

GOAL

Finland is an internationally successful pioneer of research and innovation activities focusing on smart and sustainable transport and logistics solutions, investments and new business, and able to offer smooth, safe, zero-emission solutions to customers. The aim of the programme is to promote export-driven growth within the sector based on sustainable solutions, support creation of five to seven active international transport business ecosystems, and to create 10,000 new sustainable jobs through new business by 2025.

FINLAND'S TRANSPORT SECTOR WILL EVOLVE INTO

1.	A growth industry of several business ecosystems based on sustainable business and aiming for international growth.
2.	A pioneer of development and deployment of low-carbon transport and logistics solutions based on circular economy to achieve the emission reduction goals and increase the carbon handprint of the transport industry.
3.	A source and a user of versatile, high-quality research and innovations based on it; an evolving industry that attracts new operators.
4.	An open-minded pioneer market for systematic, user-based piloting and upscaling of solutions based on new technologies and services. Public investments, pioneering legislation and active international collaboration support the creation of a market for sustainable solutions and new innovations.
5.	An attractive location for testing and piloting platforms, and an attractive target for investments of the transport sector.
6.	A dynamic operating environment for the sector's start-up businesses, and a reliable business environment for the international growth of established companies.
7.	An active and proactive application sector for new technologies and business models, such as MaaS, block chains, machine learning, artificial intelligence, automation, mass data and new zero-emission power sources and fuels.

Preparation of the programme and roadmap for 2021–2023

National Programme for Sustainable Growth in the Transport Sector was prepared in 2020 under the steering group of the National Growth Program project, as it is essentially an update of the same programme body. In 2018–2021, the steering group has included representatives of the following organisations: Ministry of Economic Affairs and Employment, Ministry of Transport and Communications, Ministry of the Environment, Ministry of Agriculture and Forestry, Ministry of Education and Culture, the cities of Espoo, Helsinki, Oulu, Tampere, Turku and Vantaa, Business Finland, The Finnish Innovation Fund Sitra, Helsinki Metropolitan Smart & Clean Foundation, VTT Technical Research Centre of Finland, Regional Council of Häme (Growth Corridor), Finnish Transport Infrastructure Agency, Finnish Transport and Communications Agency Traficom, Skoda Transtech Oy, TietoEVRY Oyj, Solita Oy, MaaS Global Oy, Intelligent Traffic Management Oy, Rightware Oy, and ITS Finland ry.

The programme has been prepared through extensive and open collaboration. Lessons learned in the implementation of the National Growth Programme of the Transport Sector and the expertise of the workgroup of the National Growth Programme have been leveraged in the preparation of the current program. To support the work, three thematic workshops were arranged for stakeholders in June 2020, along with a number of interviews of relevant participants. Based on these, the background information of the programme, such as the chapter on the operating environment of the industry and especially the roadmap actions, has been brought up to date. The programme draft was available online for comments on the Lausuntopalvelu.fi website in late 2020.[1] Comments were received from 35 parties.

Three principal spheres of action and the ten strategic actions for 2021–2023 have been defined:

I Operating environment for sustainable growth

1. A shared commitment and an enabling administration that promotes sustainable transport and business.
2. Development and utilisation of diverse financing sources to support innovation and internationalisation.
3. Development of research collaboration and industry knowhow on both the national and the international level.
4. Proactive influencing within the EU and on international forums.

1 https://www.lausuntopalvelu.fi/FI/Proposal/Participation?proposalId=7d7be169-4d91-429e-883a-188188c45041

II Scalable solutions for the export market

5. Cities as platforms in the development and deployment of sustainable, pioneering solutions.
6. Development of scalable experiments with real impact.
7. Innovative public procurements to support the creation of scalable solutions and market references.
8. Leveraging of digital information as the foundation of sustainable business operations.

III Continuous ecosystem collaboration

9. Systematic promotion of sustainable growth ecosystems and internationalisation.
10. Investments in joint international marketing and sustainable transport branding.

In all action points, the aim of developing solutions to meet the challenges of climate change, the decline of nature and urbanisation is a key driver. Important tools include digitalisation and zero-fossil power sources in all modes of traffic and transport, and product and service innovations that cross the sector boundaries between, for example, traffic, energy and the constructed environment. Solutions that respond to the global challenges of climate change and urbanisation create opportunities for the sustainable growth of the transport sector. The goal of all the actions is systematic development of expertise and collaboration within the industry, along with leveraging of the advantages of ecosystem thinking.

Roadmap implementation and tracking

A factor crucial in the implementation of the growth programme is achieving commitment by companies, public organisations and the research sector to large-scale implementation of roadmap actions. To track the progress of implementation work, a broad-based steering group with participants invited from the state, cities, companies and the research sector has been established within the framework of the National Growth Programme of Transport Sector. In the future, the steering group will be tasked with tracking the progress of the National Sustainable Growth Programme actions and to decide on new actions to be integrated into the programme. Implementation and tracking are discussed in more detail in chapter 6.

1 Introduction

Finland, like most developed economies, is undergoing substantial technological, economic and social change involving the processes and business models of the industrial, the commerce and the service sectors. While the changes challenge conventional operators to evolve, it also creates new business opportunities for innovative companies.

The premise of the National Programme for Sustainable Growth in the Transport Sector 2021-2023 is to support company-driven innovation development, internationalisation and sustainable growth within the transport sector in order to realise the export potential of the technology and service solutions. Sustainable growth means growth based on ecologically, socially and economically sustainable solutions. An ecosystem approach where the public and the private sphere as well as the research sector work together is applied to establish a systematic mode of operation that supports the achievement of the goals and develops the business ecosystems of the industry.

Evolving, increasingly versatile export operations and success in international value networks are paramount to Finland's future success and vitality. The role of service exports will become even more important in the future. The actions of the growth programme realise the export potential of the technology and service solutions of the transport sector. This development has been supported since 2018 through the National Growth Programme of the Transport Sector, which has now been brought up to date in the National Programme for Sustainable Growth in the Transport Sector 2021-2023 to reflect the latest developments within the operating environment as well as the programme of Prime Minister Sanna Marin's government and the sustainable recovery targets set for recovering from the coronavirus pandemic.

Prime Minister Sanna Marin's government programme aims to support the growth and the internationalisation of Finnish companies on a broad scale and to support the creation and development of business ecosystems in the range of billions of euros. The aim is to make Finland a pioneer of the development of digitalisation. The Sustainable Growth Program of the Transport Sector supports the implementation of these goals within the transport sector. The actions also take into account the emission reduction goals of the transport sector as well as the targets set for Finland's carbon handprint in the government programme. The Growth Programme also supports socially fair, environmentally sustainable and economically sound regional and urban development,

as well as the circular economy targets set in the government programme, especially through development of business models based on these principles. The Growth Programme also responds to set goals for employment, export trade, the development of export ecosystems and innovative public investments in the government programme.

The transport sector is one of the industries undergoing massive change. Its development is affected by numerous megatrend-level change drivers simultaneously. Some of the drivers are based on the challenges brought about by climate change and increasing traffic volumes, while others depend on new opportunities opened by digitalisation and technological development. The changes are reflected widely across the entire sector – regardless of the mode of transport selected – in both passenger and cargo traffic, in the industry, and in the services of both urban and rural areas.

The need for a change is most clearly seen in cities where the increasing number of private cars has in many places become a factor that undermines urban development and the wellbeing of the population. However, no easy solutions are available as forecasts estimate that the global number of cars is expected to double within the next decade. At present, only approximately 15 percent of the growing global population are affected by the motorisation trend. Regardless of this, the costs of traffic congestion to the global economy are enormous, more than 100 billion dollars per year in the United States alone.[2] In addition, more than 1.2 million individuals are killed in traffic every year with up to 50 million getting injured.[3] The need for evolution in the transport system is real.

Global warming is the greatest challenge of our time, and traffic emissions are one of its primary causes. The goals set in the Paris Agreement and in the EU will not be reached through current measures alone. On the national level, Finland is committed to cutting domestic traffic emissions by at least 50 percent by 2030. Achieving the emission targets depends on a versatile set of measures, and pressure for change is felt by virtually all participants in the transport sector as well as the users of transport and logistics services.

The evolution of the transport sector is largely based on opportunities opened by digitalisation. In step with this, legislation, technologies, business models and customer needs will also evolve. Finland is in an excellent position to leverage the digital revolution of the transport sector: it has strong digital expertise, and Finland's digital competitiveness is among the best in the world.[4] The post-Nokia expertise combined with a new generation of data processing knowhow, an active start-up culture and internationally

2 Texas A&M Transportation Institute and INRIX 2015, Urban Mobility Scorecard

3 WHO, 2015, Global status report on road safety

4 The DESI index of the European Commission, 2020

recognised thought leadership in the transport sector provide an excellent foundation for sustainable growth in the transport sector. An overview of the development of digitalisation and the opportunities opened by it were discussed in the final report of the working group for digital measures in the aftermath of the coronavirus crisis published in September 2020.[5]

In the vision and the roadmap[6] published by the Research and Innovation Council working under the Prime Minister's Office, Finland was projected to be the most attractive experiment and innovation environment with the best expertise in the industry in 2030. The council's vision and the roadmap give a common direction for national research, development and innovation policies with the aim of establishing solutions to global problems and responding to international demand. The council's long-term objective is to have several business-driven growth ecosystems in the range of billions of euros that provide competitive solutions for global needs in Finland.

Finland must take an active stance in utilising the opportunities opened by global challenges, such as climate change, and the need for sustainable development and offer solutions for them. New ideas, data and technologies are the primary sources of growth and productivity. The goal of Prime Minister Sanna Marin's government is to increase the share of Finland's research and development investments from the current 2.7% of gross national product to 4% by 2030. To achieve this, a common vision, a shared mission, more ambitious R&D activities, and public and private investments are required. However, without a substantial increase in investments from the private sector, the goal will not be reached. The RDI roadmap[7] published in April 2020 was created to support the achievement of this target and to build sustainable growth, and to establish an operating environment that encourages both Finnish and international companies to invest in RDI activities in Finland. The aim is to maintain Finland's position in the forefront of the production of new knowledge and the development and deployment of new technologies. It is also important for Finland to adopt knowledge and expertise developed elsewhere.

The National Programme for Sustainable Growth in the Transport Sector 2021-2023 ensures that the transport sector is involved in the effort for achieving the national goals set by the Research and Innovation Council and the implementation of RDI roadmap actions. The growth programme provides a national framework for the digitalisation, RDI operations, investments and allocation of public acquisitions in the transport sector.

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5 Digiloikasta vauhtia uuteen kasvuun ja hyvinvointiin, Publications of the Ministry of Transport and Communications 2020:15

6 GOVERNMENT OF FINLAND, 10/2017, Vision and Roadmap of the Research and Innovation Council

7 National RDI Roadmap, 2020

The National Programme for Sustainable Growth in the Transport Sector 2021-2023 also takes synergies with action plans of other public sector operators relevant to the goals of the growth programme into account. The programme serves especially as a sector-specific implementation instrument of horizontal programmes that brings together initiatives and measures taken in Finland to promote sustainable growth within the transport sector. Key programmes and strategies relevant to an operating environment that supports sustainable growth within the transport sector are:

- Sustainable Growth Programme for Finland
- Export and International Growth Programme
- Kasvuportfolio 2.0 (“Growth Portfolio”)
- AuroraAI national artificial intelligence programme
- Talent Boost programme
- National transport system plan
- Energy and Climate Strategy
- Zero-fossil traffic roadmap and the low-carbon roadmaps of different sectors
- Transport automation action and legislation plan
- Logistics digitalisation strategy
- ICT sector climate and environment strategy
- Strategic programme to promote circular economy
- Overall transport taxation renewal
- RDI roadmap of the Research and Innovation Council
- Academy of Finland’s Research Infrastructure Strategy 2020–2030
- Project on opening up and using public data
- National Urban Strategy 2020–2030
- Digital aviation workgroup report and recommendations

2 Sustainable Growth in the Transport Sector: Target State and Vision for 2030

2.1 Sustainable Growth in the Transport Sector: Target State

Finland aims to be an internationally successful pioneer of research and innovation activities focusing on smart and sustainable transport and logistics solutions, investments and new business that offers smooth, safe, zero-emission solutions to customers.

The aim of the programme is to promote export-driven growth based on sustainable solutions in the sector, launch 5–7 active international transport business ecosystems and to create 10,000 new sustainable jobs based on new business by 2025.[8]

The National Programme for Sustainable Growth in the Transport Sector brings key operators together under a shared mission statement and encourages closer collaboration between different participants. Dialogue between ministries, urban stakeholders, the research sector and business on the direction, the potential and the actions required in the transport sector helps establish an overall view and a shared growth story. A target state and a future vision formulated together helps in the optimal allocation of resources and the identification of potential growth areas.

Sustainable growth of the transport sector explicitly refers to growth based on sustainable business in the sector, not an increase in vehicle-kilometres. Sustainable business is based on elements such as zero-fossil transport and solutions made possible by digitalisation

8 The aim is to create 5–7 active international transport business ecosystems with the programme. The reference year is 2018, after which systematic development has started within the framework of the National Growth Programme of the Transport Sector. The ecosystems will be established in sectors with higher-than-average costs and added value. Turnover per employee in the software industry, for example, was approximately 174,000 euros per employee in 2018. On average, every second company is still in operation after five years, while less than 20% of start-ups are in operation five years after being established. The impact of the programme has been estimated at 8,000–12,000 new jobs in Finland over the next five years from one or two extensive ecosystems alone. Sources: Publications of the Ministry of Economic Affairs and Employment 2020:6 and Maliranta, Pajarinen & Rouvinen (eds.) (2018): Startups in the Economy.

that are used to make the use of infrastructure, urban space and the different modes of transport more efficient, and to offer new services as alternatives to private car ownership, in other words, to reduce the vehicle-kilometres. The intention is to enable movement of people and goods in a way that is smart also in terms of resources – simply, to put urban space and people's time to good use. Digitalisation and servitisation are also used to develop transport and logistic solutions for areas of low population density. Solutions that more and more people can afford that increase the possibilities of customer-oriented mobility without excessive environmental load are introduced to the market. Sustainable business solutions are also found in the interfaces between transport and other sectors in services that reduce unnecessary traffic through, for example, the utilisation of remote connection technologies. The need for mobility can also be reduced by offering more services locally and by offering clean logistics solutions that bring goods close to the people.

A key notion of the growth programme is to leverage national collaboration and the domestic market in developing expertise within the industry and to create market references for the companies. Simultaneously with the development of the national transport system into a more environmentally friendly, flexible and safe direction, a broad effort to develop the expertise of all operators in the sector and to produce solutions with international demand is required. This increases the perceived value of Finnish companies among investors and makes the Finnish market more attractive from the perspective of "Invest in" operations in a broader sense. It also improves the collaboration opportunities of Finnish companies in international networks when looking for project partners or competing for EU funding.

The primary objective of the programme is to support sustainable, company- and export-driven growth in the sector and to realise the sector's technology and service export potential through a joint effort of the public and the private sectors. However, the growth programme does not to focus on individual transport projects, overall development of the transport sector or questions of transport policy. The primary emphasis of the transport sector's growth programme lies in ecosystem development, and its focus is closer to innovation and business policies instead of traffic policy.

In addition to sustainable growth of the companies, the National Programme for Sustainable Growth in the Transport Sector supports public investments in innovations that improve resource and cost efficiency. Innovation is understood in a very broad sense in the programme. Moreover, it is important to identify all the content areas with impact on the competitiveness of the ecosystems. In addition to those mentioned above, these entities include (for example) innovations in financing and insurance.

All this means that the transport sector of Finland is:

1. A growth industry of several business ecosystems based on sustainable business and aiming for international growth.
2. A pioneer of development and deployment of low-carbon transport and logistics solutions based on circular economies that achieves the emission reduction goals and increases the carbon handprint of the transport industry.
3. A source and a user of versatile, high-quality research and innovations based on it; an evolving industry that attracts new participants and operators.
4. An open-minded pioneer market for systematic, user-based piloting and upscaling of solutions based on new technologies and services. Public investments, pioneering legislation and active international collaboration support the creation of a market for sustainable solutions and new innovations.
5. An attractive location for testing and piloting platforms, and an attractive target for investments of the transport sector.
6. A dynamic operating environment for the sector's start-up businesses, and a reliable business environment for the international growth of established companies.
7. An active and forward-looking application sector for new technologies and business models, such as MaaS, block chains, machine learning, artificial intelligence, automation, big data, new zero-emission power sources and fuels.

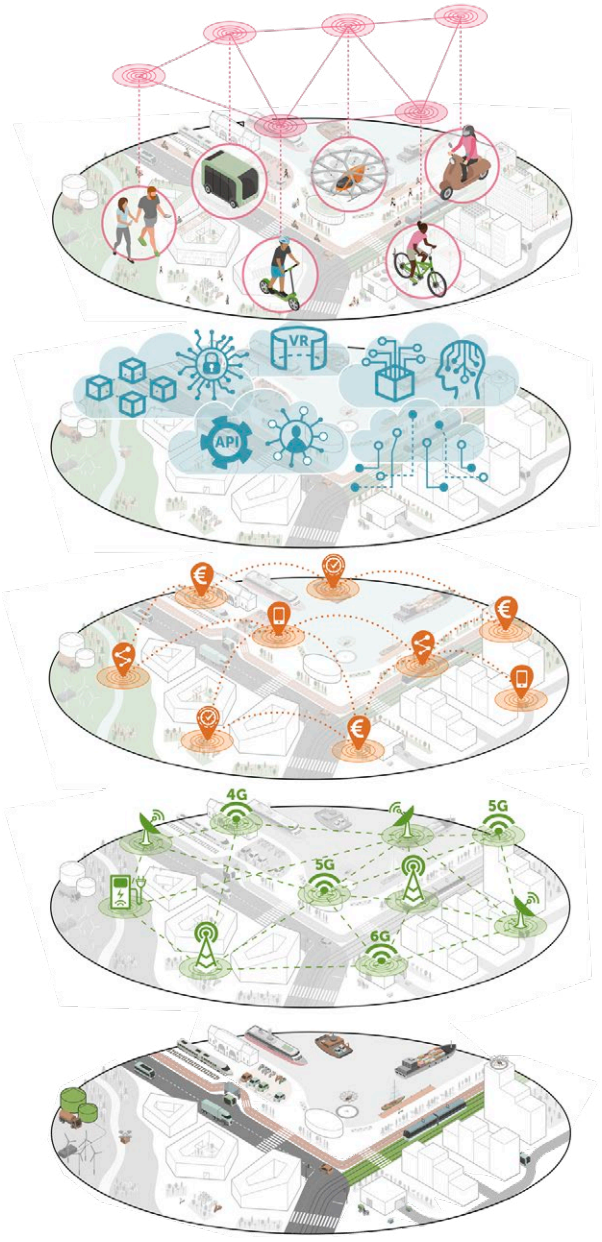
2.2 Transport System 2.0 – Future Vision for Transport Sector 2030

The transport system of the future is currently being built on a global scale. To achieve emission targets, new solutions are being planned and built in every city in the world. At the same time, companies are developing new services, vehicles, power source solutions, algorithms, applications and business models for mobility and transport.

The transport system consists of transport infrastructure, vehicles, information and energy sources, various information resources, technologies, and mobility and transport services. In all modes of transport, the development trend is towards clean energy sources,

distributed and gradually autonomous traffic; an integrated transport system where different modes of transport and mobility and logistics services are connected seamlessly. Being user-driven is the key premise of the smart transport system. Its primary objective is sustainability, and its chief construction element is data.

Figure 1. Transport system 2.0



Mobility and transport as services

- Public transportation, services specific to different modes of transport, logistics services, support services, MaaS operators

Cloud services, data, interfaces and platforms

- Cloud services, open data, source code, API, IoT, MyData, cybersecurity, AI, blockchains, VR, AR, platforms, machine learning

Smart transport infrastructure

- Compatible information services, digital payments and clearing
- Transport pricing
- Real-time, location-specific data communications

Data and electric traffic infrastructure

- Mobile data, broadband, 4G/5G/6G
- Smart networks and charging infrastructure

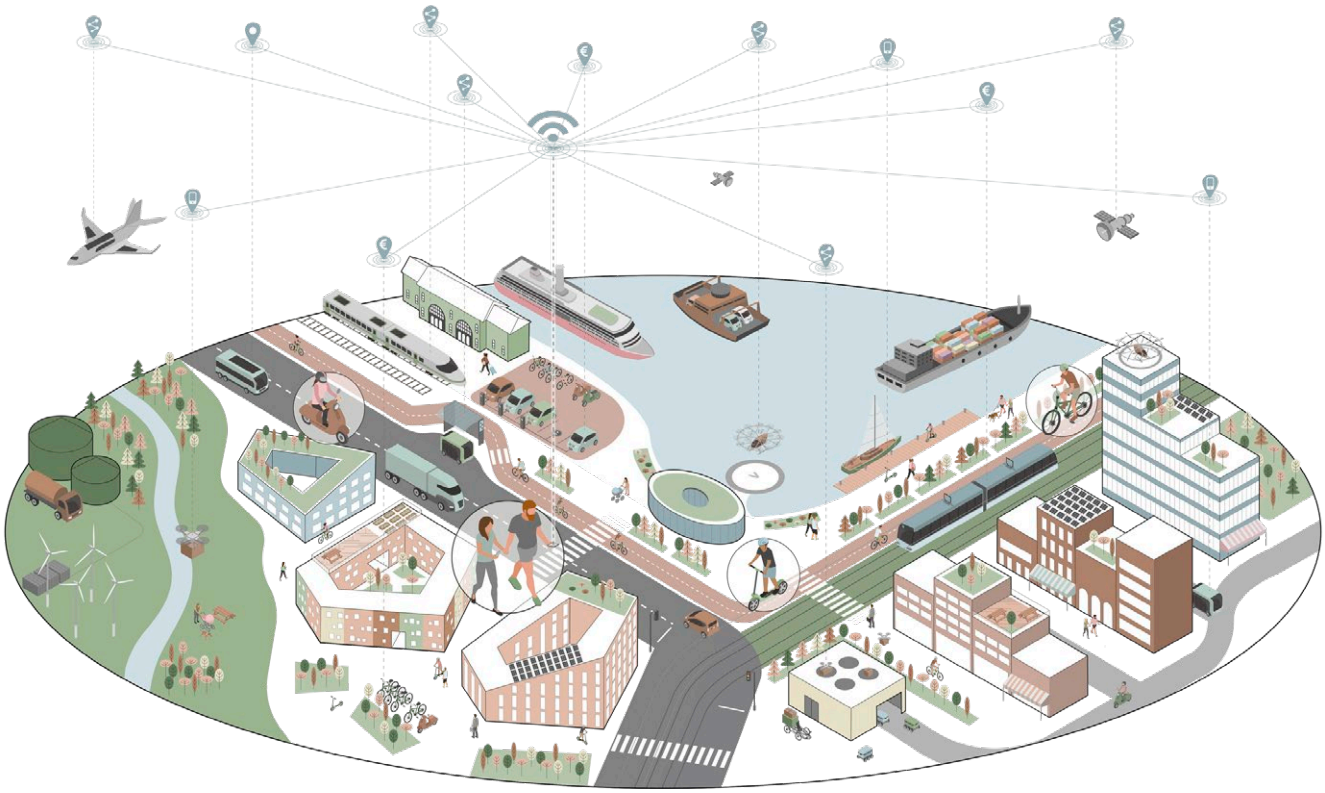
Infrastructure and modes of transport

- Roads, tracks, waterways, ports, airports, hubs, urban planning, MAL land use, housing and transport agreements
- Zero-emission vehicles and automation in all modes of transport
- Smart development, service and maintenance

A transport system can be considered smart when the participants of the transport system can be connected to data ecosystems that utilise decentralised transport system information. The ecosystems are used to integrate the transport sector into data and energy networks and the development of the built environment. They make user-driven mobility and logistics services that cross traditional business sector boundaries possible. The capacities of different modes of transport and the infrastructure are utilised optimally through smart traffic management, the optimisation of travel and logistics chains, and user assist services. Smart systems and automation improve transport safety.

Vehicles start increasingly resembling terminals, and the entire system can be programmed and updated over data networks, which also enable the leveraging of real-time system data. Real-time, proactive overall views open ground for significant innovation and create a foundation for extensive changes in how things are done. Utilisation of information and new technologies makes it possible to utilise the capacities of the infrastructures and the modes of transport efficiently, and also make material usage, maintenance and service systems based on circular economy models possible.

Figure 2. Future of Transport: Vision for 2030



Smart and sustainable transport systems hold new business opportunities on all levels and across the entire system. Traditionally, the largest business opportunities have been found in solutions that increase overall system capacity, but now social objectives along with digitalisation are changing the entire transport sector. In particular, solutions that improve efficiency and robustness are now seeing growth; they are focused on digital evolution and radical innovations that challenge current operating models.

Smartly planned transport hubs use data and functional infrastructure solutions to bring different modes of transport together seamlessly in both passenger and goods traffic, making the use of sustainable modes of transport an attractive choice.

Traffic with low-emission power sources along with versatile and smart mobility and logistics solutions make urban environments more comfortable, improve health and safety, and make the environments more attractive and competitive. In the cities of the future, the everyday environments are good for people – nice to live in, spend time in and move around in. The increasing proportion of walking and cycling along with other sustainable mobility solutions makes everyday life easier, releases space formerly used by traffic for other purposes, improves air quality and reduces transport costs.

The public sector plays a key role in achieving this change – or in slowing it down. Transport and market regulation, public investments and different grants, incentives and pricing are efficient instruments for directing the development of the transport sector and to create a market for solutions that serve both business objectives and the societal goals.

3 Operating environment

3.1 Primary change drivers in the transport sector

Transport is a derived demand that serves the social and economic wellbeing of people and business. At the same time, transport is closely linked to overall social change characterised by global megatrends such as the climate crisis, urbanisation and digitalisation. Climate change, the depletion of nature and overconsumption of natural resources are closely linked, and it has been estimated that more than half of the global gross national product is directly dependent on nature. New technological and social innovations made possible by digitalisation guide the development and manifest in the everyday lives of people in the form of user-driven products and services. Great changes are also occurring in consumer behaviour. Changes especially relevant to the transport sector are the increased consumption of services, the changing face of work and the increasingly important role of sustainability. Megatrends are also reflected in goods traffic and logistics, and sustainability is an increasingly important factor in all business and investment decisions. Finland now has the opportunity to create comprehensive, systemic solutions to the greatest challenges of our time.

Automation and fossil-free traffic are developed in all modes of transport, and the development of the transport sector, mobile services and innovations are seeing considerable investments. In 2016, Bill Ford, the chairman of the executive board of Ford, described the change as follows: "*Our new transportation revolution will be like going from horses to cars*". A global race for market leadership and the greatest innovations is already in progress, and the speed of this change has only accelerated in recent years.

Climate targets build demand for efficient low-emission solutions

The prevention of climate change, the decline of nature and sustainable use of natural resources have become important challenges also for the transport sector. At the same time, they create a large growth market for solutions and services that reduce greenhouse gas emissions and use natural resources wisely. Limiting the increase in average global temperatures to close to 1.5 degrees depends on fast and radical emission cuts across all sectors of the society. Global CO2 emissions need to be halved by 2030, and emissions must fall to net zero near mid-century.

In EU countries, the traffic sector produces almost 25% of greenhouse gas emissions, and globally nearly 20%. According to the Strategic Agenda of the European Council

for 2019–2024, the EU must show the way and change its own economy and society comprehensively to achieve climate neutrality.[9] As part of the Green Development programme[10], the European Commission has proposed EU-level climate reduction targets much more stringent than the current level. At the same time, funding is channelled to the prevention of climate change and to circular economy solutions through EU instruments, and this is an opportunity that Finland should utilise to the maximum. The goal of the Commission's Sustainable and Smart Mobility Strategy and its legislative action plan is to achieve 90% emission reductions in the transport sector by 2050 as stated in the European Green Deal Programme.[11]

Transport plays an important role also in the achievement of Finland's climate targets. Transport emissions account for approximately one fifth of Finland's total greenhouse gas emissions, and approximately 40% of emissions in the effort sharing sector. In 2019, approximately 94% of domestic transport emissions came from road traffic. However, the reduction of emissions has been very slow, and with the current actions the emission targets will not be reached.

On the national level, Finland is committed to cutting domestic traffic emissions by at least 50 percent by 2030. The emission reduction targets of Finland's domestic traffic have been agreed in the National Energy and Climate Strategy (2016), the Medium-Term Climate Change Policy Plan (Kaisu, 2017), and the government programme. In addition to this, many cities have their own carbon reduction targets. In their implementation work to reach the targets, it has frequently been observed that compared to other emission reduction sectors the transport sector is challenging because its functions are distributed between various operators and the range of tools required is extensive.

Actions aiming to reduce greenhouse gas emissions have opened completely new business opportunities for companies and solutions that help the transition to low-carbon traffic are sought everywhere in the world. New smart, clean and resource-efficient transport solutions play an important role in the global reduction of emissions in the transport sector. Finland is currently working to reduce the greenhouse gas emissions of domestic traffic as outlined in the Roadmap for fossil-free transport.[12] Many operators in the transport sector have also committed themselves to the goals in their respective roadmaps and have explored methods to achieve them.

9 New Strategic Agenda 2019–2024

10 https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_fi

11 COM(2020)789

12 https://valtioneuvosto.fi/hanke?tunnus=LVM050:00/2019

The evolution of the energy system towards a more distributed production of renewable energy makes new energy solutions, business models and transport services possible, bringing the value chains of the transport and the energy industries closer to each other through sector connections.

New technologies accelerate the evolution of business models

The biggest business opportunities lie in solutions and business models that combine different technologies, especially when they produce clear added value for the end user and respond to the most important change drivers simultaneously. Transition to the real-time economy brings flexibility and opens up possibilities for completely new ways of using different modes of transport and shared logistics. It also makes new business models possible in passenger traffic, logistics and heavy traffic.

While technological development makes new ways of operation and automation solutions possible, more and more services, platforms and products become increasingly dependent on the reliable operation of communication services, communication networks, radio frequencies and information systems. Because of this, it is of paramount importance that both the private and the public sector develop and maintain the cybersecurity and the data security of their rapidly evolving operating environments – also in transport and logistics services.

Rapid deployment of new technologies is required for environmental reasons, to maintain national competitiveness and to produce scalable export solutions. Investments are especially important in the early stages of internationalisation of solutions and companies. International competition increasingly takes place between business ecosystems as companies operating within them gain advantage of the competitive edge and the synergy offered by their ecosystem partners and the operating environment.

The evolution of the transport sector is also manifested in vehicle development that opens new possibilities as the vehicles are integrated more closely with software technologies and information systems.

Urbanisation and an aging population call for new solutions in cities and in rural areas

Rapid urbanisation necessitates that the transport system evolves both in cities as well as in areas of low population density. It is estimated that 70% of the global population will live in cities by 2050.[13] If the current trends continue, the demand for passenger and cargo

13 Sitra Megatrendit, 2020

traffic will triple globally from 2015 to 2050.[14] Urbanisation is fastest in Asia and Africa. This contributes to many of the challenges faced by transport systems (congestion, accidents, air pollution) but also opens new business opportunities for sustainable transport and logistics services. The infrastructure of most cities cannot sustain a constant increase in traffic volumes, while the number of individuals belonging to the middle class that aspires to obtain their first car is forecast to increase from 3 billion to approximately 5.5 billion between 2015 and 2030.[15]

Managed properly, the automation and servitisation of the transport system releases urban spaces for more fruitful uses, and, together with zero-fossil fuels, improves the comfort, health, and quality of life in urban living environments. Changes in how urban space is allocated to different modes of mobility will change the way people move in the future. By directing urban and regional planning, land use and construction regulation create demand for new services and encourage the population to use sustainable transport solutions. Developing a real-time overview opens possibilities for new combined services and lays a foundation for a change in how things are done.

Urbanisation and the increase in online commerce create both challenges and opportunities for achieving the emission reduction goals and socially equal regional development. Moreover, aging populations have impact on what kind of transport solutions are required. In countries with low population density, such as Finland, providing comprehensive mobility services calls for versatile solutions based on the structure, transport needs and possibilities for connecting different modes of transport inherent to each region. In Finland, population clusters to the large growth centres. In other parts of the country the population decreases while the proportion of aged population increases. In step with this, the population becomes more differentiated. This causes a need to develop cost-effective mobility and transport services that respond to the needs of different regions and population categories.[16] At the same time, global demand exists for solutions intended both for sparsely population regions and different population segments.

The coronavirus pandemic accelerates the change

The coronavirus pandemic has presented exceptional challenges to transport companies and operators in Finland and abroad. The use of public transportation and mobility services has decreased dramatically. If the situation persists, it will contribute to adverse

14 For more information, see OECD International Transport Forum Transport Outlook 2019

15 Homi, K., 2017. The Unprecedented Expansion of the Global Middle Class. An Update. Brookings

16 Sitra Megatrendit, 2020

developments in terms of transport policy goals in the modal share between different modes of transport and will make achieving the emission targets even harder. This may have long-term impact in the use of public transportation and the shared services. Investments in future viability of public transportation in the form of (for example) request-based solutions and by provision of a broad range of traffic services and "pandemic safe", up-to-date digital travel information solutions and payment services to customers will also open new opportunities for business.[17]

The remote work trend accelerated by the pandemic is likely to have permanent effect, which can have adverse impact on already strained public transportation systems. On the other hand, demand for telecommuting technologies and high-quality data connections will increase. As a positive trend, walking and cycling have increased considerably and have already changed the ways how the urban spaces are used in many cities of the world to better support sustainable modes of transport.[18]

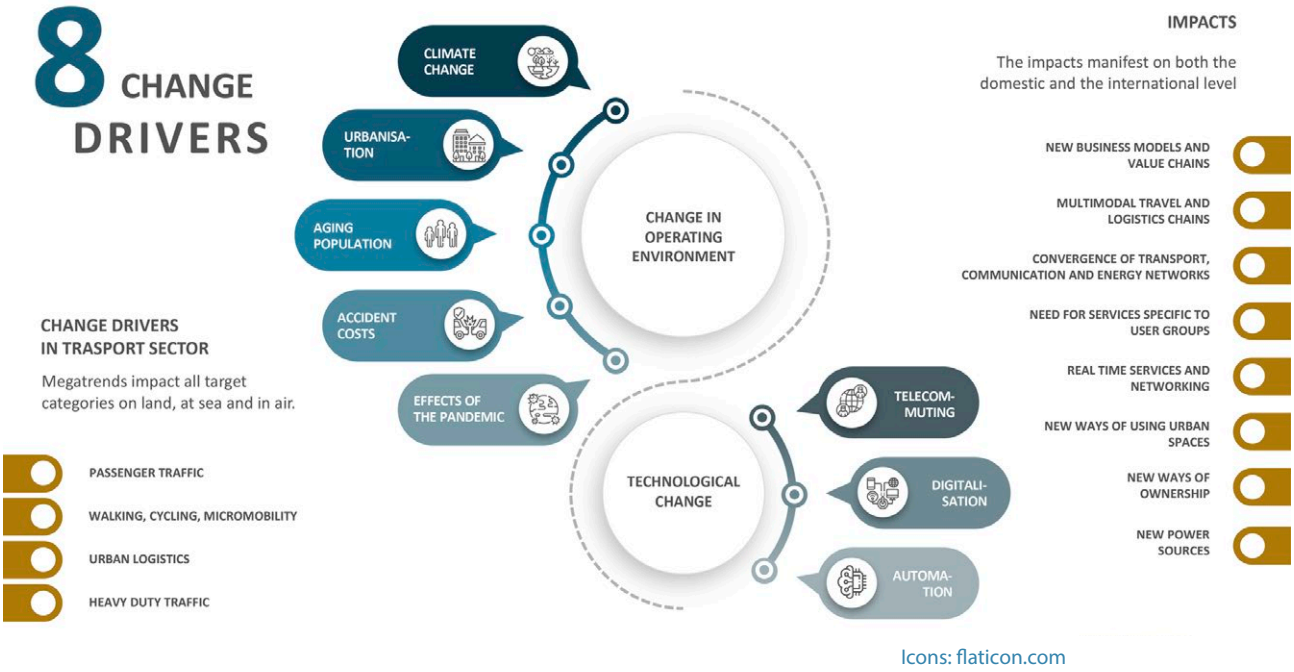
The coronavirus pandemic has profound impact on the entire transport sector. Aviation is going through the deepest crisis in history, and its capacity to invest is falling at a time when new solutions need to be tested and deployed urgently. The situation accelerates the consolidation trend in the global traffic market that was already on the horizon before the pandemic. In addition to consolidation, the market is impacted globally by state subsidies, which may cause market distortion. These effects have impact on numerous commercial and official participants through the service chains of the transport sector. In addition, the pandemic has highlighted the role of Finnish knowhow in supply and logistics, which may also translate to exportable knowhow and concepts.

The role of public money and procurement is emphasised as a factor that guides and expands the domestic market. Sustainable recovery packages and emphasis on green transition and digital evolution should be leveraged maximally. The coronavirus recovery effort also involves a genuine opportunity for a leap forward in the digitalisation of the transport sector, autonomous traffic, and the transition to cleaner transport and logistics.

17 Different scenarios with coronavirus impact have been assessed by (for example) Deloitte in the "The Futures of Mobility After Covid-19" article. Moreover, the current state and the operating environment of the traffic sector has been assessed in the national Liikenne 12 transport system plan: Liikennejärjestelmän nykytila ja toimintaympäristön muutokset, Traficomin tutkimuksia ja selvityksiä 4/2020.

18 The impacts of the coronavirus pandemic have been assessed in more detail in reports such as Digiloikasta vauhtia uuteen kasvuun ja hyvinvointiin (Liikenne- ja viestintäministeriön julkaisuja 2020:15) by the Ministry of Transport and Communications.

Figure 3. Transport sector change drivers and their effects.



Icons: flaticon.com

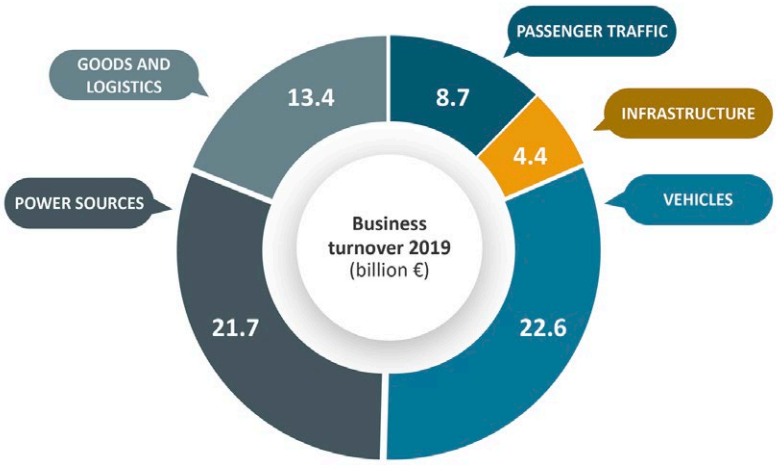
3.1.1 Transport sector and transport markets

The transport sector and the transport market in Finland

An efficient and productive transportation system is an integral part of national competitiveness and comfortable everyday life of citizens. Transport is also a key driver of national economy. In 2019, approximately 31,000 companies operated in the traffic sector and its supporting industries, employing a total of approximately 175,000 person-years.[20] In addition to these, the sector has impact on employees from supporting and related sectors that are not reflected instandard industrial classification. These include software companies that develop smart traffic solutions, IT houses that work with traffic control systems, and a number of new operators, such as companies that offer traffic automation, recharging and MaaS services. As a whole, the Finnish transport market is relatively large measured by turnover and by costs caused by transport to different participants in the society. In a report published by the Ministry of Economic Affairs and Employment as part of the National Growth Programme of the Transport Sector in 2020, the overall transport market is studied through company turnover, and is divided into passenger traffic, goods traffic, the traffic infrastructure, and vehicle and power

source submarkets. Statistics Finland estimated the turnover of all companies operating within these industries as approximately 71 billion euros, while sector exports amounted to approximately 10 billion euros in 2019.[19]

Figure 4. Transport sector volume and operators



- In 2019, more than **31,000** companies operated in the traffic sector and its supporting industries in Finland, employing a total of approximately **175,000 individuals.**
- Statistics Finland has estimated the turnover of these companies at approximately 71 billion euros in 2019.

Source: Traficom

The transport market can also be analysed from the perspective of costs caused to different participants in the society. According to the national accounts, domestic spending on transport was 14 billion euros in 2018[20] with the average household spending 5,800 euros on transport annually. In other words, transport (excluding services such as package travel) amounted to almost 12% of domestic household consumption. Based on the 2018 logistics report, logistics and transport costs of the industrial and the commercial sector allocated to Finland were approximately 27.5 billion euros, roughly 14% of the companies' turnover, in 2017. According to Statistics Finland, transport expenditure of state and municipal administration was approximately 5.3 billion euros in 2018, with state administration amounting to 2.6 billion euros and local administration to 2.7 billion euros.[21]

19 Liikennelan mittaristo ja tilannekuva. Ehdotukset kasvuohjelman arviointiin ja toimialan kehityksen seurantaan. Publications of the Ministry of Economic Affairs and Employment 2020:25.

20 Kilpailu- ja kuluttajaviraston selvityksiä 1/2020

21 Statistics Finland 2020. General government expenditure by function 1990–2018, http://www.stat.fi/til/jmete/

As a whole, the transport sector is a relatively wide and heterogeneous industry, and it includes various subsectors, such as metal, technology and software industries, transport energy solutions and numerous service categories, such as traffic and logistics services, tourist services, payment and information services, and different kinds of transport- and infrastructure-related solutions.

Finland has considerable expertise in automobile industry, train and tram car manufacturing and the maritime and shipbuilding industries, as well as in digital solutions and the technology and software industry that supports them. Internationally, Finland is known as one of the pioneers of traffic servitisation, thanks especially to the Mobility as a Service (MaaS) concept developed in Finland.

The growth potential of the transport and logistics sector has been reviewed as part of the Ministry of Employment and Economic Affairs' Kasvuportfolio 2.0 project ("Growth Portfolio 2.0"). The project recognises that Finland's promising growth opportunities are related to the energy revolution, information networks, leveraging of new technologies, health technologies and new operating models in the data economy. In these sectors, Finland has high-level knowhow and other unique competitive advantages. Smart traffic, traffic systems and logistics are understood as the spearhead solutions that support the green transition. For Finland, the societial significance of these growth opportunities is immense. Traffic and logistics solutions have a wide impact on all aspects of sustainability. The growth opportunity is based on global challenges and global solutions. In the transport sector, bringing together the national goals for economic, social and ecological sustainability is possible and can be leveraged as a foundation for export-driven growth. The most successful concepts take all three aspects of sustainability into account.[22]

The global transport market

The proportion of traffic and transport of EU's gross national product is approximately 5%, and it employs more than 10 million individuals in Europe. For European households, transport is the second biggest cost item after housing.[23]

The global transport market is estimated to grow from the nearly 15,000 billion USD of 2017 to more than 26,000 billion USD by 2030, forming approximately one fifth of the global economy.[24]

22 https://tem.fi/kasvuportfolio

23 https://ec.europa.eu/commission/presscorner/detail/en/fs_20_2350

24 Oliver Wyman Forum, 2019

In the next few years, fossil-free traffic and the digitalisation of transport will play a major and tangible role as the drivers of the revolution.

The value of the data market that is made possible by digitalisation and vehicle-level connectivity has been estimated at 450–750 billion USD.[25] In the short term, digitalisation of vehicles and services is seen as the number one change driver, which is linked to all other change drivers in the sector. Micromobility already has a considerable impact on urban traffic, and growth in this sector is expected to remain strong. The value of the micromobility market has been estimated as 300–500 billion USD by 2030 in Europe, the United States and China alone.

Electrification of traffic has taken considerable leaps forward especially in Europe, which in 2019 passed China with 60 billion euros invested to the sector – almost triple the amount invested in China and a 19-fold increase from 2018.[26] The global market for electric transport has been estimated to reach 1,300 billion USD by 2030, and the vehicle base (two- and three-wheel vehicles excluded) is expected to grow more than 30-fold compared to 2019.[27] In autonomous traffic the development has not followed earlier forecasts, but the entire autonomous vehicle market is still expected to grow to 1,600 billion USD by 2030. The growth will be immense with annual growth during the 2020s projected at 60%.[28] Before this, the market of services that supersede private car ownership will grow substantially, reaching 1,200 billion USD by 2030 (EU, USA and Canada).[29] Digital aviation also has substantial growth potential, and its role in the national economy may grow significantly. According to an estimate by the European Commission, the use of drones alone will employ approximately 100,000 individuals by 2035, and the annual value of the market is estimated at more than 10 billion euros, mostly in services.[30]

The full value of the European logistics market was estimated at 1,050 billion euros in 2015, including internal logistics cost of companies. The share of companies that offered logistics services was approximately 525 billion euros with the second half of the market formed by industry and retail trade.[31]

25 Mckinsey: The Future of Mobility is at Our Doorstep, Compendium 2019/2020

26 Transport & Environment 2020

27 ASD Reports 2020

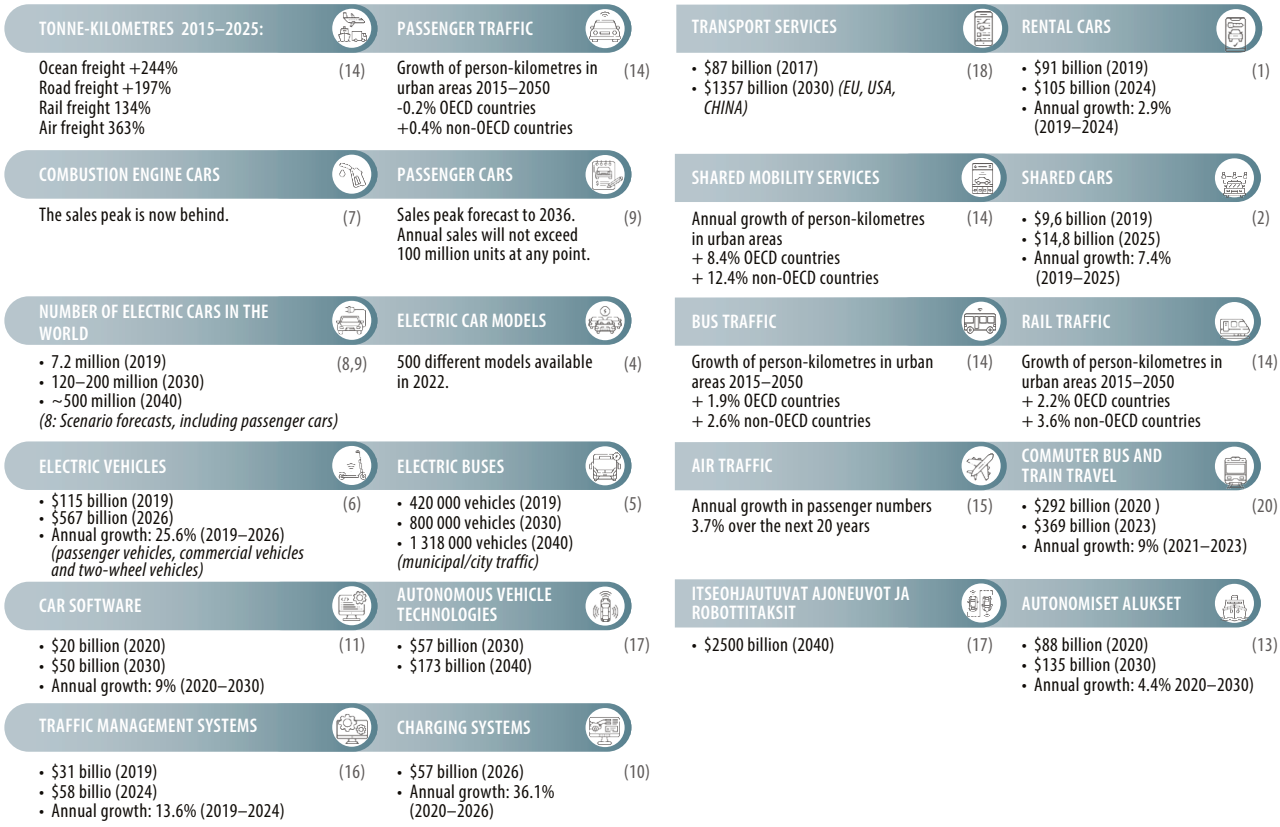
28 Mckinsey: The Future of Mobility is at Our Doorstep, Compendium 2019/2020

29 PWC 2019

30 European Drones Outlook Study, SESAR, 2016, https://ec.europa.eu/growth/sectors/aeronautics/rpas_en

31 Logistiikkaselvitys 2018, Turun kauppakorkeakoulun julkaisuja, sarja E-2:2018.

Figure 5. Growth forecasts of the global transport market.



1) Statista Research Department (referenced 11.10.2020) https://www.statista.com/forecasts/891221/revenue-in-the-car-rentals-market-worldwide

2) Statista Research Department (referenced 11.10.2020) https://www.statista.com/outlook/502/100/car-sharing/worldwide

3) MAIA Research (2019) https://medium.com/@marketinsightsreports/global-ride-sharing-market-growth-analysis-2019-blablacar-di- di-chuxing-uber-mytaxi-fasten-e40dac2b3d0b

4) Bloomberg New Energy Finance (2020) https://about.bnef.com/electric-vehicle-outlook/

5) Bloomberg (2020) https://www.statista.com/statistics/577685/forecast-for-global-transit-bus-sales/

6) Acumen Research and Consulting (2019) https://www.globenewswire.com/news-release/2019/09/06/1912241/0/en/Electric-Vehicle- Market-Size-Worth-USD-567-2-Billion-by-2026.html

7) The Driven (2020) https://thedriven.io/2020/01/31/bosch-says-peak-ice-has-been-reached-plans-1-6b-spend-on-ev-tech/ ja Bloomberg New Energy Finance https://bnef.turtl.co/story/evo-2020/page/3/2?teaser=yes

8) International Energy Agency (2020) https://www.iea.org/reports/global-ev-outlook-2020

9) Bloomberg New Energy Finance (2020) https://about.bnef.com/electric-vehicle-outlook/

10) Polaris Market Research (2019) https://www.polarismarketresearch.com/press-releases/ electric-vehicle-charging-infrastructure-market

11) McKinsey (2019) https://www.mckinsey.com/~/media/McKinsey/Industries/Semiconductors/Our%20Insights/How%20will%20chan- ges%20in%20the%20automotive%20component%20market%20affect%20semiconductor%20companies/How-will-changes-in-the-automotive-component-market-affect-semiconductor-companies.ashx

12) International Transport Forum 2019 https://www.maritime-executive.com/article/global-freight-demand-to-triple-by-2050

13) Allied Market Research 2019 https://www.alliedmarketresearch.com/autonomous-ships-market

14) International Transport Forum - ITF Transport Outlook 2019 https://www.oecd-ilibrary.org/sites/transp_outlook-en-2019-en/1/2/1/index.html?itemId=/content/publication/transp_outlook-en-2019-en&_csp_=1b3375008054c148f41fef71cd42b552&itemIGO=oecd&itemContentType=book

15) IATA (2020) https://www.iata.org/contentassets/e938e150c0f547449c1093239597cc18/pax-forecast-infographic-2020-final.pdf

16) MarketsandMarkets (2020) https://www.marketsandmarkets.com/Market-Reports/traffic-management-market-1036.html

17) IDTechEX (referenced 2020) https://www.idtechex.com/en/research-report/ autonomous-cars-and-robotaxis-2020-2040-players-technologies-and-market-forecast/701

18) PwC 2019 https://www.statista.com/statistics/872599/global-mobility-services-market-regions/

19) OECD; Arthur D. Little; United Nations (2018) https://www.statista.com/statistics/1013579/ urban-passenger-mobility-demand-worldwide/

20) ResearchandMarkets (2020) https://www.businesswire.com/news/home/20200505005838/en/Commuter-Rail-and-Public-Bus-Ser- vices-Market-to-Experience-a-CAGR-of--0.9-from-2019-to-2020-due-to-Travel-Restrictions-Amid-the-COVID-19-Pandemic---ResearchAnd-Markets.com#:~:text=The%20global%20commuter%20rail%20and,CAGR)%20of%20%2D0.9%25.

Transport as part of the data economy and the built environment

The constantly increasing data volumes produced by traffic and transport systems will integrate the market more closely with the international data economy in the coming years. In 2018, the value of EU's data economy was 377 billion euros, 2.6% of EU's gross national product. By 2020, the value is expected to increase to 477 billion euros, and by 2025 to more than 1,050 billion euros – more than 6% of EU's gross national product.[32] In Finland, the share of gross national product is larger, and compared to other EU countries, Finland has the highest basic digital skill level. Online services are used widely in different sectors of life. This gives Finland good starting points for success in the digitalisation of traffic. The value of Finland's data market was 1.24 billion euros in 2019.[33] Maintaining the leading position, however, calls for constant development and investments, which are supported through the sustainable growth programme.

In Finland, property trade has already been digitalised (Dias.fi), and the construction industry is rapidly becoming digitalised through KIRAHUB and its predecessor KIRA-Digi. Digital interfaces to the transport system, housing and construction have helped utilise the synergies between the sectors more efficiently than before. The traffic sector is also connected into the global circular economy market.

The Nordic countries and the EU are important markets

Even though Finnish companies operate in the global market, both the European and the Nordic markets are important for them. Based on the survey of companies working with new transport solutions conducted by the Ministry of Economic Affairs and Employment in 2020, the EU and the Nordic countries were considered key markets. Almost half of the respondents had positive expectations concerning their target markets. More than half of them (54%) expected the market to grow substantially in the future, while 44% expected their target markets to grow at least modestly. Approximately 2% expected their markets to remain unchanged, while none of the respondents expected negative market growth.

The overall situation and the trends of the transport market need to be monitored in a systematic way in the future to maintain understanding of the market, its current service development and service availability, and to identify emerging business opportunities.[34]

32 The Digital Economy and Society Index 2020, https://ec.europa.eu/digital-single-market/en/desi

33 The European Data Market Study, 2020

34 The export and internationalisation potential of digital aviation, for example, needs to be investigated more closely. https://valtioneuvosto.fi/hanke?tunnus=LVM054:00/2020

3.2 SWOT analysis of Finland's transport sector

Finnish companies operating in the transport sector are already actively involved in the international market, and the start-up companies of the sector are noted by international investors. Experiments and pilot projects are conducted in different parts of the country in both urban and rural areas in spheres of services, automation and utilisation of data in different modes of transport. New ecosystems have been born, and more are born constantly. Finland and Finnish cities have excellent positions in international rankings in terms of the operating environment, environmental sustainability and smart solutions.[35]

International competition in the development of new solutions, however, is hard. In Europe, many state administrations are investigating the development of new transport services, and Finland has lost some of its head start in terms of regulation that makes this possible. Important support programmes for promoting electric and automatic traffic, as well as pilot environments of new solutions have been launched in various countries. Pioneer cities and countries are deploying emission cut targets that are more stringent than those applied internationally and within the EU. Traditional operators in the sector seek alliances with data economy participants, and enormous sums are invested to product development especially in Asia and United States.

Staying at the forefront requires constant monitoring of the operating environment and international networks. Finland's strengths and the potential of the operating environment need to be leveraged in a systematic manner, bottlenecks need to be removed and external threats need to be prepared against. The results of the SWOT analysis have been used in the drafting of the roadmap that outlines the programme actions.

35 See for example https://www.businessfinland.fi/en/do-business-with-finland/invest-in-finland/invest-in-fin- land/ and https://www.businessfinland.fi/en/do-business-with-finland/invest-in-finland/business-opportunities/ ict-digitalization/

Taulukko 1. Strengths, weaknesses, potentials and threats of Finland's traffic sector business and its growth opportunities, including broadly all modes of transport, logistics and all parts of the transport system.[36]

STRENGTHS	WEAKNESSES
Digitalisation knowhow and degree of digitalisation: Strong digital intellectual capital, digital infrastructures, open data and excellent digital competitiveness. **Expertise:** Several strong areas of expertise, such as Arctic knowhow, clean tech, rail traffic, marine technologies, marine traffic, end-to-end software applications, photonics, circular economies, 5G/6G development, autonomous traffic, drones, ships, electrification, P2X, MaaS, strong subcontractors in sectors including the automotive industry, cybersecurity, forest and maritime industry ecosystems and pioneer positions. **Strong tradition of collaboration**: Collaboration both inside the public sector and between the public and the private sectors. **Finland's brand:** Neutral and dependable partner. Attractive for employees. Stable and predictable conditions and society. **Good testing opportunities:** Changing road and weather conditions offer versatile testing environments. Sufficiently small structures; low thresholds for building of new systems. Human-driven solutions and politics, LivingLabs. Legislation that supports the development of innovative services in passenger traffic and use of automation.	**Small domestic market and limited resources:** Small scale of operation, small domestic market, small cities; limited human resources and financial resources, limited scope of experiment. **Lack of focus**: Fragmented effort and decision-making. Lack of strong guidance to the selected direction, including financial control, uniformity of operations, commitment and alignment of actions to achieve shared goals. **Lack of capital investors**: Limited and partly undeveloped private equity investment market. Lack of big automotive industrial companies. **Commercial ability:** "Engineer thinking" and focus on technology. Lack of experience in developing ecosystems in the range of billions of euros; lack of experience in commercialisation and scaling of platform solutions. Lack of joint marketing effort and lack of organisation in ecosystems. **Focus of transport system development and investments:** Transport investments and the discussion on the development of the transport system are still generally focused on the building of new traffic lanes. **Lack of vision and attitudes:** Lack of shared vision in a heterogeneous business sector. Hesitant attitudes and slow change of behaviour patterns.

36

POTENTIALS	THREATS
Demand for cross-sector solutions: International demand in fields related to the transport sector, including sensor technologies, 3D modelling, circumstantial data, cybersecurity, artificial intelligence and quantum technology.	**International competition:** The development race in digital solutions for the transport sector is becoming harder. Companies, cities and testing platforms; research. Other markets attract the best international talents and corporations.
Traffic and transport in the core of global Smart & Clean urban development: Demand for comprehensive smart traffic and smart city solution offerings and traffic lifecycle solutions. Cities in the same size range as Finland's big cities as the international target market.	**Closed data and platforms:** Big global operators are taking over parts of the market. Finland's transport system is based entirely on foreign solutions.
Green financing on the rise: Systematic leveraging of EU's Green Deal and the global recovery momentum.	**Loss of ownership and experts to other countries:** The ownership and the focus of operations of Finnish growth companies will shift to the international market.
Data: New data-driven services and business models; platform solutions.	**Impacts of the coronavirus:** The impact of the coronavirus pandemic on the operating environment and the public transport system that forms the foundation for the services is substantial. Changes from the current status of the transport system; habits and fears; change over to individual modes of transport; utilisation of data; profitability of the public transport system and customer recovery.
Low-emission sources of power: Vertical value chains in batteries; other new technology initiatives; sector integration solutions in the power source industry.	**Vulnerability of interconnected systems:** System-level vulnerabilities caused by dependence between communications, transport and different participants and operators; cyber threats and data security risks.
International interest: The interest of leading participants in Finland. Experts may attract more sector participants and investments to Finland.	

4 Sustainable company-driven growth and ecosystem thinking

Ecosystem thinking has become a key tool in Finland's innovation and business policy, which is reflected in both the government platform and national RDI financing. There is strong theoretical basis for ecosystem thinking. In ecosystem thinking, the ideal is that the ecosystem is, through broad and interactive collaboration, able to get more out of a given contribution than the participants working alone. In the rapidly evolving competition landscape of the global market, no success is possible alone or through slowly evolving networks where collaboration relationships typically last for years. Resolving broad systemic challenges calls for joint problem-solving by many different operators. In ecosystems, joint operations are guided by shared goals and platforms where new added value is produced together in a multilateral network.[37]

To ensure Finland's prosperity and competitive edge, new sources of growth, business opportunities and successful innovations are required. Innovations are born especially in ecosystems where all participants work in close collaboration and where the ecosystem is led by a system coordinator, that is usually an international spearhead company. According to the results of the Europe-wide innovation study, 96% of innovations are born within ecosystems.[38]

Ecosystems are constantly evolving network structures formed around a shared vision. New ecosystem features are born through interaction and dependency between ecosystem participants. Three key types can be identified based on their different objectives: expertise ecosystems, business ecosystems and innovation ecosystems. Value chains, networks, clusters and ecosystems are complementary collaboration models.[39]

37 Yhdessä kestävää kasvua -ekosysteemiopas. VTT-julkaisuja 2021.

38 Suomen kilpailukyvyn ja talouskasvun turvaaminen 2020-luvulla. Selvityshenkilön raportti. Työ- ja elinkeinoministeriön julkaisuja 2019:1

39 VTT julkaisu 2020, Yhdessä kestävää kasvua -ekosysteemiopas

1. The aim of expertise ecosystems is to produce new information or technology solutions. Focusing on networked research effort, often in the form of individual projects, is characteristic of them.
2. In business ecosystems the participants, such as customers, companies, their subcontractors and their service producers, focus on creating value for the customer.
3. Innovation ecosystems combine the new information produced by expertise ecosystems and the customer value produced by business ecosystems in the production of new solutions and innovations.

The aim of the Export and International Growth Programme, part of the government programme implementation work, is to create new, globally competitive and international cross-sector ecosystems that Finnish companies can leverage to evolve while simultaneously increasing their productivity, added value and international competitiveness through RDI operations. The principal goal of the ecosystems is to create export-driven growth, new companies and new jobs in Finland.

Controlling the ecosystems is not the task of the public sector, but the public sector plays an important role in building and developing the ecosystems. This means not only maintaining a functional shared operating environment (consisting of elements such as education, research, financing and infrastructure) but also an aspiration to resolve important social challenges. It calls for active facilitation of networks and a close dialogue between Finnish and international companies and research organisations.[40]

4.1 The ecosystem approach in the National Programme for Sustainable Growth in the Transport Sector 2021-2023

The transport sector is an industry that faces considerable social challenges, resolving of which calls for broad collaboration, a wide selection of instruments and an ecosystem approach. Finland has a long tradition of working across the entire transport sector to promote digitalisation. The foundation for bringing of ecosystem thinking to the transport sector was laid already in the Smart Traffic Strategy of 2013: "The implementation of the second generation of smart traffic enables the development of a smart traffic ecosystem.

40 Valtioneuvoston selvitys- ja tutkimustoiminnan julkaisusarja 28/2017 Innovaatioekosysteemit elinkeinoelämän ja tutkimuksen yhteistyön vahvistajina.

This serves both the achievement of domestic traffic policy goals and business policy goals."[41] Collaboration within the industry has been developed further in the framework of the National Growth Programme of the Transport Sector. The growth programme has created the framework and the systematic approach for constant network-like working with the primary aim of identifying and supporting business ecosystems that have the potential to grow into entities in the range of billions of euros in the future.

The starting point for building company-driven business ecosystems with impact is identification, or even creation, of new business opportunities on both the national and the international level. In the transport sector, market opportunities are built around solutions based on new technologies and digitalisation. Digital platform solutions are an important way of producing solutions for current and future needs. Regardless of the leaps made possible by digitalisation, transport ecosystems will not be born without active and goal-oriented effort. No ecosystems can be built artificially; they cannot be separated from the global, national and local contexts. On the contrary, business ecosystems that are internationally competitive must be based on the meeting of national/regional/local competitive advantage and international demand.[42] Experts of international markets and value chains, on one hand, and those with knowledge of domestic ecosystem projects and their competitive advantages, on the other hand, need to be brought together for identifying new potential ecosystems. These are the key starting points when assessing the business viability of a new ecosystem (see Table 2).

In the public sector, general and systematic support and facilitation of ecosystem creation is important. This can take place through active networks, organising of joint discussions and by linking of ecosystems. The public sector also enables the development of ecosystems through investments and other funding instruments.

Ecosystem development coupled with high-quality training and R&D investments creates preconditions for innovative, high-added-value business and the creation of new products, services and business models.

4.2 Ecosystem development in the transport sector

In the transport sector, ecosystem development has been implemented systematically through collaboration between the public sector, the academia and the private sector. Ecosystem thinking is reflected in the key strategies and plans of the industry, and

41 Liikenne- ja viestintäministeriö 2013. Älyä liikenteeseen ja viisautta liikkujille. Toisen sukupolven älystrategia liikenteelle.

42 Valtioneuvosto 2/2017, Innovaatioekosysteemit elinkeinoelämän ja tutkimuksen yhteistyön vahvistajina

practical ecosystem development work is conducted across the board. Ecosystems and areas of expertise where broad, internationally competitive business ecosystems can be developed have been identified through industry collaboration.

Ecosystem development has been conducted in all ecosystem types of the classification, in all modes of transport and in different areas of expertise. The strong role of data and the leveraging of different digital processes, technologies and platforms is common to the implementations.

Ecosystem development efforts are in progress in different subsectors of the transport sector, such as:

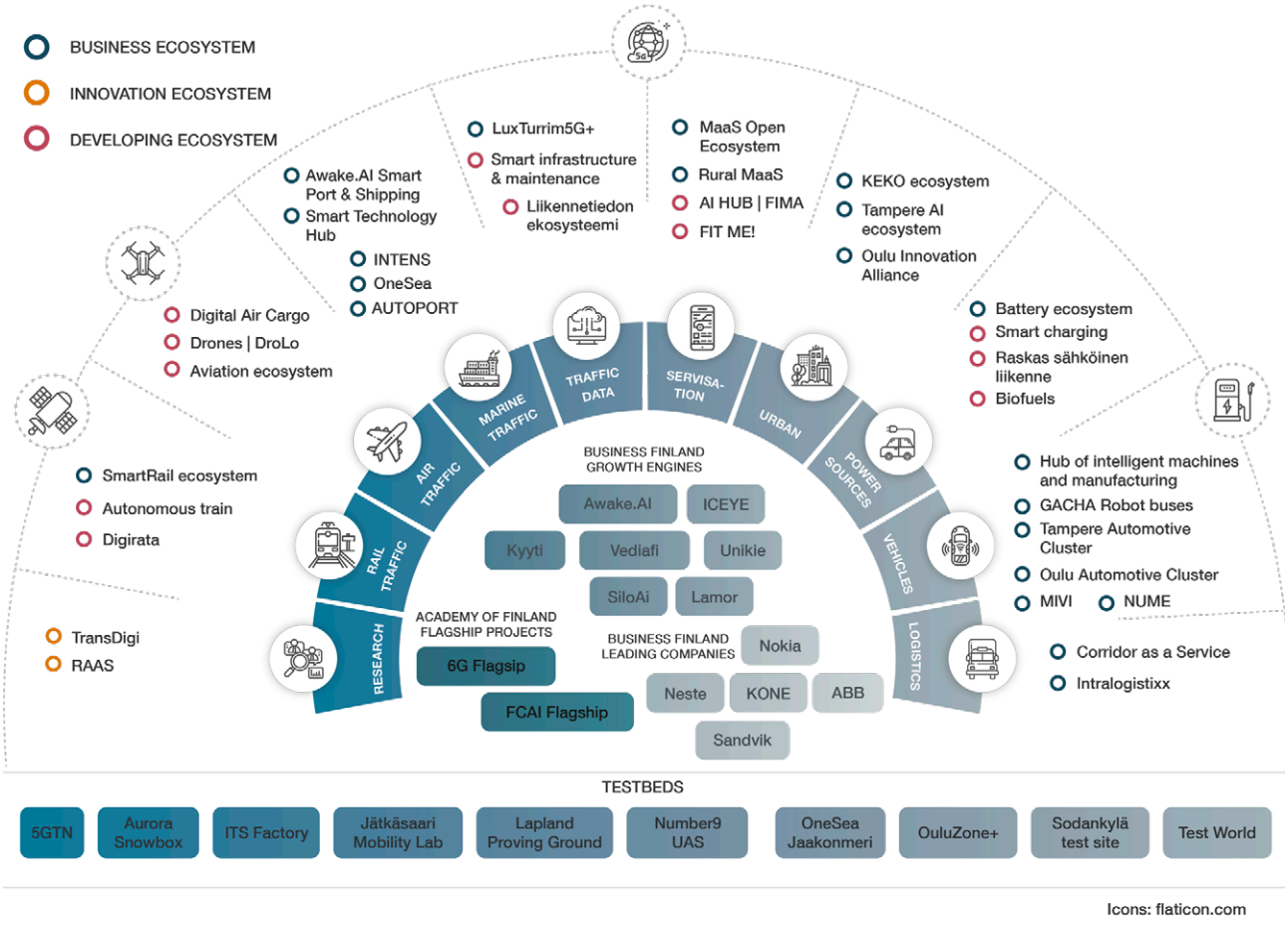
- smart rail traffic
- autonomous marine traffic
- automatic traffic (such as robot buses and platooning of heavy traffic)
- smart infrastructure and maintenance
- drone business
- low-emission marine traffic and smart ports
- electric traffic (including charging, heavy electric traffic and the battery industry)
- alternative fuels, including biogas/bio-LNG
- zero-emission urban traffic, mobility as a service
- traffic data ecosystem and traffic management solutions
- tourist mobility services and Rural MaaS
- digital logistics.

As transport systems are an important sphere of application for the new technologies, 5G/6G ecosystem development is another key element in the development of the transport sector, while the use of artificial intelligence in transport and logistics forms another interesting field of development. The transport sector has also been recognised as an important sphere of application for the digital platform economy, artificial intelligence[43], IoT, diagnostics, VR and AR solutions, machine learning and cybersecurity solutions.

43 Suomen tekoälyaika. Suomi tekoälyn soveltamisen kärkimaaksi: Tavoite ja toimenpidesuositukset. TEM 2017 http://urn.fi/URN:ISBN:978-952-327-248-4, Kasvuportfolio 2.0, TEM 2000

The ongoing ecosystem work and the active testing areas of the transport sector are summarised in the figure below, which also illustrates the heterogeneous nature of ecosystem development.

Figure 6. Ongoing ecosystem and test platform development in the transport sector. In practice, ecosystems work as systemic cross-connected entities between different modes of transport.



Icons: flaticon.com

Work on ecosystem development continues in the form of collaboration between different operators. In the future, ecosystems will be developed into larger wholes to ensure maximum effect and support internationalisation. The National Sustainable Growth Programme of the Transport Sector accelerates especially those ecosystems that genuinely aim for sustainable growth and support sustainability in all aspects (environmental, social, economic). The emphasis lies on ecosystems that develop scalable solutions for the international market, even though ecosystems that operate in the domestic market are also important for the overall development of the sector.

Supporting the ecosystems and turning them into actual projects depends on genuine market demand as well as broader interest and participation by companies. Business Finland funds ecosystem development in the transport sector through a number of programmes. Many of the public administration organisations, such as various transport administration agencies and the National Land Survey of Finland, are involved in different ecosystem projects, while urban participants contribute to ecosystem development through initiatives such as business incubators and by providing experimentation and testing platforms.

Cities can identify needs for innovation ecosystem development. They can also serve as a neutral intermediaries that bring regional participants together and build strong collaboration networks that promote innovation activities.

Taulukko 2. Criteria for assessing ecosystem business potential.

Criterion	Questions for studying ecosystem preconditions and strengths
Shared vision and objectives	• Are there **motivated (and established) companies** that want to collaborate in the development of the business sector and the ecosystem? • Are the development investments and development plans of the participants compatible, making risks smaller and promoting commitment to a shared vision and development of the operating environment?
Ecosystem need	• Does full leveraging of the business opportunity depend on **collaboration between numerous participants**? • Would an open ecosystem produce more added value compared to a closed ecosystem (doing it alone or through a fixed supply chain/ consortium)?
Advantages and competitiveness	• Is it a new **international business opportunity** based on current or potential **Finnish competitive advantage**, such as expertise, challenging demand circumstances or other resources? • Would the Finnish operating environment (such as the climate or the regulatory conditions) be a weakness or a possibility in developing international competitive edge?

Criterion	Questions for studying ecosystem preconditions and strengths
Expertise for critical tasks	• Does the ecosystem have suitable key actor(s) and coordinators to build the strategy and facilitate collaboration? • Is it possible to find complementing and sufficiently broad expertise and enthusiasm in Finland? • Are there parties with sufficient expertise in international business to establish market dialogue, find key customers and work on the shared offering between the participants and the customers involved? • What expertise is required from the international participants? • Is there a **suitable and motivated orchestrator and facilitator** involved that can operate without public financing in the long term?
Prerequisites for key role	• What are the roles of the Finnish companies in the value network (current status vs. goals)? • Do the Finnish participants have the prerequisites to lead the development of the product, platform or solution instead playing the supplier network or component supplier role as an ecosystem?
Systemic obstructions and structural bottlenecks	• Are there any **systemic obstructions or structural bottlenecks** such as legislation, regulation, standards, infrastructure shortcomings or lack of testing platforms that require public intervention or may prevent or slow down the development of the ecosystem?
Foundations of growth; attracting of international talent and companies	• Is the ecosystem's growth potential in Finland based on the manufacturing industry, good testing platforms or a strong expertise cluster? • What is the key attracting factor that is expected to bring offices and employees of the international companies to Finland?

5 Roadmap 2021–2023

The starting point of considering the actions selected for the roadmap is their direct or indirect impact on ecosystem development and sustainable, company-driven growth.

The roadmap was updated in 2018–2020 based on experiences from the implementation of the National Growth Program of the Transport Sector roadmap and on preparatory work undertaken with a broad range of stakeholder groups. The key actions identified in the National Growth Programme of the Transport Sector are still relevant in the current operating environment. The programme has formed a shared administrative agenda between different ministries, enabling uniform, shared communication about the national commitment of the transport industry. It has also made collaboration between different participants closer. The sustainable growth targets of the transport sector call for work that extends across government terms and for systematisation across different administrative sectors and the entire business sector.

The 2021–2023 roadmap addresses these issues in terms that are broader than before and integrates the targets of ecologically, financially and socially sustainable growth deeper into the actions to meet the targets of Prime Minister Sanna Marin's government platform. The impacts of the COVID-19 pandemic on the operating environment, including sustainable recovery, have also been taken into account in the roadmap actions.

The roadmap also reflects the need to increase collaboration between participants and to support coordination between participants and developing ecosystems both inside the sector and between the sectors integrated into the transport industry. Attempts have also been made to increase the responsibilities and strengthen the role of the companies in the implementation of programme actions as well as their focus. The need for shared metrics and clearer communication of results in relation to the goals to the stakeholders has also been addressed.

Key spheres of action for achieving the goals of the programme have been identified as 1) providing an operating environment for sustainable growth, 2) creating scalable and sustainable solutions for the export market and 3) engaging in continuous ecosystem collaboration. Ten strategic actions are listed below these with the first action points to move them forward. New action points can be added as the implementation work progresses.

Drivers that cross all the actions are climate change, the depletion of nature, urbanisation, digitalisation and cross-sector solutions. Solutions that respond to the global challenges of climate change, the depletion of nature and urbanisation create opportunities for sustainable business within the sector. Digitalisation that occurs across all forms of mobility, logistics and solutions used in the interfaces between sectors (such as transport, energy and the built environment), on the other hand, opens possibilities for new innovative implementations and business models.

Figure 7. Spheres of action, strategic actions and drivers cutting across all roadmap actions.

THE ROADMAP: SPHERES OF ACTION AND STRATEGIC ACTIONS

Operating environment for sustainable growth	Scalable solutions for the export market	Continuous ecosystem collaboration
1. A shared commitment and an enabling administration that promotes sustainable transport and business.	5. Cities as platforms in the development and deployment of sustainable, pioneering solutions.	9. Systematic promotion of sustainable growth ecosystems and internationalisation.
2. Development and utilisation of diverse financing solutions to support innovation and internationalisation.	6. Development of scalable experiments with real impact.	10. Investments in joint international marketing and sustainable transport branding.
3. Development of research collaboration and industry knowhow on both the national and the international level.	7. Innovative public procurement support the creation of market references and scalable solutions.	
4. Proactive influencing within the EU and on international forums.	8. Leveraging digital information as the foundation of sustainable business operations.	

DRIVERS

Climate change and the depletion of nature
Urbanisation
Digitalisation
Cross-sector solutions

The roadmap actions form a mutually complementing, closely interconnected whole. Close attention has been paid to tangible actions and distribution of responsibility for the roadmap actions defined for 2021–2023. The SWOT analysis of the business sector has also been utilised. The actions are mostly neutral in terms of transport modes used, and they aim to develop sustainable transport and logistics solutions on a broad scope.

Most of the roadmap actions call for collaboration between participants. A party with primary responsibility for each action as well as the key participants whose input is required to move the action forward have been defined for each item. The intention is that the groupings are allowed to change during the term of the programme. New participants are actively encouraged to join the implementation work.

Actions with biggest impacts in terms of programme goals have been selected for the roadmap. The focus is explicitly on actions that support the creation of sustainable transport and related business. In addition, a number of actions that are important as such but smaller in scale were identified during the preparatory work. None of the actions are sufficient alone; instead, their combined effect is required to achieve the goals of the growth programme.

The roadmap also highlights a number of other programmes currently under construction where the goals of the programme need to be taken into account to achieve systematic change. Many projects related to transport policies, for example, will support establishing new markets for the transport sector, but have not been included in the strategic actions of this programme.

The programme actions can be carried out within the framework of current public economy plans. Actions that call for additional financing will be discussed and decided on in connection with the budget process and the planning of general government finances.

5.1 Operating environment for sustainable growth

The "Operating environment for sustainable growth" section focuses on establishing favourable conditions for active ecosystem development through collaboration across different sectors of state administration.

In addition to the development of the overall operating environment of the companies and the addressing of market shortcomings, the ecosystem approach highlights the role of public administration as an active collaboration partner of the companies and a creator

of new markets. Public administration creates preconditions for the development of new business ecosystems.[44]

Developing and funding innovations and business that support the evolution of the transport sector calls for active collaboration between the public administration, the companies, the investors and research bodies. The role of the public sector is to facilitate the operations through experiments, investments, legislation and policy. The public sector does not select winner companies or industries. Instead, its role is to work in close collaboration with the business sector to identify and develop the ecosystems that appear promising.

The measures defined in this sphere of action:

- Establish a long-term view to the policy and legislation trends for the companies and support the shared commitment to achieve sustainable growth within the transport sector.
- Offer funding that supports innovations and international growth and develop mechanisms for full leveraging of national and EU funding.
- Support domestic and international research collaboration and the leveraging of research results as foundations for new business and ensure constant development of expertise in the sector.
- Support influencing in the EU and on the international level to achieve an enabling international operating environments and networks.

Strategic Action I: A shared commitment and a change-enabling administration that promotes sustainable transport and business

A consistent and predictable long-term policy is crucial for activating the product development and investment contributions of the private sector. It is especially important to achieve broad commitment to the goals, policies, legislation and guidelines in both the public and the private sector.

The growth programme supports the enabling role of the public sector in the promotion of sustainable business growth and in establishing trust between the participants.

44 Valtioneuvosto 2017, Innovaatioekosysteemit elinkeinoelämän ja tutkimuksen yhteistyön vahvistajina

Rapid technological development and the need to find solutions to social challenges call for new regulatory approaches. At best, regulation can be an important incentive and a positive driver of innovation. Firstly, a predictable and consistent regulatory environment creates preconditions for stable business and investments in new innovations. Secondly, regulation can sometimes create demand and legitimacy for new innovations and, ultimately, provide the foundation for entire markets and ecosystems. The role of regulation is more and more important in times of accelerating technological and social change as new technologies disrupt traditional markets and ways of operation. Simultaneously, competitiveness of the regulatory environment is an important factor in location and investment decisions made by companies.[45]

Up-to-date legislation and project work create the framework for the development of transport systems and services and for climate and environmental goals. In a situation like this it is important to predict and to prepare for the possibilities opened by the new solutions and to create room in the market for new operating models.

The first national transport system plan (tLiikenne 12 plan[46]) is made for 2021–2032 and opens a long-term view into the development of the transport system. It brings the complex system together into one whole and sets the guidelines for its development for the next 12 years. Liikenne 12 plan is an important tool in the development of the infrastructure and service innovations.

At the same time, the future of the transport sector is shaped by the fossil-free traffic roadmap, the traffic tax reform, the automatic traffic legislation and action plan, digital aviation development measures, the logistics digitalisation strategy and the strategic programme to advance circular economy. Traffic control mechanisms, tax policies and pricing are important factors in both consumer and business choices and can be used to promote the creation of a sustainable market. Active participation in the preparation of projects that will shape the development of the transport sector has already taken place in 2018–2020 within the framework of the National Growth Program for the Transport Sector, and this work continues under the National Sustainable Growth Program for the Transport Sector.

Dialogue and forums where information is exchanged play an important in the building of shared commitment and an understanding between the participants. As the transport sector becomes more and more complex with the introduction of new technologies

45 Innovaatiomyönteinen sääntely: Nykytila ja hyvät käytännöt, Valtioneuvoston selvitys- ja tutkimustoiminnan julkaisusarja 2020:27

46 https://valtioneuvosto.fi/hanke?tunnus=LVM018:00/2019

and business models, it is more and more important to connect to a shared vision and a shared commitment. A shared understanding of the direction the development promotes genuine public-private partnerships (PPP) and a sense of trust makes learning together easier. Open dialogues and future-oriented forums help predict potential development bottlenecks and shape the sector into an environment that produces innovative solutions and achieves sustainable growth.

To implement the strategic action:

a. **A description of the impact chains through which the digitalisation of the transport sector, smart servitisation and behaviour changes will have effect on the achievement of the strategic goals of Liikenne 12 plan will be produced to support the vision and the goals of Liikenne 12 plan.** The descriptions will support the measurability and tracking of the relevant phenomena. Moreover, representatives of the transport sector will be consulted annually in connection with the Transport System Strategic Overview work conducted by Traficom. The work on the overall view and the identification of the impact chains will support the implementation of Liikenne 12 plan and its continuous updating across administrations.

   Parties responsible: Ministry of Traffic and Communications, Traficom.

   Also involved:operators in the transport sector.

b. **The perspective of sustainable business in the transport sector is taken into account in key legislation and other projects; the playbook for the transport sector that clarifies the roles of the public and private sector in the transport markets are put into practice;** The themes are discussed regularly between the participants in shared forums. The forums are also utilised for shared learning and exchange of information in the development of sustainable solutions for the evolving industry. International best practices are also identified for application in Finland. The aim is also to extend the dialogue to industries linked to the transport sector.

   Parties responsible: Organisations involved in the growth programme steering group and all transport sector participants.

Strategic Action II: Development and utilisation of diverse sources of financing to support innovation and internationalisation

Utilisation and impact of different funding opportunities will be increased through better planning, long-term coordination and innovative financing models. Ecosystem financing supports the development of large-scale solutions and attracts large national and international participants and financiers. Financial expertise and knowledge of funding mechanisms need to be increased so that financing opportunities can be leveraged fully across the entire industry. By directing public financing to the development of sustainable solutions and by building a foundation of data to track the impact of the effort, business development is steered in the direction of green evolution.

Achieving international breakthroughs will require extensive collaboration across business sector boundaries and in international consortiums. Innovative public-private partnership models are used to ensure long-term commitment of and investments from cities, companies and capital investors. These are used to finance ecosystem leadership, the development of expertise, business incubators and start-up/spinoff companies linked to universities and research bodies. Business accelerators, incubators and the related services, such as the Kiihdyttämö programme of Business Finland, help develop the business of small and mid-size companies and support their entry to the market.

More efficient leveraging of EU funding programs and instruments calls for systematic sharing of information on different funding opportunities, a more active stance from the participants, development of expertise and focus on the application processes. EU projects provide an opportunity for securing financing for more extensive projects, for building international networks and for improving the visibility and the market references of national solutions and participants.

Financing opportunities relevant to the transport sector during EU's programme period 2021–2027 are offered through the European Regional Development Fund (EAFRD), the Horizon Europe programme and the Connecting Europe Facility (CEF) – to name a few. In particular, the European Green Deal programme and the financing sources intended for national and EU-level sustainable recovery initiatives open new opportunities for Finnish participants. It is important that the potential of the transport sector is leveraged in accordance with the guidelines of Finland's recovery and resilience plan[47] through sustainable recovery projects (RRF), and that the potential of the transport sector is taken into account in state investment programmes that aim to support and promote climate solutions. Moreover, the implementation of the government's Export and International Growth Programme supports the goals of the Sustainable Growth Programme of the Transport Sector.

47 Suomen kestävän kasvun ohjelma: https://vm.fi/kestava-kasvu

In Finland, capital investments in the transport industry usually support the early business activities of start-ups and growth companies. When the companies start scaling up their operations and increasing their share of the international market, international investors step in. Securing the financing calls for both networking and leveraging of personal relationships (including those with Finnish capital investors and major corporations). Many companies operating in the transport sector have secured significant foreign capital investments and partnerships in recent years, but constant effort is required to maintain this development.

The goals of the growth programme can also be supported through business service organisations of individual cities, and regionally through the ELY centres.

Numerous different funding sources and support functions are available for companies in the transport industry but they need to be communicated more prominently for their potential to be fully leveraged and to help different participants find funding sources and other services suitable for their requirements. National sources of funding are controlled by different organisations. Coordinated sharing of information and advice to help the companies find the suitable funding sources will help leverage the financing opportunities more fully.

Over the course of the National Growth Programme of the Transport Sector, Business Finland has in 2019–2020 financed various projects run by transport and logistics companies and research bodies with more than 30 million euros through the Smart Mobility Finland programme and through the Kasvumoottori and Veturi financing programmes. In 2019, 60 Finnish consortiums applied for EU funding, and 89 companies applied for the SMC instrument in 2019–2020.

To implement the strategic action:

a. **The Smart Mobility Finland transport development and internationalisation programme will be continued** – an extensive whole that has run for several years. The programme will support extensive leveraging of national and EU-level RDI financing instruments and includes both "export" and "invest in" actions.
   Programme components include:
   - Presentation of the Finnish offering and its spearheads, as well as the strengths and the growth opportunities of the operating environment through a joint effort between industry participants, focusing on investments and export. Continuing the preparation of shared Finnish offerings to the international market for investment and export needs.

- Arranging of goal-oriented company delegation excursions to international events, enabling participation in delegation trips and organising investment-oriented physical and virtual company visits to Finland. Continuing the national coordination for preparing the visits and ensuring their result-oriented aftercare on the Team Finland level. Creating a shared calendar of visits between cities and other participants.
- Development and implementation of an operating model where public and private financing opportunities currently available are communicated regularly to business participants in different stages of the innovation process. The opportunities include Horizon Europe, the Connecting Europe Facility, InvestEU, Digital Europe, ESIR, funding offered by EIB, and other international sources of funding.
- Development and application of a systematic model of operation where the building of consortiums and the related expertise is supported to leverage EU-level RDI funding. The aim is to leverage the funding opportunities more fully for purposes such as ecosystem expansion.
- Determining preconditions for continuing the programme activities after the current programme period.

Parties responsible: Business Finland.

Also involved: companies, research bodies.

b. Initiating closer collaboration with regional business development companies and national participants and supporting this collaboration with suitable means. The aim is to develop and market validated solutions offered by the growth ecosystems to the international market.

Parties responsible: Business Finland, ITS Finland and regional economic development agencies.

Also involved: economic development agencies, corporations.

Strategic Action III: Development of research collaboration and industry knowhow on both the national and the international level

Increasing innovation capacity and sustainable business within the transport sector calls for more RDI investments. RDI activities support both the development of sustainable business operations as well as information-based decision making in the public sector so that the evolution of the industry also supports the work to achieve the social goals. The pace of the change and the transport industry's links to other business sectors depends on leveraging of multidisciplinary, cross-sector research.

Finland's current RDI activities are often fragmentary, which frequently leads to projects of limited scale and experiments that fail to achieve systemic changes. In terms of international competition, added value is produced by combining the resources into broader, cross-sector wholes with more ambitious goals and a wide selection of participants and financing.

Open exchange of information between research bodies helps identify knowledge gaps, fields of complementing expertise and opportunities for collaboration. More extensive and versatile centres of expertise increase the amount of EU funding coming to Finland in key fields and makes it easier to build national projects connected to key fields.

Close, proactive national collaboration makes it easier to influence EU's RDI policies and project themes to highlight the fields where Finnish participants have strongest expertise.

Shared investments and research collaboration initiatives support growth ecosystems and promote the identification of new user needs, weak signals, business opportunities and spheres of application. Exchange of information between RDI participants and companies makes it easier to review and identify national top expertise and synergies and to leverage research data efficiently to fulfil the needs of the companies and the public sector. Linking of research work and impact assessments of business solutions supports the competitiveness of Finnish companies. In particular, carbon footprint/handprint verification over product and service lifecycles may yield business advantage in the coming years. Research is also required to, for example, leverage the notion of transport as a sphere of application for cybersecurity solutions and for turning this into a competitive advantage.

Public environments for pilot projects, test laboratories of research institutions and corporate development platforms enable agile experiments across a wide range of services and technologies. Shared resources, platforms and networks accelerate the spinoff and start-up activities linked to research bodies and companies.

In addition to RDI activities, the research and education sector plays another critical role in the achievement of competitive advantage: companies and other participants depend on a supply of experts in the future – also in situations of rapid change linked to the evolution of the transport sector.

The transport industry needs to attract both national and international experts and talent to the field. The industry's links with other fields of business, especially the data economy, calls for new kinds of expertise. The business expertise and the related training programmes of the industry need to be developed further. In terms of training, expertise requirements need to be identified more precisely. Expertise should be developed in

different levels of education and also through retraining. Close collaboration between research bodies and education institutes can be leveraged to create preconditions for new companies in the sector.

The Traffic and Logistics Forecast Group of the Expertise Forecast Forum working under the Finnish National Agency for Education has identified the significant changes within the industry that will have impact on its expertise requirements and business needs in the next 10 to 15 years. The need to attract and leverage international talent is taken into account in the implementation[48] of the cross-administration Talent Boost set of programmes. Talent Boost actions also target international start-up companies in the transport sector.

To implement the strategic action:

a. The continuing and further development of the collaboration model developed within the TransDigi[49] and Research Alliance on Autonomous Systems (RAAS)[50] projects needs to be ensured. The aim is to secure continued expertise development and the operation of the relevant networks through an extensive selection of funding sources. The actions aim to develop implementation paths for continued training and retraining initiatives that are used to ensure the availability of a sufficient base of expertise for the companies in the fields of traffic electrification, automation and servitisation and to facilitate efficient commercial utilisation of top international research results.

Parties responsible: VTT.
Also involved: Ministry of Education and Culture, Ministry of Transport and Communications, Ministry of Economic Affairs and Employment, ITS Finland, Technology Industries of Finland, universities with transport training programmes, universities of applied sciences.

b. Proactive influencing of EU research programmes and coordination of influence and messages across different forums is required. The aim is to proactively estimate the research needs relevant to the Finnish participants and to utilise the influence channels of all participants to shape the contents of the EU research programmes.

48 https://www.oph.fi/fi/palvelut/osaamisen-ennakointifoorumi-oef

49 http://transdigi.fi/fi

50 https://autonomous.fi

Parties responsible: Ministry of Economic Affairs and Employment, Business Finland, Ministry of Transport and Communications, Traficom
Also involved: companies, research bodies.

c. **Transport and logistics training** that takes the digitalisation trend and the evolution of the business models within the industry into account is required to increase sustainable business and to build expertise in circular economy solutions.

Parties responsible: Ministry of Education and Culture.
Also involved: Ministry of Transport and Communications, Ministry of Economic Affairs and Employment, research and education bodies.

Strategic Action IV: Proactive influencing within the EU and on international forums

International collaboration, lobbying and network visibility build foundations for an international regulation framework that supports innovation. The biggest impact is achieved when different actors in Finland use their own channels to apply coordinated influence and are able to highlight their message already in the early stages of preparatory work.

Closer international collaboration improves the visibility, development and international commercial viability of Finnish growth ecosystems. The success stories of Finnish companies can be accelerated and supported by promoting industry-wide collaboration in the transport sector, through representation of interests and through influencing of standardisation work.

High-quality, versatile digital expertise combined with high level of national commitment and thought leadership in sustainable mobility form an excellent foundation for influencing through a joint industry effort. In practice, this has already manifested in Finland in phenomena such as the spreading of the Mobility as a Service thinking that originated in Finland into a global theme integrated into corporate strategies, EU project themes and state transport policies. Finland is now regarded as a pioneer of automation and data leveraging in the international forums.

A substantial number of policy and regulation projects, as well as collaboration initiatives in various forums are underway in the EU and on the international level, and their development will have substantial impact on the developments in the transport industry. Active exchange of information and proactive discussions on Finland's emphasis and business impact is required to identify needs for further influencing and to use the resources that are available to achieve maximum impact. In addition to participation in

EU-level decision-making and international organisations, the membership of industry representatives in the top-level organisations of the industry and in fields such as urban collaboration forums should be leveraged more efficiently as a channel for influencing and learning and to build partnerships. Collaboration on the Nordic level helps harmonise regulation and the political framework and creates a wider Nordic market area that services as the foundation of broader internationalisation development.

Operating in the international market also calls for active stance in the standardisation work relevant to the industry to ensure that the standards support Finnish business and scalable solutions. The product development contributions and resources of innovative Finnish companies, however, are limited in terms of international standardisation work, and for the time being this opportunity has not been leveraged sufficiently. Improved capacity not only to monitor but also to influence standardisation work is required for achieving business growth and to increase the number of products and exports.

To implement the strategic action:

a. **To improve effectiveness and predictability, key EU and international legislation and policy projects and collaboration forums relevant to preconditions of the growth of the Finnish transport sector within the next few years need to be identified.** Collaboration and distribution of work between administrative sectors needs to be agreed on; dialogue between companies and other stakeholders with the help of (for example) the relevant EU committees of the Finnish government is encouraged. Exchange of information needs to be improved to better leverage the results of pilot and research projects in international influencing,

   Parties responsible: Ministry of Transport and Communications, the relevant administration agencies.
   Also involved: cities, industry associations, companies.

b. **A plan will be drafted to develop the standardisation work in the transport sector; resources will be allocated for monitoring and actively influencing international standardisation processes.** The aim is to develop standardisation work into a strategic influencing tool and to build a foundation for scalable, competitive solutions in the global market.

   Parties responsible: YTL.
   Also involved: Business Finland, ITS Finland, ITS Factory, companies.

5.2 Scalable solutions for the export market

The growth and internationalisation of Finnish companies is affected considerably by how the companies succeed in combining strong technological expertise and the possibilities of platform economy into scalable services and solution packages for the global market. The domestic operating environment plays a key role here. Realising the sustainable growth and the export potential of the transport sector depends on systematic investments that support the development of scalable solutions.

Scalability can be improved by taking the impact of all public sector actions and the different stages of its processes into account when considering the growth of sustainable business – while simultaneously achieving the public sector's own targets in sustainable urban growth and traffic policies. Public sector participants have the role of enablers in experiments with new technologies, new services, and how they are scaled, especially through public investments. Experimentation and public acquisitions and investments need to be linked into a tighter whole already in the planning stage, and customers need to be involved in the experiments. Systematic networks and versatile testing platforms, both fenced-off and in the actual operating environment, link the different participants together and are powerful enablers of the growth story of Finland's transport industry. Public sector commitment to regional testing operations is paramount in order for the pilot solutions to be assessed by both the users and the authorities, and for the solutions to become integrated as parts of the transport system. The funding of regional testing operations also needs to be ensured.

Progressive data policies and data infrastructure investments support the leveraging of data in business initiatives. The utilisation of data needs to be an integral component of all action plans.

The items defined in this sphere of action:

- create a domestic market for sustainable, customer-driven mobility solutions through actions of individual cities
- build scalable, high-impact experiments
- support innovation deployment through public investments and
- establish a functional ecosystem for utilisation of cross-sector data.

Strategic Action V: Cities as platforms in the development and deployment of sustainable, pioneering solutions.

Smart and sustainable mobility solutions play a key role in the cities of the future. New companies and new business initiatives emerge around new solutions, and the public sector can support this in several different ways. While cities work to achieve their own goals, they create product and service development opportunities through innovative investments. They also support progressive testing, experimentation and piloting environments. They open possibilities for developing new kinds of business models and help companies attain domestic market references.

It is the aim of the cities to increase the proportion of walking, cycling and public transportation as modes of transport. High-quality public transport and shared mobility services combined with micromobility enable the development of new user-driven, cost-efficient transport services. Easy-to-use transport chains consist of the shared offering of public transportation and private mobility services. Sustainable and less expensive mobility and logistics solutions to supersede private car ownership, such as car sharing, request-based mobility services, more efficient utilisation of the capacity of public logistics services and the merging of passenger traffic and goods transport are looked for. Developing areas around railway stations into transport hubs creates attractive and functional travel chains. The evolution in the modes of transport depends on increased awareness of new services and their benefits. Cities have also created broader mobility and circular economy roadmaps.[51]

Land use, housing and transport agreements (MAL agreements) made for 2020–2031 open long-term perspectives for the integration of urban development, mobility and housing services. Zoning as well as controlling land use and construction are used to build demand for public transport and the related smart mobility services. In the implementation of the MAL agreements, it is important to ensure continuous development of low-carbon mobility and logistics solutions and to prepare for future solutions brought about by digitalisation and automation.

Automation solutions implemented in a sustainable manner increase economic efficiency of mobility and improve mobility services. Finland has a significant supply of world-class expertise in automatic traffic and the related development work, such as software,

51 The city of Tampere, for example, has the Carbon Neutral Tampere 2030 roadmap that also covers the transport sector: https://www.tampere.fi/tiedostot/h/k63zEwnY3/Hiilineutraali_Tampere_2030_tiekartta.pdf. In the circular economy roadmap of the Turku region, transport and logistics are analysed as a larger whole. Together with regional participants and operators, the roadmap identifies significant and tangible transport interventions that individual participants, actions and projects can implement together and alone. The aim is to give a clear message of the long-term objectives and enable long-term development towards them by the city and the regional participants.

sensors and digital information processing. In recent years, testing and development areas for automatic transport complete with the required data networks have been built in urban areas in Finland. Robot bus pilot projects have also been conducted in urban environments. 5G networks that support automatic transport also support the implementation of other smart solutions.

Moreover, cities are an excellent platform for sustainable post-coronavirus recovery. In particular, major urban transport development projects open opportunities for deploying broader system-level solutions, which include shared services based on sharing economies as well as extensive transport solutions based on automation and clean power sources.

To support sustainable growth in the transport sector, synergies between the present programme and agreements with university cities are recognised. The agreements direct public and private RDI funding to support competitive ecosystems in Finland and to support the linking of regional ecosystems into national ecosystems and global value chains. Regional transport-related RDI projects are integrated into the Sustainable Growth Programme of the Transport Sector and its communications.

Figure 8. Cities have potential to create local climate solutions with global effect. Changing the transport system, for example, calls for everything from urban planning, change-positive regulation and incentives to technological innovations by companies, the use of alternative fuels, compatibility between participants/operators and shared data. In the capital region, the Smart & Clean Foundation has built systemic climate solutions in ecosystems shared by the public and the private sector aiming for maximum impact (=emission reduction). All participants play important roles in the ecosystems and are dependent on each other to achieve the desired change

To implement the strategic action:

a. The creation of sustainable, carbon-neutral traffic and mobility business solutions and ecosystems in urban areas is supported.

- Joint development of mobility and housing solutions in connection with urban development initiatives is promoted.
- New innovative incentives to promote sustainable mobility utilising the lessons learned in the CitiCap personal emission trading scheme pilot project are developed.
- Development of circular economy thinking and circular economy business models through city-level initiatives is promoted.

Parties responsible: Project for promotion of circular economies in transport.[52]
Also involved: cities, Association of Finnish Municipalities, companies.

b. Seamless travel chains and mobility services that link public transport and commercial services in cities and between them are facilitated.
The roles of different participants and their goals in the development and deployment of mobility services are specified. The roles are strengthened through ecosystem work. The framework created in the CIVITAS Eccentric project in MaaS service deployment is utilised.

Parties responsible: ITS Finland, Traficom.
Also involved: cities, Association of Finnish Municipalities, companies, public transport operators.

c. Autonomous traffic is promoted aiming for production use and the establishment of a development ecosystem.

- The physical and digital infrastructure requirements of production use of autonomous traffic in cities are identified.
- The production of a reference architecture and design guidelines for autonomous traffic is initiated.

52 As a continuation of the circular economy potentials identified by Sitra, ITS Finland, Sitra, The Capital Region Smart & Clean Foundation and the cities of Helsinki, Vantaa, Tampere, Oulu and Turku have also launched a joint project for promoting circular economies in the transport industry in 2020. The project supports the goals of the growth programme and aims to create sustainable business. The growth programme also supports the implementation of the Strategic Programme to Promote Circular Economies in the Transport Sector.

- Production-use acquisitions of robot buses (vehicles and operating services) are prepared, potentially also the actual acquisition. Joint acquisitions between cities are used to produce synergy, create markets and increase impact.

Parties responsible: Tampere, Turku, Espoo.

Others: cities, Association of Finnish Municipalities, Traficom, companies.

Strategic Action VI: Development of scalable experiments with real impact.

In the future, test platforms and experiment-positive operating environments that support business development will be increasingly important factors in international competitiveness. Companies will direct their development operations into locations with best premises for solution development, experimentation and scaling.

For a long time, Finland has had a reputation as the pioneer of transport solutions, where companies and the authorities collaborate seamlessly to develop the industry. Flexible and service-oriented authorities combined with experiment-driven business have created a culture where pilot and demonstration projects can be launched quickly.

Cities play a key role in enabling experimentation. Pilot projects are crucially important at a time when transport is changing faster than ever before. Urban development projects often entail innovation or experimentation elements that the cities use to look for new solutions for the problems that are identified. The experiments provide valuable data and lessons to both the companies and the cities. First market references give tangible experience of solution functionality in actual environments and are highly valuable especially for young companies. Experiments and acquisitions made as part of city-level projects also need to consider mechanisms that can be used for upscaling successful solutions. The possibilities of municipalities utilising such experiments also need to be developed.

To support the growth of the transport sector, test platforms for both technologies and service development projects are required. When such platforms are built, Finland's international strengths and differentiating factors need to be in focus. These include Arctic locations, prevailing conditions, the related expertise and Finland's progressive business culture and legislation that encourage experimentation and service development. A clear purpose, jointly agreed rules, operating principles and marketing actions need to be defined for each platform. Active experimentation depends on participants who market, facilitate and develop platforms and promote cross-platform collaboration.

In the future, experiments and test platforms will increasingly need to focus on synergy and scalability so that successful experiments can be turned to new services. National exchange of information, identification of synergies and marketing are promoted, for example, by Traficom, which brings together test environments, experiments and projects. In the future, larger-scale experiments are required and the leveraging of the results of the experiments through clear ownership needs to be ensured. Pilot projects of the public sector need to be linked to sustainability goals, and shared impact metrics need to be defined for assessing pilot projects. The business potentials and the customers of each experiment or solution should be engaged early on.

Traffic insurance, for example, is linked to practical applications of transport megatrends in several ways, and may – at best – facilitate experiments and service development. In Finland, the deployment of automatic cars, for example, has moved relatively fast thanks to close and positive collaboration between the testers and the insurance agencies. Due to the new technical innovations and service models, the insurance system needs constant development.

To implement the strategic action:

a. Sustainable experiments in the transport sector will be developed regionally and thematically in collaboration with research bodies and companies of the sector.

- A network of experimenters and regions will be activated, leveraging existing participants, practices and infrastructures. A clear description of national facilities will be produced, and a plan for operative development and joint marketing of the experiments will be drafted.
- The urban areas and the testing sites for development will be selected together; objectives, action plans and marketing will be agreed on; commitment to them will be obtained from the public sector as well as the relevant research bodies and companies.
- A set of national experimentation guidelines that helps improve the impact, cost-efficiency, business potential and environmental aspects of transport sector pilot projects will be created. These instructions need to take the national exchange of information, synergies, existing data and lessons learned, as well as marketing considerations into account. The information provided by the authorities on applying for testing permits will be improved.

Parties responsible: ITS Finland, Traficom.

Also involved: Business Finland, directors of experiment projects and test platforms, Association of Finnish Municipalities, Motiva, companies, research organisations.

b. **The work of the joint Transport Insurance Coverage at Times of Change forum will be continued.** The aim here is to ensure that the transport insurance system facilitates testing and early deployment of new innovations in Finland. Timely and proactive transport insurance system provides competitive advantage to Finnish service developers and attracts international testing bodies to Finland.

Parties responsible: Motor Insurers' Centre.

Also involved: ITS Finland, Ministry of Transport and Communications, Traficom, insurance companies and transport sector companies.

Strategic Action VII: Innovative public investments to support the creation of market references and scalable solutions.

Public investments play an important role in the evolution of the transport industry and in supporting the development work and the sustainable growth of its companies. The total value of public investments into the transport sector is approximately four billion euros per year. Allocating ten percent of this to the acquisition of new, innovative and pioneering solutions as set down in the government programme would constitute 400 million euros per year to innovative solutions and would encourage companies to invest in RDI activities. Public investments have great potential to promote low-carbon circular economy solutions and to provide companies more opportunities for development of new products and services. They also form valuable references for the international stage.

Improving the procurement knowhow and increasing the exchange of information between participants play a key role in the procurement of cost-efficient solutions that promote business development. In addition to a sufficiently versatile set of instruments, successful acquisitions depend on adequate resources and technology knowhow. The business culture should encourage innovative public investments and the deployment of new solutions so that no investments are left undone because of a fear of the risks that they might entail. Finnish procurement units should be more involved in EU-funded PCP (Pre-Commercial Procurements) and PPI (Public Procurement of Innovation) projects.

Active market dialogue between the buyers and the service producers is important to define needs and offerings and to identify opportunities. Discussions that crystallise these goals are required on both the strategic level and in the preparation stage of individual investments. Strategic opportunities should be identified proactively to provide

companies more reaction time that they can use to develop solutions that answer to the new needs. The market dialogue should reach as versatile group of corporate participants as possible, and procurements should be planned so that small companies are also able to participate in the tenders.

Defining the objects of procurement and the criteria used in their tendering have substantial impact on getting innovative solutions to the public sector market.

Overall, solutions that meet certain goals and respond to challenges that have been identified should be procured instead of precisely defined performances of services or narrowly specified implementation methods. The "future-readiness" of the solutions also needs to be taken into account, even if no projects are implemented immediately. Potential perspectives could include preparation for automatic traffic, electrification and the production and sharing of digital information.

Contract models and intellectual property rights policies should encourage companies to innovate while also ensuring market functionality. The customers and the suppliers need to strike a balance in the ownership of new innovations created during the procurement process so that companies have the incentive and the right to broader commercialisation of their solutions they have developed. Mutual sharing of the advantages has been successful in numerous extensive Allianssi projects, for example. Digitalisation of transport increases the need for interface definitions and data models based on open standards that enable rapid scaling of the solutions. They support connectivity with other parts of the ecosystem and make the customers less dependent on individual vendors.

Sustainable recovery also offers opportunities for leveraging public investments and the development of solutions that can be scaled for the export market. Companies should be encouraged to participate in international tenders and should be supported both by collecting information of emerging projects in the key markets for the companies and by ensuring the leveraging of domestic references as springboards for gaining access to the international market.

Transport sector procurement expertise has been developed in the KEINO Competence Centre and through Business Finland funding for innovative public investments. Sparring implemented in connection with tangible projects, for example, has produced good results. The national strategy for public investments was published in September 2020.[53]

53 For more information, see https://vm.fi/hankinta-suomi

To implement the strategic action:

a. **The transport sector acts as a pioneer in the implementation of the strategic public investments programme in order to gain weight and competitive advantage out of public investments.** Investment guidelines need to be linked to strategic plans and market dialogue needs to be developed. Sustainability impacts of the entire lifecycle of the investment are made part of the assessment of public investments.[54] Active market dialogue concerning the solutions that are available is encouraged. Projects are used as springboards for solutions that create new business.

   Parties responsible: the transport administration branch, cities and municipalities.

   Also involved: KEINO, Business Finland, Association of Finnish Municipalities.

b. **The innovative public investment development work by the KEINO Competence Centre and Business Finland will be targeted to the investment-development areas identified in dialogue with the transport sector.** The transport sector should actively leverage the expert assistance offered by the National Centre of Expertise for Innovative Public Investments. The centre of expertise develops operating models based on modular products and interfaces that support the goals of the growth programme, support functional markets and encourage companies to invest in RDI.

   Parties responsible: KEINO Competence Centre, Business Finland.

   Also involved: the transport administration branch, cities and municipalities.

c. **Innovative public investments are piloted through extensive merging of logistics services of areas with low population density.** Digital means are leveraged in combining and organising of logistics to develop efficient and sustainable services that respond to current needs.

   Parties responsible: logistics customers.[55]
   Also involved: Business Finland, companies.

54 A VN TEAS project for inclusion of carbon and environment footprint into investments through legislation and metrics is currently underway.

55 Implementation of a regional passenger mobility project, for example, has been agreed on in the Kuopio region in a transport sector letter of intent.

Strategic Action VIII: Leveraging of digital information as the foundation of sustainable business operations

The evolution of the entire transport sector depends on data-driven service and technology innovations. To guarantee business preconditions and growth, the quality and the availability of data resources needs to be ensured. Data and the leveraging of data need to be taken into account as a crucial part of the actions taken to achieve growth in the transport sector. At the moment, the data foundation of the transport sector is partly incomplete, and the data resources are fragmented to different participants in both public and the private sectors. Moreover, the data landscape has developed into a silo-like structures based on traditional participant roles.

Platform economy solutions and new participants challenge both the current participant roles and the data structures of the transport sector. New radical innovations are often born out of novel ways of combining data from different sectors. Service development opportunities found in the interfaces between the transport sector, the data communications sector, the energy industry and the built environment are especially interesting here. However, a set of rules for different participant roles are required in order for the silos to be dismantled and the data utilised more freely.

In the digitalisation of the transport sector, a shift from local, transport-mode-specific solutions to national implementations on the level of the entire transport system is first required, followed by international solutions based on compatibility of data resources and services. Open interfaces and compatibility are used to ensure the development of scalable solutions. Through leveraging of data, the development of transport and logistic services can be linked to smaller carbon footprint, sustainability and their verification – a competitive advantage in the international market.

From the perspective of business growth, closer collaboration between different participants is important. Raising the degree of digitalisation calls for an extensive data ecosystem and sub-ecosystems that connect the participants to each other through shared creation of value, shared marketplaces for digital data and shared commercial objectives. Data-driven ecosystems streamline the data resources of the transport sector, turn them into products and define the rules for the utilisation of data interfaces and resources.

In the future, users will be offered more versatile opportunities for controlling how their personal data is used as part of service development. Operating models based on ownership of personal data pave way for development of new application and service structures, where individuals have better control over harvested personal data and how it is used. This opens new possibilities for developing sustainable leveraging of data as part

of business operations. It also offers possibilities for creating new business models that encourage the users to move to low-emission services.

Finland has been an active influencer in the development of EU's data policies and regulation. A key premise of Finland's data policy has been a user-driven, distributed data acquisition model. Pioneer role in data utilisation, the data resources offered and clear operating environments also attract international participants and lower the threshold for investing in research, product development, experimentation and production in Finland. In a digital society, the importance of cybersecurity and data security as a key part of equipment and service quality and reliability will increase. Finland's strong data security expertise is a competitive advantage in the global market.

The aims of the sustainable growth programme are also supported by the fact that different collaboration forums and financing instruments are used to encourage participants to develop ecosystems around the leveraging of data.

To implement the strategic action:

a. **The opening of transport sector data to form a foundation for sustainable business in the transport and logistics sector, including dynamic data and the utilisation of restricted data, is continued. The development of transport data ecosystems and a market for distributed transport data is promoted.** The aim is to make commercialisation of the data resources possible and to develop competitive solutions for the export market.

   As part of this whole:

   - A clear and open set of rules will be developed for the utilisation, sharing and exchange of data and for the development of the entire ecosystem.
   - The current systems will be updated within each mode of transport; city-level transport systems will be digitalised; company competences will be developed and top-level ecosystem development with the required information exchange platforms will be supported.
   - A digital twin of the current transport system will be created, starting with traffic management and urban environments. On top of this, both city- and national-level simulations can be developed to support decision-making in different projects.
   - A showroom of transport sector projects that leverage open data will be created to prove the potential of open data. Mechanisms will be developed for identifying the most successful projects and their critical steps.

Parties responsible: Ministry of Transport and Communication, Traficom, Fintraffic, companies.

Also involved: The Ministry of Transport and Communication's administrative branch, cities and municipalities, the corporate sector, solution developers, data leveraging projects, the Matkatieto workgroup.

b. **A collaboration model that enables different participants to leverage cross-sector (transport, logistics, energy, housing...) data resources in their service development work will be created and implemented.** As part of this action, the current data resources that need to move across sector boundaries are reviewed. Moreover, the data resources that enable the linking of housing, infrastructure, services and energy system data into a compatible, functional whole are reviewed. Current regulation work in the EU is taken into account and viewpoints are articulated to support influencing on the EU level.

   Parties responsible: RTS Building Information Foundation.

   Also involved: Traficom, Finnish Energy, Fintraffic, The Finnish Transport Infrastructure Agency, Statistics Finland, Business Finland, ITS Finland, data leveraging projects.

5.3 Continuous ecosystem collaboration

The rapid growth of data volume and availability, the development of communications technologies and the globalisation of value networks have already changed the logic of innovation activities. The changes make it possible to create and deploy new ideas anywhere in the world, resulting in a genuinely global competition landscape. Changes of the global operating environment highlight the importance of a systemic approach, collaboration and openness in innovation processes. This is best achieved in close collaboration between companies, research bodies, the public sector, consumers and other participants, in other words, in an innovation and business ecosystem.

International growth depends on unique expertise, focus on most relevant market segments and active international networks. The most important business potentials lie outside Finland, and becoming part of networks and collaboration forums is important for companies looking for growth. Developing and marketing Finnish transport knowhow through broader wholes and developing and marketing Finland as a broader, competitive business environment through a shared message improves the visibility of the entire sector and contributes to the collective brand of Finland's transport sector.

The items defined in this sphere of action:

- Accelerate existing ecosystem collaboration within the industry to create business ecosystems and to support internationalisation.
- Build a shared growth story for the transport sector to improve international visibility and to attract international partners and investors.

Strategic Action IX: Systematic promotion of the creation and internationalisation of sustainable growth ecosystems

The guiding principles of the National Programme for Sustainable Growth in the Transport Sector is to turn the basic tenets of ecosystem thinking and the already identified best practices broadly into instruments of business development and internationalisation.

Ecosystem development within the transport sector is underway as described in Chapter 4, and has been supported strongly through both corporate investments and Business Finland funding. New potential ecosystems have been identified through collaboration between different participants. However, developing them into business ecosystems calls for systematic effort. Ecosystem development is also promoted especially through the actions of the Export and International Growth Programme. In addition to these, different participants have produced ecosystem maps and development guidelines.[56]

Supporting the collaboration between the public and the private sector and research bodies calls for clarification of roles especially in the public sector to turn public-private partnerships into a genuine opportunities also from the corporate point of view. From the perspective of company-driven growth and export, public participants should support the product development work, competitiveness and acquisition of market references by tendering the companies with sufficiently ambitious requirement specifications. They should also adapt the role of demanding and knowing service customers instead of an aggregator of development resources. This also calls for results-based management that supports the goals.

In addition to the ecosystem actions, active networking between transport sector participants to build a shared commitment and a shared business vision for the entire

56 Examples include: Internationally significant innovation and growth ecosystems in Finland https://teknologiateollisuus.fi/ sites/default/files/2020-01/Internationally%20significant%20 innovation%20and%20growth%20ecosystems%20 in%20Finland.pdf, Kasvuportfolio 2.0, Ecosystem Handbook, Yhdessä kestävää kasvua -ekosysteemiopas https:// cris.vtt.fi/en/publications/ yhdessä-kestävää-kasvua-ekosysteemiopas

industry will be continued. This also contributes to a foundation for creating new partnerships and business models, for collaboration between start-ups and large-scale enterprises and for the development of new network-like collaboration structures. In addition to pilot and demonstration projects, networked operating models create opportunities for collaboration between companies, development of broader solutions for the international market and participation in international projects, including EU-funded projects. EU projects are one of the most important tools that Finnish companies have to get into contact with international participants and to showcase their expertise through successful projects.

Investments in Nordic collaboration support the development of a uniform, attractive market area that forms both a favourable growing environment for domestic ecosystems and an attractive target for international investments. Closer collaboration may help achieve ecosystems that are international from the start and to build strong consortiums to leverage EU funding.

To implement the strategic action:

a. The international business potential of ecosystems will be realised. Active business ecosystems will be expanded into genuine international entities with special focus on sustainable growth. This includes international orchestration knowhow, establishing of a shared vision, participant roles and responsibilities, links to orchestration of global business ecosystems, potentials for business scaling and the availability of sufficient funding in Finland and in the EU. Opportunities for the piloting of new operating models in transport sector ecosystems as part of the Export and International Growth Programme will also be identified.

Parties responsible: Business Finland.

Also involved: Spearhead companies, key ecosystem participants, financiers and research bodies.

b. Implementation of shared, coordinated development of identified growth ecosystems, including control models based on constant facilitating, sharing of information and the maturity of each ecosystem. Continued focus on integration of themes with major impact on the industry that have cross-cutting impact in the ecosystems, such as drone business, artificial intelligence, platform economies, automation and cybersecurity. **Utilisation of existing ecosystem guides in ecosystem development; broad sharing of best practices from the growth ecosystems of the transport sector.** Increasing the awareness of proven ecosystem implementation methods and adapting of best practices into general policies.

Parties responsible: Business Finland, ecosystem coordinators.

Also involved: companies, cities, research bodies.

Strategic Action X: Investments in joint international marketing and sustainable transport branding work

Collaboration forums and networks have the role of "door-openers" that accelerate access to new markets. Growth depends on finding suitable local partners. Moreover, export networks familiar with the local business culture of each market region and targeted high-level export promotion excursions will be employed.

The shared growth story of the transport industry and the growth programme that supports it create a view of the transport sector as a growth industry, improve predictability and attract investments. Experimentation platforms connected to the growth story help retain the RDI functions of the companies in Finland. Companies will seek the leading expertise, a business-positive environment and attractive company clusters. This makes it possible to attract the research development investments and the "Centre of Excellence" RDI centres of international companies to Finland.

Successful marketing and selling of Finnish knowhow and innovations is supported by known competitive advantages, winning ecosystems and success stories.

Finnish growth ecosystems and companies that belong to them offer genuine added value in the international market. A shared story brings benefit to everyone in the sector. Instead of technology-driven marketing, shared means for creating internationally attractive stories around Finland's strengths are created. Companies are better positioned to gain access to international sales channels as parts of broader, more credible offerings. The shared message will be constructed in such a way that companies can use it as part of their own marketing efforts. This is how the communications of each participant also support the other companies in the industry. A credible and interesting growth story also helps attract international companies, research bodies and investments.

In early 2020, a Future Mobility Finland portal was launched as part of the National Growth Programme of the Transport Sector to facilities the shared growth story and the joint marketing effort of the Finnish transport industry. As part of the Smart Mobility Finland programme, Business Finland has created a number of shared offerings [57]and has invested strongly on leveraging the market potentials of Finnish participants.

57 Examples include Smart Ships, Smart ports and maritime logistics and Smart Automotive & Mobility Solutions.

High-level export delegations, industry participants in international forums and industry fairs, as well as the hosts of the relevant international conferences are all leveraged as part of the internationalisation effort.

To implement the strategic action:

a. The development of an attractive shared story of Finland's transport industry, a shared marketing strategy and shared marketing materials is continued using the Future Mobility Finland portal. As part of this:

- The key information and marketing materials of transport industry ecosystems and their participants will be collected into the Future Mobility Finland portal for easy access by all participants.
- The joint visibility of the testing areas is developed on the national and the international level.

Parties responsible: ITS Finland.

Also involved: Ministry of Economic Affairs and Employment, Ministry of Transport and Communications, Business Finland, the transport and communications administrative branch, business development companies of cities.

b. Closer collaboration with Nordic participants is encouraged to build a shared sustainable transport brand and to develop Nordic sustainable transport and circular economy solutions. The potential for a Nordic transport sector carbon handprint model will be reviewed.

Parties responsible: the circular economies in the transport project.

6 Implementation, metrics and progress tracking

Shared commitment to broad implementation of roadmap actions by public participants, companies and the research sector is a crucial factor in the implementation of the growth programme. Creating a pioneer market and building the winning ecosystems call for systematic, long-term work and investments from all participants. The government programme sets ambitious goals for the creation of international ecosystems in the range of billions of euros, and the National Programme for Sustainable Growth in the Transport Sector is a key tool used in achieving this target.

6.1 Organising the implementation

Organising implementation tracking, distribution of responsibilities and a shared commitment ensure high-quality, high-impact implementation. The key points of how implementation tracking will be organised are described below. The actual implementation work utilises the organisation created for the National Growth Programme of the Transport Sector.

1. The growth programme will be used as an instrument in the planning of strategies, programmes, guidelines and projects that will shape the future of the industry; the organisations participating in it will allocate resources for the implementation work.
2. A steering group will be appointed to keep track of progress, to monitor implementation of action points, to decide on new actions that will be integrated into the programme and to appoint the parties responsible for coordinating the new items. The steering group will consist of representatives of the research sector, state administration, cities and companies.[58]
3. The overall coordination of the growth programme will be done by the programme director, who also serves as the secretary of the steering group. Each participant organisation will appoint their own contact person for the

58 Steering group members: https://tem.fi/liikenteen-kasvuohjelman-yhteystiedot

implementation of the growth programme. The programme director and the contact persons constitute the implementation network of the growth programme.

4. An external assessment of the implementation and the impact of the growth programme will be conducted in 2021.[59]
5. An up-to-date information page with the growth programme action points, parties responsible, schedules, and news will be maintained and developed for tracking the implementation of the growth programme.[60] Growth programme actions will be communicated using a multi-channel approach.
6. A long-term plan for transport industry ecosystem development within the framework of the programme over successive government terms will be created during the programme term.

6.2 Growth programme impact objectives and metrics

A transport industry overview report and a set of suggested metrics have been presented in connection with the National Growth Programme of the Transport Sector.[61] The same metrics will be used in the National Programme for Sustainable Growth in the Transport Sector with potentials updates necessitated by further development of programme actions.

Impact objectives of the strategic actions of the programme have been identified as:

1. Company- and export-driven growth based on sustainable solutions is achieved in the transport sector.
2. A shared understanding of the future development path of the transport sector makes decision-making of different participants (private sector, companies, public sector) easier.
3. The market share of sustainable, low-emission mobility and transport solutions increases.
4. New business models based on sustainability and circular economies are created in the transport sector.

59 The assessment will utilise the recommendations set out in the Liikennealan mittaristo ja tilannekuva: Ehdotukset kasvuohjelman arviointiin ja toimialan seuranta report.

60 https://tem.fi/liikenteen-kasvuohjelma and https://its-finland.fi/its-finland-ry/

61 Liikennealan mittaristo ja tilannekuva: Ehdotukset kasvuohjelman arviointiin ja toimialan kehityksen seurantaan. Työ- ja elinkeinoministeriön julkaisuja, Yritykset, 2020:25

5. Companies use publicly produced data in their services, new digital services are offered and the market for services based on digital information grows.
6. A sufficient number of smart transport experts are educated and the experts find employment after completing the education.
7. The number of growth companies that leverages the research results increases.
8. The research, development and innovation (RDI) activities of the transport sector expand.
9. The amount of domestic and international business development funding received by the companies in the transport industry increases.
10. Experimental activities in the transport sector expand.
11. Innovative public procurement in transport sector's growth industries increase.
12. Finnish transport industry companies are more successful in international tenders.
13. International interest in companies operating in the transport sector increases.
14. The international impact of Finland's transport sector increases.
15. The scope of activities of transport sector companies operating in the international market increases.
16. New ecosystems aiming for the international market are created in the transport sector.

The following key metrics are used to monitor the primary goals of the programme (company-driven development, growth and internationalisation) and the overall impact of the growth programme.

1. **Sustainable growth of the transport sector.** The aim is to achieve growth in the companies operating in the transport sector, which can primarily be assessed through increase in sales volume. Increased employment is also desirable. However, sales volumes should increase more compared to employment figures to increase the productivity of work. The growth metrics of the transport sector are annual increases in the volume of sales and employment. The growth should primarily come from sustainable business sectors.

2. **Transport sector exports.** The aim is to increase the export value of goods and services of the transport sector. Export value should increase more than import value to achieve positive balance of accounts and to contribute to the national economy.

3. **Research, development and innovation activities (RDI).** Evolution, development and international competitiveness of the transport sector are achieved through research, development and innovation activities, including experiments and pilot projects. RDI metrics include the change in RDI funding as well as the proportion of new products and services in the sales volumes of companies in the transport sector.

4. **Digitalisation.** The aim is to increase the leveraging of digital information in the transport sector. Leveraging of digital information is recognised as the factor that creates preconditions for growth in the industry, improves existing products and services and supports the development of new products and services. Metrics used to measure digitalisation are the usage volumes of big data, open data and data in general in the companies of the transport sector.

Challenges in the creation of the metrics include the limitations of the traditional business sector categorisation and how the metrics can be designed in such a way that they can be used to verify that the growth and the export volumes factually come from sustainable business. In this respect the metrics will be developed further in the future with special focus on impact metrics developed for sustainable recovery initiatives.

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