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**Tekes – the Finnish Funding Agency for Technology and Innovation**

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# Foreword

Global competition and societal challenges call for new approaches to innovation where the importance of system level changes and transitions are acknowledged as the source of sustainable development, competitiveness and well-being in the future. To analyse the phenomena and to find new ideas, solutions and recommendations Tekes launched in 2011 an innovation research call entitled 'System-level change and innovation'.

The socio-technological systems may, for example, relate to transport and logistics, infrastructures and the built environments, energy, ICT and health care. System-level changes and transitions span several sectors, companies, actors and institutions and their effects on competitiveness and well-being are long-lasting. The potentials of system-level changes are especially important in relation to global societal challenges as new solutions and innovations created in areas where Finland already has invested significantly.

Finland is characterised as a country of long distances. In total, Finns travel 74 billion passenger kilometres annually, equalling 41 km per person per day. The transport sector accounts for circa 20% of GHG emissions, the main source being road transport (90%). The EU target is to reduce oil consumption in transport sector by 70% by 2050 compared to year 2008, but so far the development has been slow. Thus, new options are needed for innovation policy.

The report is based on work carried out in the FIPTrans project (Future Innovation and Technology Policy for Sustainable System-level Transitions: the Case of Transport) funded by Tekes. The project has been a joint effort by Aalto University School of Business and the Finnish Environment Institute, with input from the University of Leeds. Tekes expresses its gratitude to the research team, steering group, those interviewed, workshop participants and all others who have contributed to the project. The researchers have analysed different pathways for sustainability transitions in the passenger transport system. They give useful recommendations and policy options to enable transitions towards sustainability, particularly through a reduction of greenhouse gases. These transitions could play an important role for green growth in Finland.

March 2014,

Tekes

# Contents

# Executive summary

This report envisions alternative and complementary pathways for a transformed passenger transport system in Finland (mostly focusing on the largest cities and their neighbouring areas). Ideally new pathways fulfil both the demands for increasing sustainability and for improved service for the users of transport. The focus is on land-based passenger transport and the efforts to improve its sustainability, particularly on ways to reduce the emissions of greenhouse gases. *The analysis provides a novel view by drawing explicitly on the theoretical perspective of socio-technical transitions: our key aim is to show how this perspective can contribute to policy innovation related to passenger transport.*

The use of private cars with internal combustion engines using petrol or diesel as fuel dominates the present transport system although other modes of passenger transport (cycling and walking, public transport, and transport services) co-exist as important elements. In addition, practices such as teleworking or internet shopping provide opportunities to reverse the increasing trend of private car-based transport.

This report describes alternatives to private vehicle use and new technologies to reduce emissions from vehicles (e.g. biofuels and electric vehicles) as spaces in which pathways for future transport system develop. At present, these 'niches' complement the dominant form of mobility, private cars, but might change the transport system, if they became more widely adopted.

The analysis was carried out in the FIPTrans project (Future innovation and technology policy for sustainable system-level transitions: the case of transport) and it shows that existing mixes of policy instruments in Finland give more support to those emission reducing niches that maintain the dominant position of private vehicles. These include liquid biofuels and to some extent also alternative vehicle technologies. Public policies have already enabled a substantial volume of novel biofuel products. New actors, such as forest and food industries and waste operators have joined the fuel chain. Also electric vehicles and related services have received attention, showing that it is relatively easy to get public and political acceptance for technical measures aimed at reducing vehicle emissions, especially where technologies do not significantly change people's everyday practices. At the same time, government-level policies have paid insufficient attention to changing the transport system in a way that would reduce travel demand and increase the share of public transport or other transport-related services.

The need for increased use of public transport, cycling and walking, and combined modes of transport for one journey, as well as for travel demand reduction has been emphasized in strategy documents in Finland. Yet actual policy instruments related to these aims are still few, especially at the government level. To become more widely adopted these options require changes in the preferences of all actors, in the willingness of consumers to change their routines, and concrete political decisions. This is not easy to achieve, but policy suggestions to support this development are made below. The analysis suggests that support targeted specifically at each alternative is necessary to achieve sustainable transition of the passenger transport system.

There are many business opportunities, including new fuels, vehicle technologies and various services, linked to the alternative low-carbon pathways for transport, for both incumbents and new actors in Finland. These opportunities emerge through technology development in transport-related technologies and ICT, but also through changing attitudes towards ownership and consumption allowing for business concepts based on sharing.

The policy recommendations argue that the transition perspective enables actors to recognise policy measures that foster system-level changes. FIPTrans provides policy recommendations in four categories: support for experimentation for niche development, policy integration for regime change, market formation for consolidating regime shifts, and recognition and support of "neglected niches". The recommendations are listed below and presented in Section 6.

## Policy recommendations

1. Support strategic experiments that aim at enhancing changes in the whole socio-technical system.
2. Emphasise learning and acceptability of failures in experimentation and demonstration programmes.
3. Support multiple complementary niches.
4. Enhance broad networking, creation of generic knowledge and mutual learning in innovation programmes.
5. Strengthen cooperation between policy domains to improve coherence of policies and create policy mixes for sustainability transitions.
6. Map carefully and reduce barriers to niche innovations.
7. Design and implement environmental and transport policies to increase demand for innovative technologies, products and services.
8. Design policies for market formation.
9. Design policies to improve access of consumers to affordable high quality sustainable products and services.
10. Start specific innovation programmes for enhancing entrepreneurial experimentation reducing transport demand and promoting seamless intermodal transport.

# 1 Introduction

System-level innovations are necessary in the transport sector because of high environmental and social impacts. They are also desirable due to various business opportunities they offer, but difficult to implement because of the existing system's stability. How can the opportunities be successfully supported by innovation and transport policy measures? How can innovations significantly contribute to transitions towards environmentally sustainable transport systems? These are the questions the project 'Future innovation and technology policy for sustainable system-level transitions: the case of transport' (FIPTrans) set out to resolve. *The overall aim of FIPTrans was to generate policy options for innovation policy that will facilitate system-level transitions and green growth in the transport sector and related industries in Finland.*

The transport sector causes severe societal impacts, which are costly. Transport is globally the second largest producer of greenhouse gases (22% of all emissions in 2011[1]) and it is closely tied to problems related to health, noise and congestion particularly in larger towns and cities. Although incremental innovations in various transport technologies have reduced relative emissions and improved safety, the growth of transport volume tends to override these positive developments (see Section 3). Based on various population and economic growth scenarios, the International Energy Agency expects greenhouse gas emissions from transport to grow by 250% and the number of cars to increase by 250-375% by 2050, unless significant changes at system level take place.[2]

The Green Growth and the Green Economy discussions visible in Finnish innovation policy[3], along with many strategy-level policy initiatives in Finland (e.g. the Government Report on Transport Policy[4] in 2012) acknowledge the need for change towards a more sustainable transport system. The 2012 Transport Policy Report defines a vision for the transport system for 2030 and beyond and emphasizes the following aims: service aspects for users, safety, reliability, sustainability and the availability of different choices for mobility.

There are numerous emerging trends that offer new business opportunities and influence the future design of the transport system. There are signs in various western countries that the popularity of car ownership and even driving licences has reduced.[5] The concept of a 'sharing economy' is gaining ground (see Section 5.2.).[6] New technologies allow novel business concepts and novel ways of organising, for example, leisure and shopping. Business opportunities are significant. One example is the global ITS-markets (Intelligent Transport Systems) for road traffic: the volume is estimated to be 24 billion dollars in 2010 and growth to be 20% annually[7].

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1 IEA, 2013

2 Replogle and Hughes, 2012.

3 http://www.tekes.fi/tekes/strategia/

4 Council of State 2012

5 http://www.taloussanomat.fi/autot/2013/07/25/baana-hiljenee-kun-nuoret-jattavat-auton-ostamatta/201310373/304; http://www.taloussanomat.fi/autot/2012/06/13/tukholma-ilmio-suomeen-ajokorttia-ei-kohta-tarvita/201231348/304 /; Sivak and Schoettle, 2011; http://www.hs.fi/talous/a1366516962981 and http://www.motiva.fi/ajankohtaista/motivan_tiedotteet/2013/nuoret_aikuiset_parjaavat_kaupungeissa_ilman_ajokorttia.5443.news

6 http://suomenkuvalehti.fi/jutut/talous/luovu-ja-lainaa-jakamistaloudessa-omistaminen-ei-ole-tarkeinta; http://www.theguardian.com/technology/2013/aug/04/internet-technology-fon-taskrabbit-blablacar

7 http://www.vantaainnovation.fi/assets/CM2/seminaari-esitykset/9-Forsblom-lystrategiaa-26112013-Robottiviikko.pdf

Many examples of new business opportunities already exist, both large and small. They can be grouped as follows:

1. new fuels – biofuels in particular – integrated fuel production and waste management
2. new vehicles such as electric bikes and cars – and related services
3. new technological solutions – batteries and other energy carries, equipment for improved energy efficiency, traffic control systems etc.
4. testing services – electric vehicles, autonomous vehicles etc.
5. new services for sharing of cars and other vehicles, e.g. bikes
6. new services for integrated tickets for different modes of transport
7. applications and services enabling combinations of transport modes – e.g. businesses in and around transport centres
8. services reducing transport demand, e.g. temporary office services, teleconferencing services, social media.

The complexity and stability of the existing system create barriers for system-level innovations. An essential question for policy development is therefore how one can support the development of new radically different technologies and phase out old technologies and solutions. Theories of transitions (Section 2) explain how policies can contribute to the change of socio-technical systems. Policies from other countries are a valuable source of ideas, as many countries share similar challenges related to mobility. A number of examples from other countries are presented in the report.

The report first describes the present transport regime, which is mainly characterised by the wide-spread use of private cars with internal combustion engines (Section 3). Thereafter the main niches striving to improve the various sustainability aspects of transport as well as the policies supporting them are described (Section 4). The various new business opportunities and their drivers are summarized in Section 5.

Policy recommendations have been developed based on a synthesis of the work carried out (Section 6). Concrete suggestions are given for improving the implementation of the general findings of the transitions theory to the passenger transport sector in Finland.

The report is based on work carried out in the FIPTrans project (Future Innovation and Technology Policy for Sustainable System-level Transitions: the Case of Transport) funded by Tekes – the Finnish Funding Agency for Technology and Innovation, during 2012-2013. The project has been a joint effort of Aalto University School of Business and the Finnish Environment Institute, with input from the University of Leeds.

The findings and recommendations presented in this report are based on three types of evidence: factual background information on the passenger transport system, rigorous qualitative inquiry (see the list of scientific publications in Section 7.3.) and critical expert judgment in interpreting anecdotal information. The draft document has been discussed in the project steering group and in a stakeholder seminar in January 2014, in order to test the validity of the findings and conclusions (see the lists of participants in Section 7.1.).

The authors wish to thank all members of the project group (see Section 7.1.) for their contribution to the results. FIPTrans project is especially grateful to its active steering group for useful guidance and discussions.

# 2 Theoretical framework

The FIPTrans project applied theories of *socio-technical transitions*, including the multi-level perspective, strategic niche management and technological innovation systems, to explore innovation processes and policies in the context of transport.[8] Common to transition theories is that social and technological changes are understood as evolving together, each influencing the other. A transition is said to take place when there are shifts or 'system-level innovations' from one configuration to another. This shift is conceived to include not only new technologies but also corresponding changes in markets, user practices, policies, institutions and ways of thinking. Yet, much of the literature is dominated by technology and historical accounts of industrial change, while calls have been made for more focus on demand side factors and individual, household and community levels.[9]

Transitions involve and are driven by interactions between social groups of many types: firms, user groups, scientific communities, policymakers, social movements, special interest groups and so on. Long-term, relatively stable elements that provide the context for transitions are referred to as socio-technical *landscapes*, which include, for instance, global political constellations and conditions for trade. The *regimes* influenced by the landscape are the prevailing, mainstream order that is to some extent taken for granted (for example, private road transport supported by surrounding infrastructure, institutions and behavioural patterns). The *niches* are where novel technologies and practices are created. In niches innovations may find protection, be nurtured and eventually grow to challenge the dominant regime; or they may, like many inventions, remain known to only a few people. As there are three levels in this model of change, the approach is known as the *multi-level perspective (MLP)* (Figure 1).

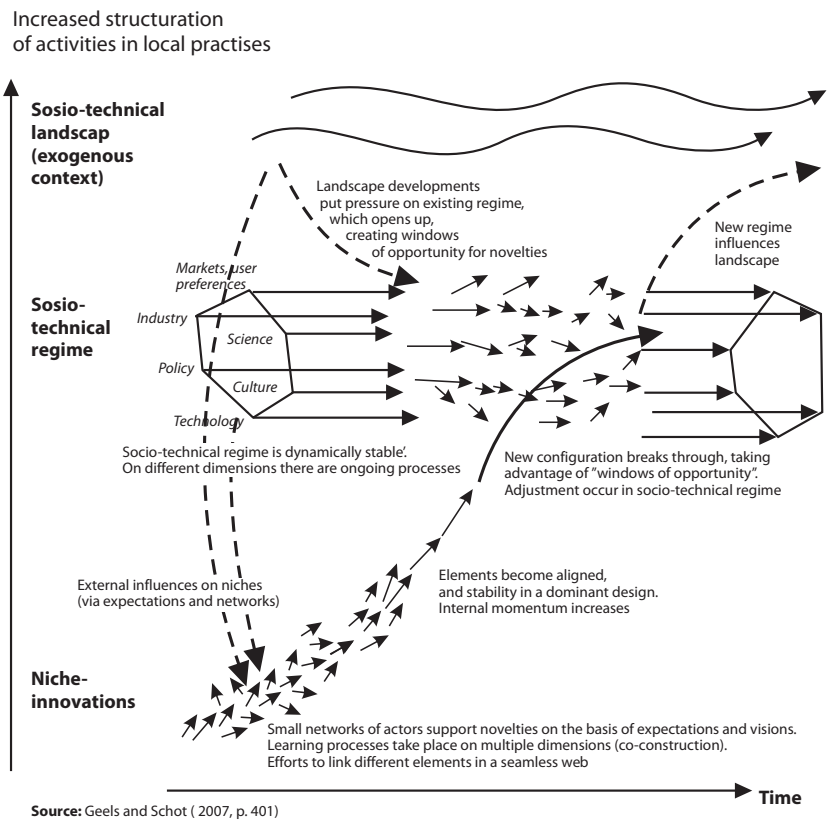
The three levels underlie much, but not all, of transitions research. Alternatives include *technological innovation systems* (TIS) theory that focuses on social networks made up by actors and institutions around a specific technology. The build-up, or breakdown, of innovation system structures are conceptualised in terms of seven key activities, or system functions[10]. These were used for policy analysis during the project (see Section 4.6.).

The study of transition processes naturally leads to the question of the extent to which the processes could be influenced or even steered towards certain societal goals. *Transition Management* (TM) seeks to do this by defining the goals of the transition and steering it through a back casting process.[11] Empirical experiences of TM indicate that it does not work as a stand-alone approach[12] and may often be controlled by incumbents.[13]

Niches are a key element in transitions and *Strategic Niche Management (SNM)* focuses on how innovation niches could be shielded, nurtured and empowered by paying attention to three different processes: articulation of expectations and visions, networking and learning in terms of multiple dimensions[14]. This approach is used in the descriptions of developing niches in Finland (see Section 4).

8 Markard et al., 2012.
9 Hielscher et al., 2013
10 Bergek et al., 2008; Suurs and Hekkert, 2009
11 Flanagan et al., 2011
12 Paredis, 2013
13 Soete and Ter Weel, 1999; Kern and Howlett, 2009
14 Smith and Raven, 2012

**Figure 1. The multilevel perspective** (Geels and Schot, 2007: 401)




**Source:** Geels and Schot ( 2007, p. 401)

# 3 Current transport regime in Finland

This Section outlines the characteristics of the existing landscape and regime of passenger transport in Finland. Key facts related to transport trends are presented along with key actors in the field. Most important national policies are described and analysed.

## 3.1 Key facts

In Finland, the transport sector accounts for circa 20% of GHG emissions, the main source being road transport (90%). Private cars are the largest source of emissions, while freight transport is also significant. Urban sprawl and the centralisation of services have increased the use of private cars[15]. Key indicators of the current regime are presented in Figure 2.

There are many landscape changes that affect the transport system. The EU Commission has listed some in its memo on Transport 2050[16]: currently transport depends on oil for 96% of its energy needs, while oil will become scarcer and oil prices are expected to double between 2005 and 2050; congestion costs about 1% of GDP per year in EU and, due to climate change, there is a need to cut greenhouse gas emission drastically.

EU target is to reduce oil consumption in transport sector by 70% by 2050 compared to year 2008; so far the development has been slow as the transport oil consumption decreased 0.6% from 2010 to 2011.[17]

Commission has calculated that for the overall EU emission reduction target of 80% by 2050 would require a 60% reduction of transport-related emissions by 2050. Different scenarios have been made about the measures needed to achieve that kind of reduction. It is clear that neither technological nor organisational and regulatory aspects alone are enough to reach the target.[18]

Finland is characterised as a country of long distances and cold winters. Yet, 64% of the journeys travelled by car in Finland are less than 10 kilometres in distance. Moreover, the use of private passenger vehicles is most common in journeys that are only 1-3 kilometres long.[19]

More than two thirds of the people in Finland live in an area that covers ***5%*** of the country, i.e. cities and their surroundings.[20] Even if cities suffer from urban sprawl, they also offer possibilities for intelligent use of public and intermodal transport.

In total, Finns travel 74 billion passenger kilometres annually, equalling 41 km per person per day. The shares of different transport modes are shown in Figure 3. In the whole country, the share of cycling and walking has decreased, while the share of public transport has increased from the early 2000's.[21] While commuting distances have increased, the share of commuting of all traveling has decreased. The total number of journeys related to shopping and other chores has increased, even though the average length of those journeys has remained stable.

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15 Luukkonen et al., 2012

16 http://europa.eu/rapid/press-release_MEMO-11-197_en.htm

17 EEA, 2013

18 "Effective and widely accepted technology" scenario from the Impact Assessment on a "Low-carbon economy 2050 roadmap"

19 FTA, 2012

20 A new geographic classification about the distribution of urban and rural areas: http://www.syke.fi/fi-FI/Tutkimus__kehittaminen/Rakennettu_ymparisto_ja_alueiden_kaytto/Tarjolla_entista_tarkempaa_tietoa_kaupun%2814424%29, last accessed 18.11.2013.

21 FTA, 2012

**Figure 2. Development of passenger transport indicators in Finland**

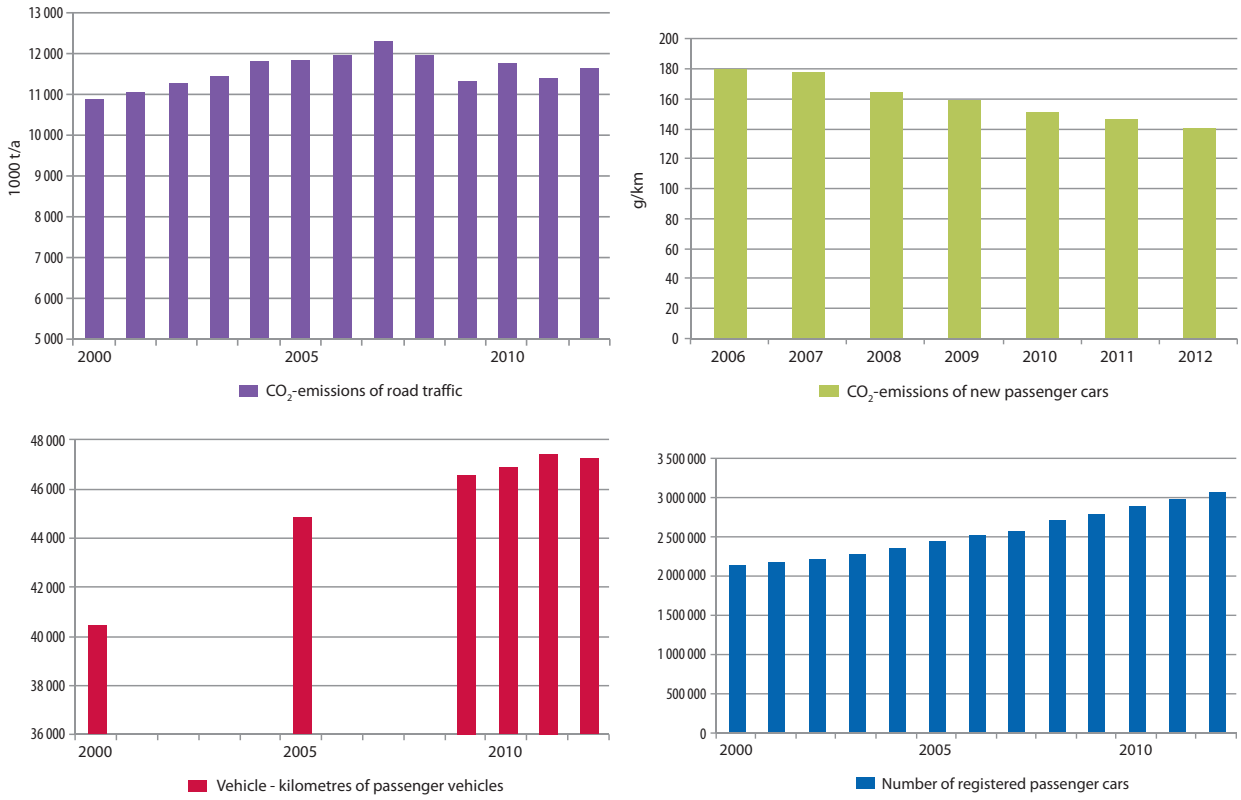
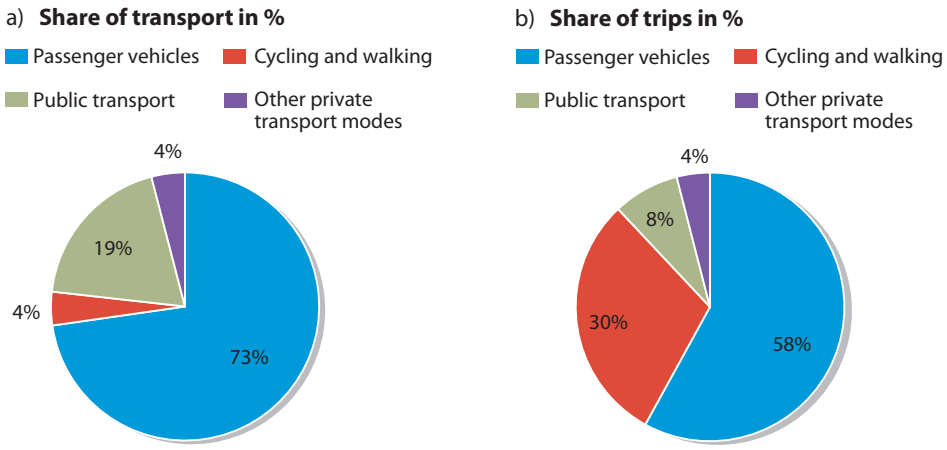



**Figure 3. Shares of transport modes in Finland. Graph a) shows the shares of kilometres of transport; graph b) the shares of the number of trips.**[22]




22 FTA, 2012

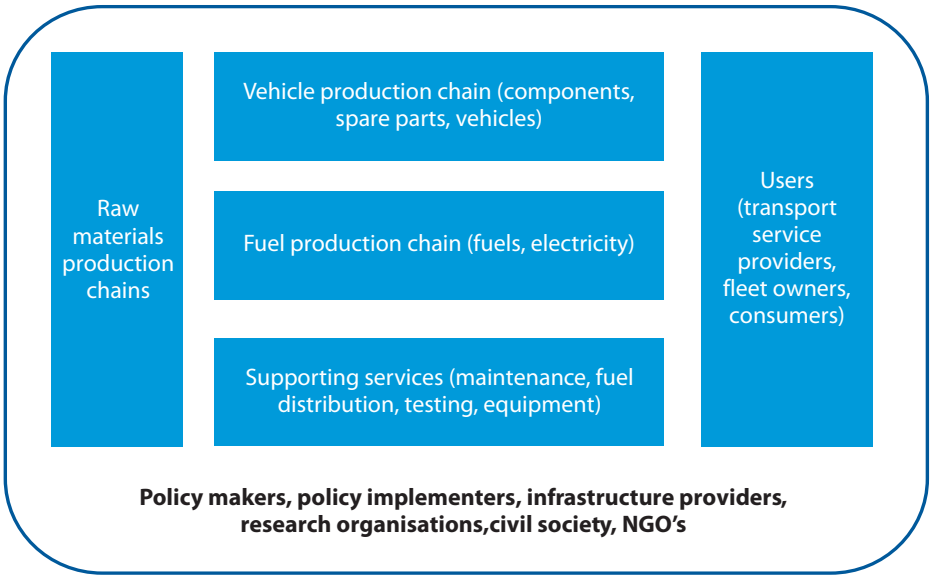
One of the big megatrends influencing all parts of our societies is the aging of population. While all EU countries are facing this demographic challenge, Finland is one of the countries where the aging is taking place rapidly. It is estimated that, while in 2011 18% of the Finnish population were over 65 years of age, in 2030 26% of Finns have passed the age of 65 years.[23] While this creates obvious challenges for public health care system and labour markets, it will also change the needs for travel and traffic services. One example of this is shopping. Surprisingly, the fastest growing online shopping group in Finland are the active Internet users over 65 years in age. Internet payment company Klarna has reported an astonishing 112% growth in online shopping during 2012 amongst this group. The growth rate of younger age groups is half of that.[24]

## 3.2 Key actors

The main policymakers in the transport system are the ministries that are responsible for transport related decisions and policies (Ministry of Transport and Communication, Ministry of Employment and the Economy, Ministry of Finance, Ministry of the Environment). The Parliament directs funds and approves relevant legislation. The national Transport Agency and Transport Safety Agency have important roles in the policy implementation. Regional and municipal public organisations are involved in infrastructure planning and organising transport. Finally Tekes provides innovation funding for the transport system. Infrastructure providers include the state-owned companies managing roads and railways, municipal organisations, as well as various private service organisations. Research organisations and consultants participate in developing the knowledge base and civil society organisations including NGOs are involved in the formation of public opinion and influence the policy process. The private actors, who operate within this context, form various value chains, which offer products and services to the users. The main actor groups are shown in Figure 4.

The multitude of actors and their mutual relationships contribute to the stability of the existing regime, which supports the interest of the dominant actors.

**Figure 4. Main actor groups in the land-based personnel transport system**




23 http://www.eurofound.europa.eu/eiro/2013/09/articles/eu1309021i.htm

24 https://klarna.com/fi/lehdistopalvelut#/pressrelease/view/yli-65-vuotiaat-nopeimmin-kasvava-verkkokaupan-asiakasryhmae-915329

## 3.3 Transport policies

Policies potentially influencing socio-technical change in transport systems include transport strategies and policies of the EU, the government and municipalities. In addition, other policy domains[25], including innovation policy, energy policy, fiscal policy, industrial policy, environmental policy and land use policy have impacts on stability and change in the context of the transport system. While land use policies are extremely important for transitions, they are not a subject of this report as they often fall under the jurisdiction of municipalities. Often the problems for deployment of innovations in transport sector are related to land use policies and therefore their role should be carefully considered in cities and their neighbouring areas.

According to the latest Government Report[26] the main goal of Finnish transport policy is "to secure smooth and safe mobility in accordance with the needs of the economy and the inhabitants of Finland, along with measures to reduce transport-related emissions and promote sustainable development". The Government Budget Proposal for 2014 included 1,980 million euro to be used for transport infrastructure, transport-related government services and subsidies for the transport sector, which accounts for 3,5% of the whole government budget.

Road transport all together receives both direct and indirect subsidies in the form of tax benefits, such as certain exemptions to vehicle and fuel taxes; tax exemptions for work-related travel and parking benefits granted by employers. Finnish Transport Agency has reported that the tax benefits for road transport exceed the taxes collected from road transport.[27]

The government purchases train, bus and coach transport services to ensure countrywide services. The budget allocation is ca. 100 million euro for 2014, of which 30 million is reserved for subsidies supporting public transport in municipalities and cities. Of this sum 12, 75 million euro is reserved for the public transport in Helsinki, Tampere, Turku and Oulu. Public transport receives funding also from the municipalities.

The most significant national-level policy instruments include regulation affecting fuel and vehicle emissions and biofuels, fuel and vehicle taxation, and subsidies for public transport, and work-related travel. Innovation policy has not put significant focus on transport but two transports related research programmes have been carried out: the Electric Vehicle Systems Programme (2011-2015, 80 million euro) and the Biorefine Programme (2007-2012, 250 million euro), and biofuel development has been extensively funded in various ways. These budget allocations present a very technology-oriented and modular approach to changing the transport system. In contrast, only 900 000 euro has been budgeted for mobility management[28] for 2014. [29]

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25 Policy domains have been defined as" components of the political system organized around substantive issues" (Burstein, 1991).

26 Council of State, 2012. P.83

27 Tervonen and Metsäranta, 2012

28 Mobility Management (MM) is a concept to promote sustainable transport and manage the demand for car use by changing travellers' attitudes and behaviour. (EPOMM)

29 Kivimaa and Virkamäki, 2014; Upham et al., 2014

# 4

# Developing niches in the transport sector

The main niches developing in the passenger transport sector in Finland are described in this Section, starting from niche-innovations affecting the internal combustion engine vehicles towards niches potentially changing the whole transport system more significantly. Each Section discusses the way in which the niche has developed, the pressures of the existing regime it needs to overcome and the policies that have been put in place to protect the niche.

## 4.1 Biofuels

### Development of the niche[30]

The success of the biofuels niche in Finland is based on several factors: creation of demand through policy measures, long-standing tradition in bioenergy research in Finland because of the abundant forest resources, and innovative actors aiming at second generation biofuels. Even if the utilisation of biofuels in transport requires a major transformation within the oil industry supply chains, no significant transition in the transport regime is needed, as the products can in most cases easily replace the existing fuel products.

Tekes has funded a long series of bioenergy research and development programmes from the 1980's driven by the active forest sector in partnership with the research community both in Finland and abroad. The development of transport biofuels, however, is rather recent and strongly driven by EU policies, which have created a market for biofuels.[31]

Neste Oil started the development of HVO (hydrated vegetable oil) in 2001, when the preparation of a distribution mandate had been started in the EU. The development was based on earlier technology exercises, and was supported by Tekes funding[32] and the delay of the Finnish government to implement the Biofuels directive[33]. In 2006 St1 Biofuels was founded[34] for the production of fuel ethanol from waste materials using technology developed at VTT (Technical Research Centre of Finland). Commercial production of both HVO and waste-based ethanol started in 2007. A real boost for the development of liquid biofuels in Finland was the decision to set the national target of biofuels to 20% instead of the 10% target set in the EU RES directive of 2009[35]. This prompted e.g. large investments by Neste Oil and an increase in the ethanol content of regular petrol from 5% to 10%.

Finnish biofuel actors have been active in the search of non-conventional raw materials. The potential of wood has been widely studied motivated by the "double-counting"[36] rules introduced by the sustainability criteria of the RES-direc-

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30 The niche description is mainly based on the following papers: Lovio et al., 2011; Peixoto et al., 2013

31 Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport (Biofuels Directive); Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources (RES-directive)

32 Interview Neste Oil 2010

33 Laki biopolttoaineiden käytön edistämisestä 446/2007: http://www.finlex.fi/fi/laki/alkup/2007/20070446, last accessed18.11.2013

34 www.st1.fi

35 Finland's national action plan for promoting energy from renewable sources pursuant to directive 2009/28/EC

36 Within the EU Renewable Energy Directive 2009/28/ EC (RES) the use of waste and residues is supported as a favourable alternative to traditional commodities-based feedstocks. In order to foster the use of such feedstocks, the RES allows mineral oil companies to blend only half of the biofuel into fossil fuel in order to reach their blending obligations if the respective biofuel was produced from waste (RES, Art.21). This incentive is widely known as double counting. (http://www.biofuels-news.com)

tive, the possibility of EU investment support for the facilities[37], and extensive public R&D funding available. Most of the activities on gasification and Fischer-Tropsch-process[38] in different alliances have been given up because of the profitability has been considered poor. Instead, an incumbent forest sector company UPM is building a plant producing biodiesel from tall oil, a by-product of pulping. Various waste raw materials are used and studied by both Neste Oil and St1.

## Lessons from other countries

The Finnish context for biofuel development is very specific. While legislation is a common driver within the EU, local contexts create distinct development paths. The Swedish context is rather similar to the Finnish one, but in Sweden biogas, DME (dimethyl ether) and flexi-fuel vehicles (FFV) are supported more strongly than in Finland. Compared to Denmark and France[39], biofuel development started late in Finland, but in France products based on agricultural crops (1st generation biofuels) may have hindered the development of 2nd generation biofuels.[40] Nonetheless, in all three countries compared biofuels have changed the oil business from vertically integrated companies to broad networks of companies.[41] A summary of examples of local drivers, existing competencies, products and alliances is presented in Table 1.

## Policies for niche protection

In Finland the whole biofuels sector is strongly policy-driven. The strongest policy instrument has been the distribution mandate given by EU legislation (see Table 2), which has significantly supported market formation for biofuels.[42] Finland opted for a higher target for biofuels requiring that 20% of the energy of transport fuels should be based on biofuels by 2020.[43] This created a protective space especially for the development of liquid biofuels,[44] while downplaying other possibilities such as biogas or electric vehicles.

From the originally very strong support for increasing biofuels, policy-makers have gradually increased restrictions on the raw materials used. This is based on the limited avail-

**Table 1. Comparison of some aspects of biofuels development in three EU countries**

| | Early local drivers | Technological competencies | Products | Alliances |
|---|---|---|---|---|
| Denmark | Need to develop domestic energy sources after being dependent on imported energy. | Biotechnology. | Ethanol from agricultural residues. | Enzyme producers and bioenergy companies. |
| Finland | Need to develop bioenergy from forest-based raw materials. | Wood-using technologies, HVO-process. | Ethanol from waste, HVO-diesel from palm oil and residues. | Oil refiners and forest products, oil refiners and waste producers. |
| France | Need to create new uses for agricultural surplus. | | ETBE and ethanol from sugar, FAME from oilseed. | Sugar producers and enzyme producers, Oil refiners and agro-industrial companies. |

37 Interview UPM 2010

38 www.upm.com, www.storaenso.com

39 Denmark, Finland and France were selected for the study as EU countries with different contexts for biofuel development.

40 Peixoto et al., 2013

41 Peixoto et al., 2013

42 Kivimaa and Virkamäki, 2014

43 The high target is based on the availability of residual raw materials like wood residues and waste, which can be "double-counted" for the target.

44 Kivimaa and Lovio, unpublished

**Table 2. Summary of policy impacts on the development of biofuels**

| Policy | Goal | Enabling impact |
|---|---|---|
| Continued Tekes funding for bioenergy from the 1980's. | Domestic self-sufficiency in energy, regional employment and viability. | Technological know-how. |
| EU Biofuels directive 2003. | Climate change mitigation and reduction of dependence on imported oil. | Creation of demand for biofuels. |
| EU RES directive 2009 (including sustainability criteria). | Climate change mitigation and reduction of dependence on imported oil. | Creation of demand for biofuels, not based on agricultural crops. |
| Finnish Target 20% for transport biofuels. | Climate change mitigation. | Creation of demand for Finnish biofuels. |
| Sustainability criteria for biofuels (proposal 2012). | Controlling the unintended consequences of biofuels, and ensuring the climate impacts. | Limiting the biofuels based on agricultural crops, and creation of market for residue-based biofuels. |

ability of biomass, on increasing criticism on the legitimacy of some raw materials (e.g. palm oil), and on the questioning of the overall climate impacts of biofuels.[45] The latest proposal for sustainability criteria on biofuels restricts the share of biofuels based on agricultural crops and gives advantage to waste-based biofuels. This has prompted activities for broadening the raw material base to wood- and waste-based raw-materials.

Biofuels are expected by Finnish policy-makers to be an essential solution for reducing the oil-dependency of transport also in the future, as shown in the objectives for future propulsion technologies. Especially in freight transport and heavy vehicles biofuels are seen in Finnish policy circles as the major future option. The final report of the *working group on future transport technologies and fuel options*[46] states that different modes of transport should be prioritized according to the needs for alternative fuels and the technical constraints, fuel availability and effectiveness of the measures. The working group sets targets for 2050: e.g. rail traffic should be 100% electrified; road transport should be almost emissions free due to the use of electric vehicles and liquid biofuels; the share of biofuels in freight transport should be 70% and the share of electricity in urban freight and public transport also 70%. Finland should also build an infrastructure for new fuels by 2020 (as demanded by EU legislation) and sustainable biofuels should be produced in Finland in amounts equalling the national demand.

## 4.2 Electric vehicles

### Development of the niche

The development of the electric vehicles niche in Finland has been a result of systematic "expectations work" of private actors towards politicians and policy-makers.[47] In the beginning of 2009, approximately 40 Finnish companies were estimated to be active in the field and their net sales totalled 200 million euro.[48] One of the main barriers to policy action was a general belief that support would leak to foreign automotive manufacturers. After extensive lobbying emphasizing the broader scope of the field, the Ministry of Employment and the Economy (MEE) appointed a working group to examine the prospects of electric vehicles in Finland and elsewhere (MEE working group).

The ambitious recommendations of the MEE working group[49] generated a new wave of private action. The events received much public attention resulting in remarkable media hype.

After the disappointments experienced in both car and component manufacturing (e.g. European Batteries), the actors reframed the field from cars and components to infrastructure and services. The Electric Vehicles Systems Programme (EVE) funded by Tekes was launched in December 2011 after extensive advocacy. One of the main activities in

45 Hildén et al., 2013
46 MINTC, 2013a
47 Temmes et al., 2013
48 Biomeri Oy, 2009, p. 130
49 MEE, 2010b

BOX 1.

## Virta Ltd. enables the use of electric cars throughout Finland

Seventeen Finnish energy companies have founded Liikennevirta Oy, a charging operator company for electric cars. The new company connects charging stations under different ownership into a Virta. Ltd. charging network. This makes it possible for electric car drivers to charge their cars at all charging stations equipped with the Virta. Ltd. symbol throughout Finland. In addition to energy companies, Virta. Ltd. services can be provided by e.g. municipalities, cities, and chains of stores, parking garages or drive-in fast food restaurants.

In August 2013 there were 330 chargeable automobiles in Finland and 261 public charging stations, of which nine were fast charging stations. By summer 2014, the number of fast charging stations will increase from nine to 18.

2013 was to prepare the founding of the Virta Ltd (Liikennevirta Oy) (Box 1), the aim of which is to make it easier for the user to change from the internal combustion engine car to an electric vehicle.

### Lessons from other countries

Norway and Estonia, the leading countries in terms of electric vehicle penetration, have implemented different policies to promote market formation.[50] In Norway, the emphasis is on supporting the purchase of electric vehicles by private people, while in Estonia the focus is on reducing the anxiety of users about the short travelling range of electric vehicles (Box 2). Both countries have enabling factors: Norway has inexpensive electricity and Estonia has surplus $CO_2$ quotas[51]. However, both countries also aim at improving the air quality of cities and fulfilling the goals of renewable energy through these policies.

BOX 2.

## Norway[52] and Estonia[53] – superior penetration of electric vehicles among the public or nationwide charging network

The Norwegian incentives for electric vehicles include a complete exemption from vehicle tax. In addition, battery electric vehicles are allowed to drive on bus lanes in large cities such as Oslo. Parking is free and there are free public charging points (700 in Oslo) in the parking areas. The total fleet of electric vehicles in Norway exceeds 20 000 cars. The incentives in Norway have been in place for a decade and the need to gradually reduce niche protection has already become evident. Some bus lanes of Oslo have started to fill with electric vehicles, which is a hindrance to public transport.

Estonia decided in 2010 to trade its surplus quotas of $CO_2$ emissions against electric vehicles and a nation-wide public quick charging network in order to reduce the emissions of transport. The quotas were exchanged to a demonstration fleet of 507 electric cars for social workers, a support scheme for purchase of further electric vehicles, and a charging system including quick chargers and an associated IT-system. The main goal was to reduce the anxiety of users regarding the short travel distance of electric cars. Indeed the purchases of electric cars by private people increased after the public charging network was introduced.

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50 Joller et al., 2013

51 Surplus quotas were created based on Kyoto protocol, because Estonia's emissions had reduced dramatically after 1990. The surplus was available for trading according to the Green Investment Scheme (GIS), a financing mechanism where financial resources that come from trading the country's CO2-quotas are channeled into environmental projects that help to cut greenhouse gas emissions. Each country selects its investment targets. Among others Estonia made a contract with Mitsubishi Corporation on electromobility.

52 Joller et al., 2013

53 Joller L and Varblane U, 2013. Estonia as the country of electromobility living lab. Unpublished manuscript, University of Tartu.

The electric vehicles niche is not the only nurtured niche in any of these countries. Estonia supports also public transport; Norway and UK (Box 3) are active in various niches.

BOX 3.

### The UK has decided to simultaneously support several ULEV technologies[54]

In September 2013, the United Kingdom launched a strategy for ultra-low emission vehicles (ULEV). A specific office was founded to coordinate an initial funding of £400 million for 2015 in the following areas: grants to support the purchase of ULEV's both by private people and by the fleet sector, support the set-up of recharging points (called Plugged-in Places) and support to research and development. In addition, incentives through the tax system are being planned. Support is given not only to electric vehicles but to fuel cell vehicles and to the improvement of the technology of internal combustion engine vehicles especially in the freight transport sector.

#### Policies for niche protection

The main innovation policy measures supporting electric vehicles in Finland have been 1) the Ministry of Employment and the Economy working group, which defined the general goals of policy in 2009, 2) the Electric Vehicles Systems Programme (EVE) 2011-2015, an R&D and demonstrations programme by Tekes, and 3) investment support for electric vehicles and their charging infrastructure by MEE. The EVE programme and its demonstration platforms have created a community of electric mobility actors supported by the Electro Mobility Group coordinated by Technology Industries.

Despite investment support for electric vehicles, the penetration of electric vehicles in Finland has remained very slow. Registrations of plug-in hybrid cars have started to increase in 2012-2013[55].

If the Directive for alternative fuel infrastructure[56], proposed by the Commission, is accepted, Finland should have 71000 recharging points and 7000 public recharging points by the end of 2020. In line with this proposal the Working Group on Alternative propulsion for the transport of the future[57] forecasted a significant increase in ultra-low emission passenger vehicles and the necessary infrastructure by 2030.

## 4.3 Seamless mobility; improved public and intermodal transport

#### Development of the niche

Public transport can be divided into local, commuter, regional and long distance transport. The niches related to public transport have been developed especially in cities. Early on, actors have adopted innovations related to ICT-technologies[58]and low-emission vehicles technologies. In some cities also service innovations, such as Kutsuplus[59] in Helsinki, are being tested. The Helsinki Regional Transport Authority has also been active in planning intermodal transport services such as park-and-ride concepts.

Niches in public transport include first-generation smart card ticketing systems, mobile travel information systems, and route planning applications such as Reittiopas.fi in Helsinki. Reittiopas.fi has over 150 000 daily users and it is one of the most popular websites in Helsinki. The same platform has been used in Tampere for their own route planning system. A similar application exists also at the national level but it is functioning poorly and there are no national policies supporting its development.

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54 Office for Low Emission Vehicles, 2013

55 http://www.trafi.fi/palvelut/tilastot/tieliikenne/ensirekisteroinnit

56 Proposal for a Directive of the European Parliament and of the Council on the deployment of alternative fuels infrastructure 2013/0012 (COD)

57 MINTC, 2013a

58 Finnish people were early adopters in the use of mobile technologies. 9 % of the Finnish people use Internet daily to find information about transport journeys.

59 Service run by Helsinki regional Transport Authority: a bus that can be ordered via mobile technology up to 10 minutes before your journey. https://kutsuplus.fi/tour

Recently, a national attempt for a second generation ticketing system has been made. In September, 2013 it was announced that 22 Finnish cities and the government will create a single card that would be valid in all the 22 cities and also in long-distance coaches.[60] Once finished, a customer could use the same card while travelling in any of the 22 cities and in certain long-distance couches. Later the system would be applied in trains as well. Helsinki region is not part of the 22 cities, as Helsinki Region Transport (HSL) is improving and broadening its own regional ticketing system.

Public transport technologies are developed in programmes funded by Tekes, such as the Electric Vehicles - EVE programme, and electric busses have been tested and even built in Finland. The goal has also been to optimise electricity use in public transport. Railway and tram vehicles and engineering products are developed by Transtech, a Finnish company established in 1985.

In many smaller cities and at the regional level new concepts and innovations have been rare. The service level has diminished. One of the reasons behind this slow diffusion is that public transport in Finland has traditionally been rather tightly regulated. The field has been opened up to competition slowly, and mainly due to requirements set in EU legislation. Actors have had quite stable shares of the market. The tight regulation, little competition and the dominance of incumbents have hindered innovations in the field.[61]

### Lessons from other countries

Recent studies show that, as the needs and preferences of individuals vary, the planner and decision-maker can only do their best to make the whole system as functional as possible (i.e. develop the service aspects, see Section 5.2.).[62] Some of the key parts of the public transport system are the ways in which public transport is organised, how well the travel chains function and how fast different modes are.[63] Also cost of the public transport compared to alternative modes has been found to be important.[64]

Successful policies from other countries include: dedicated bus lines (e.g. in Nantes, Eindhoven); environmental or low-emission zones in city centres (Prague, Stockholm, Berlin); eco-drive programmes (in the Netherlands; similar to environmental bonus of Helsinki Regional Transport Authority), smart ticketing systems (as one in the Netherlands, presented in Box 4) and different ICT-technologies for route planning and travel information (Germany, UK). The Belgian city of Hasselt was the first city to introduce a free public transport scheme in 1997. It brought both environmental benefits and attracted new tourists. Due to financial reasons, Hasselt introduced a pricing system in 2000s. Even though, the city of Tallinn has decided to try out the free public transport scheme since 2013.[65]

BOX 4.

### OV-chipkaart in the Netherlands

OV-chipkaart is the payment method for all public transport in the Netherlands. It started out as a collaborative initiative of five large public transport operators: the main rail operator NS, the bus operator Connexxion and municipal transport operators of the three largest cities: GVB (Amsterdam), HTM (the Hague) and RET (Rotterdam). Nowadays all public transport companies in the Netherlands use and are able to use the system.

With OV-chipkaart one "checks in" at the beginning of one's journey and "checks out" and in again when changing operator or mode of transport (e.g. from a bus to a tram), and "checks out" when one's journey is complete – upon checking out, the OV-chipkaart recognises which travel products (if any) have been used and takes action accordingly. If a user fails to check out, they would pay more than the quoted fare for their journey, deterring misuse of the system. This deposit – minus the cost of the actual journey – is refunded a passenger's OV-chipkaart upon checking out.

60 http://www.motiva.fi/ajankohtaista/motivan_tiedotteet/2013//joukkoliikenteessa_matkustus_helpottuu.5790.news
61 Rosenholm, 2013
62 Bristow et al., 2008; Buhrmann et al., 2012; Rantala and Wallander, 2012
63 Rantala and Wallander, 2012
64 EEA, 2013
65 EEA, 2013

BOX 5.

## Services for seamless mobility

**Turin: 5T – Traffic operation centre integrated with Public Transport real-time Monitoring System**

A company owned by the city of Turin, regional authorities and one private company offers different kinds of services with an aim to make traffic work better in general – with a specific focus on public transport. Its services include information about traffic conditions and parking availability, a system that allows green light priority to public transport all the time, controlling vehicle access to city centre, and an internet journey planner that provides real-time information on bus and train delays, arrival times at bus stops, best route calculations and real time information on parking availability.

There are also plans for 'Biglietto Integrato Piemonte' – a single contactless ticket for the purchase of any mobility service in Piemonte region.

**Madrid Interchange Bus Stations**

In 2004-2008, Madrid built four new Interchange Bus Stations with a total budget of 369 million euro. These stations allow passengers to change more easily from long-distance coach and regional bus systems to local bus and metro networks in Madrid.

The stations improve the interconnection between long distance transport networks and local/regional transport networks of all modes, reducing total travel time and increasing the efficiency of individual trips and the system as a whole.

The system has received the best innovation in public transport price in 2010 (ITF-UITP price). It is rather exceptional also because of the innovative private-public funding.

Many countries and cities have been looking for ways to support intermodal transport, which is defined as the use of at least two different modes of transport in an integrated manner in a door-to-door transport chain. Usually the promotion of intermodal transport integrates many innovations together. The two examples presented here are from Turin and Madrid (Box 5).

### Policies for niche protection

Up until now, there have been only few national policies supporting niche creation in public transport in Finnish cities. Legislation concerning bus and coach transport was changed in 2009 to open up competition in the field. The operation of trains is still the monopoly of VR but EU legislation is demanding to open also train transport to competition. The new strategy on intelligent transport and its implementation may give protection for niches in this field.[66]

Methods to improve the vehicle technologies in public transport include the environmental bonus programme by Helsinki Regional Transport Authority and public procurement requirements. The requirements were tightened in 2012 when the Act on environmental requirements in public procurement related vehicle purchases was adopted.

New possibilities lie in intermodal transport systems which require also new types of innovations policies. Earlier studies show that for popularity of public transport, door-to-door time and effort needed to reach the nearest bus stop are few of the decisive selection factors for users. These basic service aspects (see Figure 8, Section 5.2.) should be taken into account in all levels of transport and land use planning, while also promoting intermodal transport.

66 MINTC, 2013b

The opportunities in larger cities and their neighbouring areas are different than those in smaller municipalities and regions. It is not possible to find a solution that would fit in all areas. In smaller regions it would be recommendable to think about innovative ways to deal with all transport organised by public authorities (public transport, rides to school, services for disabled and the elderly etc.). The Ministry of Transport and Communication has published a report on the issue.[67]

## 4.4 Cycling and walking

### Development of the niche

One of the first cycling related innovations in Finland was JOPO, introduced in 1965 – a revolutionary "every one's" bicycle. About 200 000 first generation JOPOs were sold in 1965-1974, mainly in Finland. The second generation JOPOs came to the market in 2000. The producer, Helkama, has slowly transferred the manufacturing process back to Finland and since autumn 2013 all JOPOs are produced in Hanko, Finland.[68] Over 100 000 bicycles have been sold in Finland, Sweden, Denmark, Germany and even Japan.[69] One new company is the successful start-up Pelago bicycles, which focuses on high end quality bikes. Pelago was founded in 2009 by local activists without much public support. Currently Pelago, which has won the ISPO Brand New Awards –competition, has a turnover of 1,1 mill. euro and sells bikes to many other European countries in addition to Finland.[70]

Otherwise, the cycling and walking niche has not developed very well in Finland. The share of cycling and walking relative to other transport modes has decreased during the past decades and national innovation funding is not focused on creating innovations in this field. Positive signals come from Helsinki, where the share of cycling and walking has been gradually increasing.[71] Helsinki has taken certain small steps: in central areas there are the new bicycle lanes, parking facilities have been upgraded and new the Baana cycling passage has improved cycling in the central Helsinki (as well as the image of cycling). Helsinki has also taken steps to develop its' own bicycle brand (Box 7). On the other hand doubts have been raised about the real use of funding for bicycle infrastructure in Helsinki[72], which may hinder the development.

Most actions taken in cycling and walking can be found at grass roots level. For instance Megapolis, a project by the environmental NGO DODO, has been an area for developing innovative business concepts at the city level.[73]

Innovations in planning and policy making have taken place in the form of mobility management. A national network has been set up, while municipalities have the jurisdiction over the actual actions. Until now mobility management projects have mainly been informative, for example, to invite employers to support cycling, walking and public transport instead of passenger vehicles.[74] Some cities, such as Oulu and Kuopio, have adopted policies to support pedestrianisation and restrictions on car use and parking, while the Helsinki Regional Transport Authority has promoted park-and-ride schemes (Box 6).

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67 http://www.lvm.fi/tiedote/4145276/selvitysmies-esittaa-henkiloliikenteen-kehittamiseen-isoa-remonttia

68 http://www.taloussanomat.fi/yrittaja/2013/06/05/jopon-valmistus-palasi-suomeen-myynti-kasvoi/20137979/137

69 Good News Finland, 26.12.2012

70 http://pelagobicycles.com/about

71 FTA, 2012; http://www.fillari-lehti.fi/Etusivu/tabid/40/ctl/ViewItem/mid/539/ItemId/666/Default.aspx

72 http://www.kaupunkifillari.fi/blog/2014/01/13/mihin-pyorailyn-rahat-katoavat/

73 Ideas include services such as The Tire man (Rengasmies), who offers bike mechanic services for cyclers having trouble on the road; Finderbase-application, which helps to find e.g. stolen bicycles and Tavarafillari-blog, which gives information about family-suited bicycles. http://rengasmies.com/, http://finderbase.com/en/, http://tavarafillari.fi/

74 Kivimaa and Virkamäki, 2013

BOX 6.

## Kamppi Bicycle centre[75]

The Bicycle centre has been in operation in Kamppi since summer 2012. Services include repair services; tools for do-it-yourself maintenance, and a supervised parking area. During summer months bicycle rentals are also available.

The centre was created in co-operation between the City of Helsinki and private businesses. The city offers the venue and brand, while commercial services are run by entrepreneurs. Most of the services are available only during summer time; repair services and parking facilities also during the winter. During the second year, 10-30 people have visited the centre per day.

The city is currently thinking about the continuation of the project. There are no definite plans yet but one of the options would be to provide similar services also in other areas of Helsinki, e.g. close to interchange train stations.

People have considered this kind of centre as useful but hoped for better opening hours and cheaper services (Metropolia School of Applied Science, 2012).

BOX 7.

## Branding cycling services – case Helsinki[76] (Tiina Koivusalo)

In the 2013 cycling promotion programme, the city of Helsinki identified a need to develop a positive and recognisable cycling brand for Helsinki. The brand and a unified concept for the city cycling services, the "Dotted Line Concept", were developed by a student at the Aalto University School of Design and Architecture.[77]

To facilitate the handling of cycling services by the different city departments the whole of cycling services were combined into a service family. It showed the close relations of cycling infrastructure, guidance system, bicycle parking and transporting facilities in public transport, city-wide cycling communication and marketing and upcoming bike-share system and the Kamppi Bicycle Centre.

The greatest barriers in the branding process were the structural system of Helsinki and lack of ownership of cycling services in the Helsinki departments. Also HSL (Helsinki Regional Transport Authority) as a transport authority was only interested in cycling communication and marketing closely connected with public transport, not in creating a whole cycling brand.

Productization of the bike sharing brand can be seen as a possibility for new businesses. Branding theories show that unifying design affects recognisability, desirability and reliability of the cycling services at user level. Branding can also spark international interest.

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75 http://pyorakeskus.info/; Malk et al., 2012; Interview with the coordinator

76 Koivusalo, 2013

77 The thesis was followed by a pilot project in Sörnäinen, where certain applications were tested such as marked metro car, cycling guidance in metro station and new cycling ramps.

### Lessons from other countries

Once a city is built around a certain structure, corrective moves are difficult and take time. Nevertheless those changes are possible. In those countries that have managed to decrease the use of private vehicles (Netherlands, Denmark, Sweden, Switzerland) the changes have happened over 30-40 years.[78] National policies have supported the efforts done by cities. Cities in such countries have adopted several different elements: they have improved the infrastructure for biking with dedicated bicycle lines, more direct routes and separation of cycling and walking (cities in Denmark, Sweden, Germany and the Netherlands). Parking facilities have been improved to better suit the needs of people. For instance, in Copenhagen, specific parking areas for cargo bikes have been built and, in Basel, a huge underground parking facility for bikes has been constructed at the main railway station that is the most important transportation hub in the area.[80] Other examples of innovative policies are barometers and Greenwave in Odense, marketing measures in Berlin and new types of city bikes (box 8). These cities follow a crucial principle: in order to increase the share of cycling, walking and public transport, these need to be put on the top of the priority list.[81]

Many countries have also promoted intermodal transport by improving opportunities to carry bikes on public transport and ticketing systems that combine public transport and city bikes (France and Germany). In these countries there are also many business opportunities present (Box 9).

BOX 8.

#### "Call a Bike"[79]

It is a service provided by the German Railways (Deutsche Bahn) in several German cities, including Berlin. Bikes are rented and returned by using mobile phones.

Call a Bike tries to makes the most of new technical developments. Nowadays, customers in many cities no longer even have to have a mobile phone to rent or return a bike. Instead there are pillars, where customers use a chip card to check in. In Frankfurt am Main customers are able to check out simply by pressing a button.

The BMW automobile group has declared Call a Bike the official means of transport for its 60,000 employees when they have to cover short distances on the company premises.

BOX 9.

#### Business opportunities in cycling

Business opportunities in cycling could be looked from three perspectives: city planning and infrastructure, technological development, and services. In many countries it is in fact the urban middle and upper class that has created the bike hype. These people want to spend their time and money in a sustainable manner, yet are willing to pay more for quality and style. Many companies have reacted to this and there is a growing number of cycling related businesses booming globally. For instance, there are many clothing brands creating urban, business-fit clothing for cyclists. Other ideas include suit packs for cyclists to keep their work clothes crease-free and different technological improvements to bikes to make cycling easier for users. Service ideas from other countries include special yoga for cyclists, cycling date services and drive-ins for cyclists.

Technology-related innovations have been such as parking-robots (Japan) and smart iPhone applications (http://www.gizmag.com/automatic-gear-shifting-bicycles/24956/) and electric bicycles.

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78 EEA, 2013

79 http://www.bahn.de/p/view/service/fahrrad/call_a_bike.shtml

80 The Veloparking has 4 dedicated bicycle ramps and 4 additional pedestrian entrances. There are also bike rental, restrooms, showers, bicycle repair services and food available.

81 Newman et al., 2009; Vaismaa et al., 2011; Kosonen, 2013; EEA, 2013; Newman P: Presentation at the Urban Fabrics -seminar, 24.10.2013. Available: http://www.urbanfabrics.fi/uploads/HkiUrbanFabricsNewman.pdf, last accessed 18.11.2013.

### Policies for niche protection

The *National Strategy for Walking and Cycling 2020* was adopted in 2011 with an aim to increase the share of journeys undertaken by foot or bicycle by 20% or 300 million trips by 2020. A corresponding decrease should take place in short passenger car trips. Currently the main national legislation that contributes to this target is the Land Use and Building Act (32/1999) complemented by the National Land Use Guidelines. The guidelines are not binding and, although the legislative goals are good, in practice, the level of national control is relatively low in this area.[82]

There is room for innovation policy measures. For innovations in cycling and walking, the major barriers are the qualities of existing infrastructure and services. As the European examples show, good quality infrastructure is crucial for making biking and walking real alternatives to driving. Thereafter, service related innovations can develop.

Similarities can be observed between successful and innovative policy measures to create better public transport systems and to support cycling and walking: political commitment, organizational structure that promotes better planning and implementation, expertise in public transport, cycling and walking; and public support. There have also been, at least to some level, participatory planning and implementation processes. It is obvious from the wide range of examples from different cities and countries that best results come from the use of multiple policy instruments.[83]

## 4.5 Reducing the need to travel

This Section describes the impacts of activities mainly outside the transport system, which affect the demand of passenger travel. These include, for example, novel arrangements of work, shopping and leisure.

Reduced mobility creates new types of businesses, not all in the traditional transport sector. Room for business has already opened up in Finland: 2% of the Finnish people do their shopping online.[84] Yet, in contrast, for example, in the UK, 74% of consumers regularly shop online for groceries. This has changed transport from driving privately-owned vehicles for shopping to delivery van transport.[85]

**Working from home** (etätyö) is generally considered a useful means to reduce transport especially during the rush hours. It has increased in Finland from 2% to 14% of working hours between 1990 and 2008; 11% of all employees have worked from home at least partly.[86] Working from home is one aspect of increasingly distributed way of working. To reduce transport, working from home should take place as full days. Distributed working has already created new business opportunities (Box 10).

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82 MINTC, 2009

83 Bürhmann, 2007; Tuominen and Kanner, 2011; Rantala and Wallander, 2012; Two interviews, 2013

84 FTA, 2012

85 In the United Kingdom, one of the leading countries for online shopping, already 74% of consumers used the internet for grocery shopping in 2012 (http://www.nielsen.com/uk/en/insights/press-room/2012/three-quarters-of-uk-consumers-use-the-internet-for-grocery-shop.html)

86 Ojala and Pyöriä, 2013

BOX 10.

### New ways of working reduce work traffic and create new business opportunities

Working takes place increasingly wherever people happen to be, in airports, cafeterias, homes, trains etc. (distributed work). This reduces the need for regular office space and regular commuting. In many cases, however, office space and services are needed. This has created new business opportunities, which potentially contribute to reduction in transport. Some examples include:

Business Center Papula (www.bcpapula.fi) in Helsinki has launched a service package called Virtual office, which can consist of hourly rental office, meeting rooms, access to various office services and a business address and mail forwarding service.

Business Meeting Park (http://meetingpark.fi) specializes in meeting facilities and temporary working spaces, which are offered 24/7.

In Mietoinen a concept of a village-based working space was experimented in 2013 (http://www.mietoinen.fi/tyotila). The space was used by various entrepreneurs, but to continue, the space and the service would have required improvements.

Hub Helsinki (http://helsinki.the-hub.net), which is part of an international network of Impact Hubs, offers in addition a community of sustainable businesses and social enterprises. If you happen to be staying abroad, you can use another hub.

#### Policies for niche protection

At the strategy level, Finland has adopted the goal of reducing the need for travel and promoting alternative transport modes. However, policy instruments have not changed accordingly and there are some instruments that guide us to using more private vehicles (see Section 4.6). For example, many work places, even governmental organisations, offer free parking places for their workers. Policies supporting mobility reduction are not effectively present at the national level and are not enough used at the municipal level.[87]

Until now the mobility management projects funded by the government (see Section 4.4.) have mainly dealt with communication, marketing and mobility planning[88]. The aim has not been to create innovations. Innovation funding has not particularly addressed mobility management, while, the TransEco programme (TransSmart since 2013)[89] has some implications on mobility management.

An important part of influencing the need to travel is land use policies and policies deciding the service level in regions and municipalities. Those policies are indeed important, but not covered in this report.

## 4.6 Policy instruments for niche protection and creation in whole transport system

In the latest *Transport Policy Report*,[90] presented by the Finnish Government to the Parliament in 2012, some pursuits towards a more systematic view on transport were made in comparison to the previous report from 2008.[91] Aims to reduce passenger kilometres and direct traffic towards more sustainable transport modes were presented in addition to renewing the vehicle fleet and developing sustainable fuel options. Also, the Climate Policy Programme of the Ministry of Transport and Communications (2009) aims to switch from conventional

87 Kerkkänen and Savikko, 2012; Kivimaa and Virkamäki, 2014

88 http://www.motiva.fi/liikenne/viisaan_liikkumisen_edistaminen/liikkumisen_ohjauksen_ohjelma

89 http://www.transeco.fi/; http://www.vtt.fi/research/spearhead_transsmart.jsp

90 Council of State, 2012

91 Kivimaa and Virkamäki, 2014

planning towards a more integrated transport system design. The recommendations give some possibilities for implementing these strategy-level aims but a lot can still be done to strengthen policy development and implementation in support of sustainable transport system transition.

This Section presents a recent assessment (carried out in 2013) of the most important national level policy instruments influencing transport (some of them originating from EU legislation) and their impacts on the personal transport system and its 'low-carbon' niches (Table 3). Each policy instrument was placed in a matrix with two dimensions: (1) the route through which policies influence GHG emissions from transport[92]: amount of transport (passenger kilometres), mode of transport (occupancy rate of vehicles), vehicle efficiency (fuel needed) and fuel efficiency ($CO_2$-emissions from fuels), and (2) their role in the technological innovation systems, i.e. which of the seven innovation system functions they support.

In addition to EU and national policies, city and regional policies also influence innovation processes in transport, and they should play a particular role in supporting innovation in transport demand reduction and modal change, even though they are not presented in the table. The role of cities is important as urban transport contributes significantly to environmental impacts caused by transport. It has been estimated that urban transport accounts for close to 25% of the $CO_2$ from transport.[93]

The table shows that the current instrument mix for transport appears to support innovations reducing vehicle and fuel emissions. Policies aimed at modal change in transport or travel demand reduction and at innovations related to these have been fewer, and mostly communication related. At the same time, some instruments have guided consumer habits towards increasing private vehicle transport. Those include mileage allowance and commuting cost reduction.[94]

The analysis shows that there are policy gaps from the perspective of low-carbon transition, at least with respect to the instruments covered. Coherent policy-mixes can be observed in relation to selected technology-specific niches, not at the system level as a whole.[95] In relation to all niches (and other transport solutions), there are gaps in policies for knowledge development and diffusion, market formation, and entrepreneurial experimentation. These gaps are further highlighted in a comparison of the Finnish policy mix to a UK one for mobility (Figure 5). A comparison to a policy mix influencing energy use reducing innovation in the UK illustrates that while the Finnish policy mix for mobility is fairly strong in terms of guidance (influence over direction of search and legitimisation of new, more sustainable paths), the concrete inputs in terms of market formation and resources are stronger in the UK. For example, the UK policy mix includes recent instruments to promote ultra-low emission vehicles (the plug-in places programme and plug-in car grants), government funds to support the procurement of green business and other means for sustainable travel in cities and municipalities, and focused innovation platforms (Catapult Centre in Transport and Environmental Technologies Institute's Transport Programme) – that are not as prominent in Finland.

While the policy mix for transport system innovation contains useful policy changes and new instruments, several areas will need attention in the near future:

- A more holistic approach to mobility and transport in policy design and implementation is needed (going beyond the strategy level and across levels of governance).
- New policies and instruments are particularly needed for *transport demand reduction* and *modal change* (from the perspective of absolute GHG emission reductions) and for *market formation* and *entrepreneurial experimentation* from the perspective of new niche creation and development.
- Policy mixes for transport system transformation imply a need not only for new policies, but the alteration or removal of existing policies in cases where they create significant barriers to new niches or present system-level change towards sustainability.

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92 Monni and Raes, 2008

93 EEA, 2013

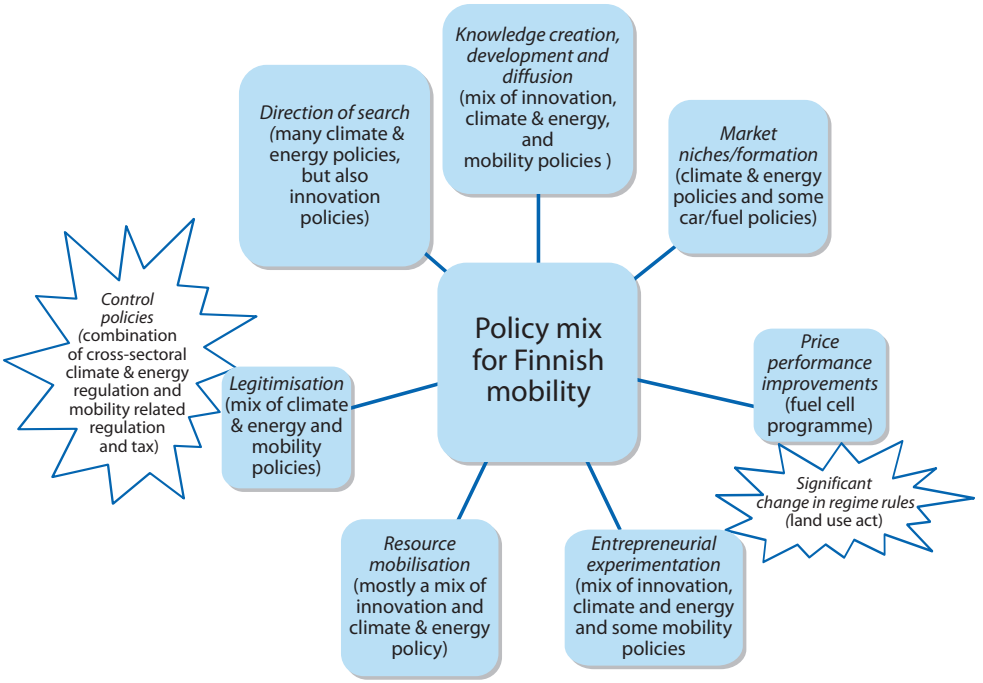
94 The commuting cost reduction alone is estimated to be greater than all the climate funding allocated by the state of Finland. Ristimäki and Oinonen, 2011

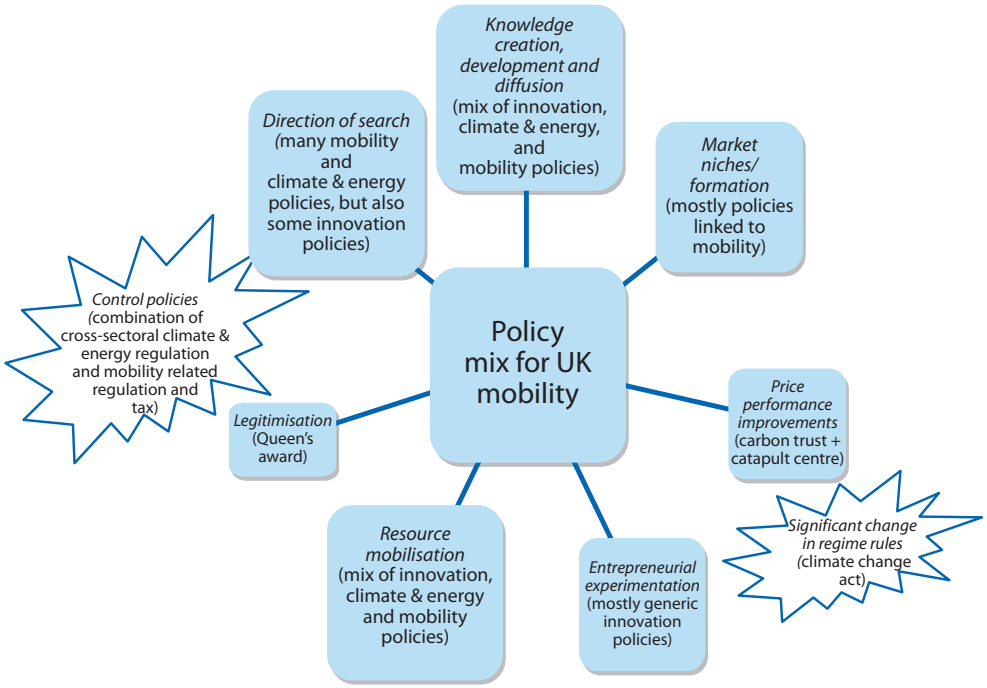
95 Kivimaa and Virkamäki, 2014

**Table 3. Illustration of the impact of existing transport-related policies on the system functions of the Technological Innovation System (TIS) approach** (source: Kivimaa and Virkamäki, 2014)

| System function | Transport demand reduction (passenger-km) | Transport mode (vehicle-km per passenger-km) | Fuel efficiency of vehicles (CO2 per km) | Reduced carbon content of fuel |
|---|---|---|---|---|
| Knowledge development and diffusion | *Support:* Sustainable communities programme | *Maybe:* Sustainable communities programme | *Support:* EVE-programme, CO2-labels for cars, *Maybe:*TransEco-programme | *Support:* Biorefine-programme, energy subsidies for demonstration *Maybe:* TransEco programme |
| Influence on the direction of search | *Support:* Fuel taxation *Barrier:* tax deductions for commuting costs and work-based driving | *Support:* Fuel taxation *Barrier:* tax deductions for commuting costs and work-based driving | *Support:* Fuel taxation, CO2-limits for vehicles, car & vehicle taxation, energy-efficiency agreements with public transport | *Support:* Regulation on the emission content of fuels, biofuels distribution obligation, fuel taxation |
| Entrepreneurial experimentation | | *Maybe:* Public transport licensing | *Support:* EVE-programme,TransEco-programme | *Support:* Biorefine programme, energy subsidies for demonstration, TransEco-programme |
| Market formation | *Maybe:* Fuel taxation, land use legislation, land use, housing and transport -agreements between state and municipalities *Barrier:* tax deductions for commuting costs and work-based driving | *Maybe:* Fuel taxation, land use legislation, land use, housing and transport -agreements between state and municipalities, public transport licencing *Barrier:* tax deductions for commuting costs and work-based driving | *Support:* CO2-based car and vehicle taxation, energy-efficiency requirements in public procurement *Maybe:* energy-efficiency agreements with public transport | *Support:* CO2-based fuel taxation, biofuels distribution obligation |
| Legitimisation | *Support:* Mobility management creating support for reducing passenger kilometres | | *Maybe:* Strong justifications for vehicle tax based on climate change and traffic safety | *Maybe:* Strong justifications for higher distribution obligation based on domestic production |
| Resource mobilisation | *Support:* Land use, housing and transport -agreements between state and municipalities *Barrier:* lack of national innovation funding for municipalities, mileage allowance | *Support:* Increasing public spending on rail, subsidies for public transport, land-use, housing and transport -agreements between state and municipalities, support for public transport | *Support:* EVE-programme | *Support:* Biorefine-programme, energy subsidies |
| Development of positive externalities | | *Maybe:* Mobility management | *Maybe:* Eco-driving instructions | |

**Figure 5. Comparison of the impact of the policy mixes for mobility in Finland and in the UK on the system functions of the Technological Innovation System (TIS) approach** (the size of the shape reflects the number of policy instruments in use)
(Data source: Kivimaa and Kern, 2014)



## Social acceptability of policies

Social acceptability is fundamental to the success of any innovation and has multiple dimensions. Consumers and users need innovations to serve particular functions at an affordable cost. Citizens grant legitimacy to those innovations or withhold it. Innovation is a thoroughly social activity, from first conceptions of design, through to products, processes or practices becoming taken for granted or little used.

In order to study how different segments of the Finnish public living in the urban areas view a broad range of innovation and transport policies, technologies and practices intended to reduce the climate impacts of transport, a questionnaire[96] was sent to a demographically stratified population sample[97] based on the Helsinki, Tampere and Oulu travel to work areas. The results reveal a range of demographic and geographic differences. The heterogeneity of opinion implies differentiated social acceptance and legitimacy for policies intended to influence socio-technical transitions in transport. The results suggest that use of an online survey panel can provide useful information on public opinion of innovation policy options but that geographical as well as demographic representativeness should be sought.

It needs to be borne in mind that the opinions recorded are those of a relatively interested, educated and older public who accept the reality of anthropogenic climate change. Most use a car frequently, but are particularly supportive of innovations that would facilitate their use of public transport, cycling and walking. A large majority are supportive of a self-reliant Finnish bio-economy for transport. Electric vehicles are seen as important but do not have quite the same level of resonance.

The group differences and associated correlations in the data highlight that while there are certainly discernible majority views, opinions do differ by both demography and geography. This in turn raises issues relating to the distribution of benefits for any given policy and also the perceived social legitimacy of particular policies. Notable statistically significant regional differences include higher car use in the Oulu region; stronger environmental concern (climate change, traffic congestion, forestry) in the Helsinki region. Of even wider importance is that there are statistically significant gender differences across most of the questions, with more men owning and using a car and with men expressing less environmental concern (climate change and congestion). Men are stronger supporters of the bio-economy for transport; women are more likely to express uncertainty, as they are in relation to electric vehicles.

There are also age-related differences, with two age extremes cycling more than the middle groups, the oldest group being more accepting of anthropogenic climate change, but the youngest groups being more inclined to link this to car use. The youngest groups are most averse to biofuel development and more likely to be neutral on electric vehicles. In terms of income, car usage increases with income. People in the lower income brackets agree more strongly with the proposition that the current level of car use has a serious effect on climate change and regarding traffic congestion. The highest income group is more positive on the bio-economy for transport, whereas the lowest income group is more optimistic than the others regarding the potential of electric vehicles to address issues such as increasing travel and congestion. Having children at home also seems to affect transport usage: those with children at home appear more likely to own and use a car, less likely to use public transport and less likely to walk. There are relatively few group differences based on educational level, but nonetheless this does relate to car usage (lower car usage among those less educated) and the same pattern for acknowledgement of anthropogenic climate change.

Further information on the survey can be found from: www.syke.fi/projects/fiptrans.

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96 The survey was conducted by TNS global, with design and analysis by SYKE, the Finnish Environment Institute.

97 In each TTWA, demographic representation was sought in terms of gender, age and social class, though the sample is older, contains more retirees, fewer students and is better educated than the census population.

# 5 Creation of new business opportunities

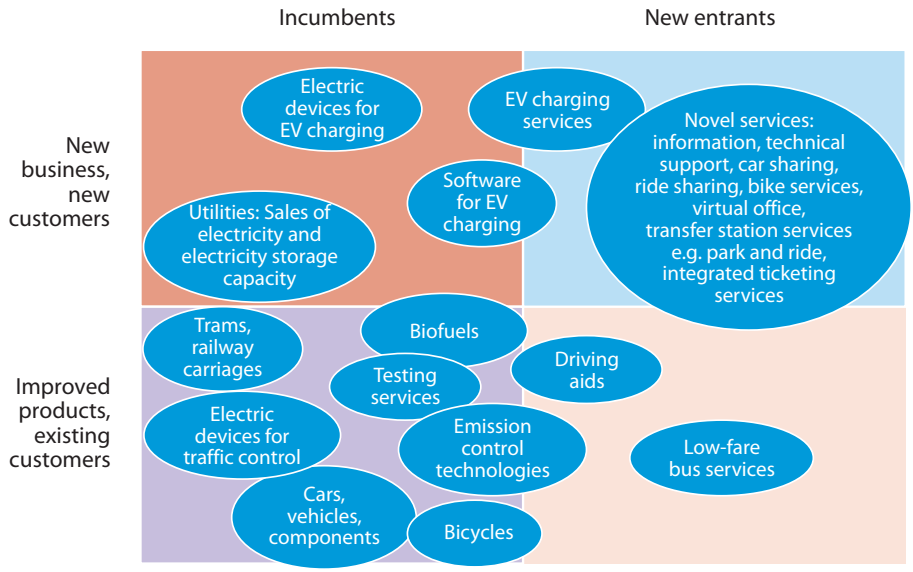
## 5.1 New businesses

Regime shifts normally create both winners and losers. New entrants are expected to be better equipped to introduce novel products and services to the market, but incumbent players, who are able to adapt to the changing regime, benefit from their better resources.[98]

The 'greening' of transport has already contributed to the development of new businesses and improved the products and services of existing businesses offered by both incumbent companies and new entrants (see Figure 6). By far the largest business, both by the turnover and by the production volumes, have developed in the biofuels sector: the business of Neste Oil is in the range of 2 billion euro per annum[99], St1 dehydrates ethanol with a capacity of 100 000 t/a[100] and UPM is about to start production of 100 000 t/a biodiesel in 2014[101]. Protection of the niche through energy and climate policies has been very successful and one can argue that there are signs of a transition to a new fuel mix.

There are numerous business initiatives in the area of electric vehicles and their infrastructure but the volumes of these businesses are still small. Some Finnish companies have

**Figure 6. Types of new business opportunities in the transport sector**




98 Hockerts and Wüstenhagen, 2010
99 ww.nesteoil.com
100 interview St1
101 www.upm.com

benefitted from export to countries such as Norway, where the market formation of electric vehicles has been supported. For example Ensto won the charging station tender of the city of Oslo in 2009 and has since expanded to various other cities. The protective space has been successful in keeping the niche alive, but has not been able to offer opportunities for its significant expansion.

Businesses related to cycling vary from actual production of bicycles to various innovative start-up services (see Section 4.4.). The role of policies has not been very strong in maintaining the niches, and local level policy measures have been more important for the expansion than national policies.

Various novel services have recently appeared on the scene. Many are provided by very small businesses and most likely all will not survive. Such has been the beginning of also the major success stories of Finnish economy. Many of the niches are claimed to be protected in declarations and statements, but active policy support has often been haphazard, increasing rather than decreasing the risks that the companies face.

To support the strategic goals of the Ministry of Transport and Communications, new innovations and business models would be needed in the areas of public transport and related services, reducing the need to travel and services for cycling and walking.

There are several activities taken up on the European level, which show that any innovation created in Finland, could also provide business opportunities on a wider scale. Other countries are looking for low-carbon transport innovations in both passenger and freight transport. European Union has its own funding mechanisms such as Marco Polo programmes. Also cohesion funds are used for transport related projects. The European transport industry has been able to use them to test innovative solutions, even though European Court of Auditors has stated some criticism towards the actual benefits of the programmes.[102]

## 5.2 Drivers of emerging business models

Even if transport related consumption in Europe has become increasingly unsustainable in the past decades (for example the ownership of private cars increased 35% between 1990 and 2007), there are several examples of emerging **sustainable lifestyles**[103]. European citizens are becoming aware of sustainability issues, and the availability of efficient and sustainable technologies and products has improved. One of the examples of lifestyle changes is a shift of preferences from ownership of goods to "access" to goods and services.[104] This is often called a **sharing economy**, which refers to economic and social systems that enable shared access to goods, services, data and talent.[105] It is enabled by web and mobile technologies, it offers various novel business opportunities and it is considered to bring both environmental and community benefits.[106]

For example, the ownership and use of passenger cars can be arranged in various ways. The traditional option has been ownership of a car for one's own use, which is relatively inefficient use of a ride. A private car also represents inefficient use of cars over their lifetime, as on average private cars stand 95% of the time unused. Various solutions of leasing, renting and sharing all aim at increasing the use of cars over time (Figure 7). In addition most concepts allow choosing the car based on the current need (big car only when there is much to transport).

**New ICT technology** increasingly allows the development of business concepts for more efficient use of private cars, like ride sharing and car lending. Car sharing and ride sharing concepts tend to be restricted by the rules of the existing regime, e.g. taxation, business licensing and insurance policies. In Box 11 two Finnish examples are shown: GreenRiders has been able to establish itself but Weegos has met serious problems with its original business model.

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102 ECA, 2013a; ECA, 2013b

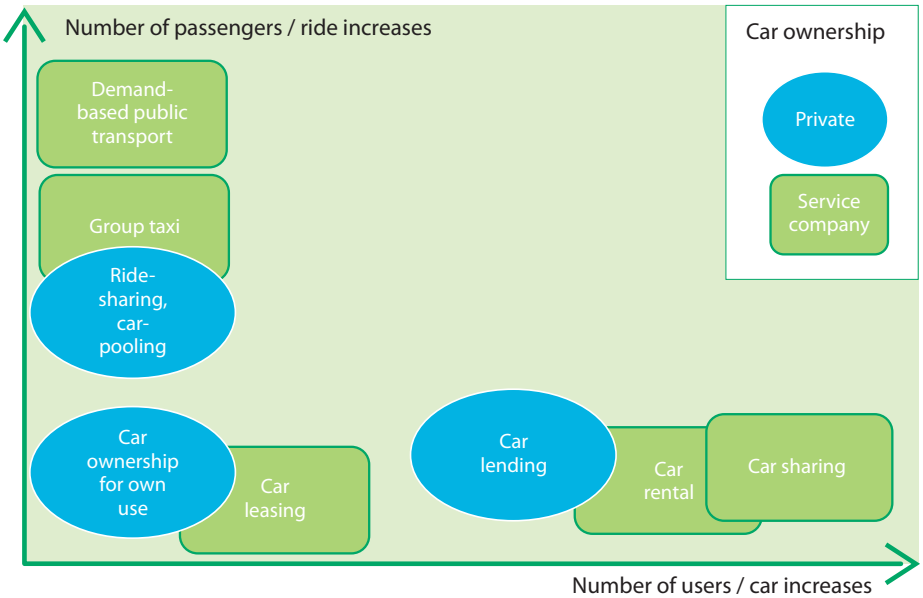
103 Sustainable lifestyles: Today's facts & tomorrow's trends. SPREAD Sustainable Lifestyles 2050 project 2011-2012.

104 Sustainable lifestyles: Today's facts & tomorrow's trends. SPREAD Sustainable Lifestyles 2050 project 2011-2012.

105 Wikipedia

106 Sustainable lifestyles: Today's facts & tomorrow's trends. SPREAD Sustainable Lifestyles 2050 project 2011-2012.

**Figure 7. Different arrangements of passenger car ownership and use**




BOX 11.

## Two different sharing services of vehicles: GreenRiders and Weegos

GreenRiders[107] is a web-based service for arranging shared rides either publicly or within trusted groups, such as companies. Internet and mobile technologies are the main enablers of the service. The largest share of the business takes place within trusted groups and these services also create income for the company, as the basic service is free of charge. The motivation for the companies to join in the service is based on the possibility to decrease the transport cost and the burden of traffic around their offices. In addition, it potentially improves the image of the company and supports the engagement of the employees. As an additional service GreenRiders offers calculation of the $CO_2$-emissions of work-related transport.

A regulatory challenge during the development of the service has been the differentiation between ride sharing and taxi service that requires a license. The current understanding is that ridesharing does not require a license. Offering transport services on a public place without license is, however, forbidden.

Weegos[108] was created in connection to an Aalto University New Venture Creation course based on a need to create use for cars that are not regularly in use by their owners. The project attracted much interest and the entrepreneurs developed their smart phone application to a level which was superior to any international competitors. However there was no insurance policy available for the service. The products available for car rental companies assume that the cars are rented continuously and thus the products are unfeasibly expensive for private car sharing. The negotiations with insurance companies have been unsuccessful; there is little interest in developing a new insurance product like this. Weegos Oy has been forced to change its strategy more towards more efficient use of cars owned by organizations like cities. The private service is currently on hold.

107 http://www.greenriders.fi/en
108 http://www.weegos.fi/

Business opportunities are driven also by **governmental strategies and decisions**. For example the decision made by the government to open free access to different governmental databases (e.g. weather data from the Finnish Meteorological Institute) may offer many opportunities to innovate transport related applications and services.

Business models depend on how transport issues are framed. In this sense the recently introduced term **Traffic as Service** in Finnish transport policy has the potential to increase the consideration of new business opportunities, as it highlights service aspects that users value (Figure 8).

Alternative business models arise because priorities of these service aspects vary remarkably between users.

By improving particular service aspects, the businesses are able to profile themselves. For example Onnibus (see Table 5, Section 6.2.) focuses on low cost public transport and Call-a-bike system (see Box 8, Section 4.4.) emphasises the ease of use.

The increased consideration of total **customer cost** over the useful life of new products drives new business models (see Figure 9). Novel products and services tend to have high acquisition cost, but this may be compensated by lower costs in other stages of the life-cycle.

The electric vehicle is a typical example. Its acquisition costs are higher than those of a comparable internal combustion engine car. In the use phase there are switching costs as a charging system needs to be installed and the daily practices of driving need to be changed (e.g. parking with charging possibility). Low running and maintenance costs (see Box 12) and low vehicle taxes compensate partly for the high acquisition costs. Little is currently known about the resale value and market for used electric vehicles, which adds to the risk of purchase. Batteries may require special disposal. The business model depends on the cost structure, which may change, if external costs to the society are internalized e.g. through fuel and electricity taxes and waste treatment fees.

**Figure 8. Service aspects of transport to the consumers**

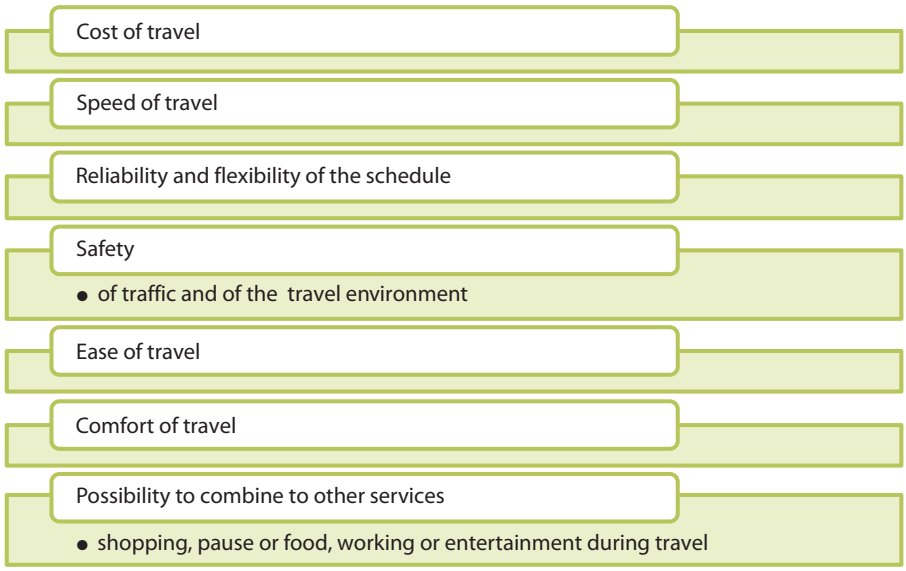
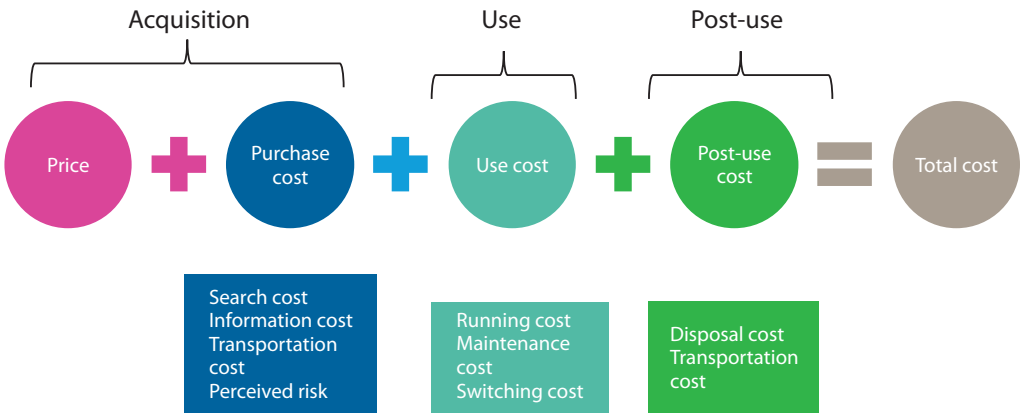


**Figure 9. Elements of total customer cost of products**[109]




BOX 12.

## PlugIt Finland Oy

PlugIt Finland was founded in 2012 in order to support the penetration of electric vehicles in Finland. It provides services that help users, real estate managers and various equipment providers to manage the changes needed in the transition from internal combustion engine car system to an electric vehicle system. These services include support in various practicalities and safety issues of charging, and a calculator to check the total customer cost of an electric vehicle compared to a vehicle, which can be freely chosen by the user. The data on the electric vehicles is provided by the importers of the cars, and in some cases appears optimistic. The calculator is still technically clumsy, but it is an important tool in creating understanding of the total cost of electric vehicles. The calculator shows that the higher purchase cost of Nissan Leaf compared to a same size, low-consumption diesel car is compensated within 3,5 years by the lower power cost.

[109] Belz and Peattie, 2009: p. 204

# 6 Policy recommendations

This Section makes recommendations for policy options and policy characteristics that are expected to facilitate transitions towards sustainability, particularly the reduction of greenhouse gases, and support green economy in the transport sector in line with the strategic goals of the Ministry of Transport and Communications. The recommendations are mainly directed to the main actors in innovation policy, the Ministry of Employment and the Economy (MEE) and Tekes. Some of them, however, require actions and cooperation of several policy domains, particularly with the Ministry of Transport and Communications, the Ministry of the Environment and the Ministry of Finance. The principal and secondary target groups of the recommendations made are listed in Table 4.

Sustainability transitions require strong political commitment. Even though transitions cannot be fully controlled by governments and politicians, these actors do have a crucial role in steering the direction of the processes. The public administration's role is to enable and support transition by removing barriers and strengthening enabling structures. In order to make progress *there should be common political will, crossing sectors, to achieve sustainability. Internationally Finland has urged for sustainable development as an overarching principle*[110]*, but progress at the domestic level also requires actions that remove silos and barriers in the public administration. The whole Government needs to be involved, new approaches are needed to develop innovative solutions fostering cooperation between ministries.*

The detailed recommendations are arranged in four groups. The groups are based directly on the ideas presented in the multi-level perspective (MLP); relating to the niche-level by promoting experimentation in niches that are protected from selective pressures of the existing regime (Sections 6.1 and 6.4), and to the regime-level focusing particularly on the policy and market dimensions of the regime (Sections 6.2 and 6.3). Many of the recommendations relate to ongoing processes and projects. In these cases, the FIPTrans recommendations can be seen to underline specific features that are particularly worth strengthening.

Each recommendation starts with a short rationale, followed by selected concrete examples and a few detailed suggestions or tools for policy action.

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[110] Finland urges 'bold' agenda for sustainable development targets http://www.un.org/apps/news/story.asp?NewsID=46102&Cr=general+debate&Cr1=#.UwDkz3jhKSo [retrieved February 16 2014]

**Table 4. Summary of recommendations and actors responsible for their implementation**

| | Recommendation | Principal implementing body | Other, possible implementing actors |
|---|---|---|---|
| 1 | Support strategic experiments that aim at enhancing changes in the whole socio-technical system. | Tekes, Ministry of Employment and the Economy | Regional Councils and municipalities |
| 2 | Emphasise learning and acceptability of failures in experimentation and demonstration programmes. | Tekes, Ministry of Employment and the Economy | Other innovation funders, e.g. Sitra |
| 3 | Support multiple complementary niches. | Ministry of Employment and the Economy, Tekes | Other ministries, e.g. Ministry of Transport and Communications; Ministry of the Environment |
| 4 | Enhance broad networking, creation of generic knowledge and mutual learning in innovation programmes. | Tekes, municipalities, companies | Different ministries |
| 5 | Strengthen cooperation between policy domains to improve coherence of policies and create policy mixes for sustainability transitions. | Council of State; Prime Minister's Office | All ministries, particularly Ministry of Employment and the Economy, Ministry of Transport and Communications, Ministry of the Environment, Ministry of Agriculture and Forestry; Tekes; municipalities. |
| 6 | Map carefully and reduce barriers to niche innovations. | Ministry of Employment and the Economy; Tekes; Ministry of Transport and Communications | All ministries, particularly Ministry of the Environment; Ministry of Agriculture and Forestry; municipalities. |
| 7 | Design and implement environmental and transport policies to increase demand for innovative technologies, products and services. | Ministry of Transport and Communications; Ministry of the Environment; municipalities | Ministry of Employment and the Economy, Ministry of Finance, Transport Safety Agency, Transport Agency. |
| 8 | Design policies for market formation. | Ministry of Transport and Communications; Ministry of the Environment; Ministry of Finance, municipalities | Ministry of Employment and the Economy |
| 9 | Design policies to improve access of consumers to affordable high quality sustainable products and services. | Tekes, Ministry of Transport and Communications, municipalities | Transport Agency |
| 10 | Start specific innovation programmes for enhancing entrepreneurial experimentation reducing transport demand and promoting seamless intermodal transport. | Tekes, Ministry of Employment and the Economy | |

## 6.1 Experimentation for niche development

### Recommendation 1: **Support strategic experiments that aim at enhancing changes in the whole socio-technical system**

Existing innovation policies, such as technology programmes, offer spaces for experimentation. For example, the biofuels sector has benefited from long term technology funding in bioenergy and transport biofuels. However, existing experimentation is arguably too focused on the development of technologies alone, while experiments testing the fit of innovations with the existing socio-technical system are not sufficiently supported. For example, it is important to test how niche-innovations fit with existing legislation, production and distribution systems, including user practices (see Box 13). These kinds of experiments are important in order to identify the measures needed to facilitate systemic change.

Some recent examples of experimentation, in which the user experience aspects have been taken into account, include the testing of biofuels in the Helsinki Metropolitan Public Transport system (Box 14), investment support for electric vehicles and the testing and demonstration programme of electric buses in Espoo.

BOX 13.

### PiggyBaggy shared ride for goods

PiggyBaggy[111] is a web-based service for connecting people sending and receiving goods, and people who can take additional goods in their cars on their way. Compensation for the transport is agreed between the driver and the users of the service. The attempts of the entrepreneur to get guidance on the mitigation of the legal issues have not been successful. Existing legislation is strict in its demand of a transport license from drivers offering commercial transport services and from transport operators. The way in which this is applied to private people offering transport and the web service is not clear. Another open issue is the taxation of the payments received by the drivers.

The requirement of Tekes for funding the experiment is that the company is aware of legal risks which cannot be mitigated. The entrepreneur has decided that the only way to proceed is to start testing the service and bear the legal consequences that may arise, but another solution would have been to grant temporary and limited licenses for the service and properly test how the business model works and its societal impacts before making final decisions about licenses and taxation, which also would enhance control of the black market.

BOX 14.

### Tax incentives supported testing of biofuels in buses[112]

Helsinki Metropolitan Public Transport Services (HSL) was able to carry out an exceptionally large experiment for the testing of user experience of renewable HVO diesel by bus companies. The test, in which 300 buses used HVO diesel for three years (2008-2010), was supported by a reduction in fuel tax agreed by the Ministry of Finance in order to compensate the additional cost to transport providers. This was a 9 mill. € investment to biofuel development. Based on the test a small number of buses continued to use HVO diesel even if it is more costly than regular fuel.

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111 http://piggybaggy.com/

112 Interview HSL, 2011

The ITS FACTORY[113] in Tampere offers a good test case for experimentation on smart traffic at local level. It has made national, regional and local authorities join forces together with companies. The aim is to enable experimentation and business development with the help of open access to data. The city can ease bureaucratic requirements when the demonstrations and experiments are made in close cooperation.

Future innovation policy instruments should

- Specifically support market experimentation and policy experimentation, aiming at understanding the barriers experienced by novel technologies and business models with potential for sustainable systemic change.
- Enhance cooperation between various actors in experimentation to improve understanding of the changes needed in the socio-technical system.
- Use temporary relaxation of regulation and specific permit conditions to enhance policy experimentation.

### Recommendation 2: **Emphasise learning and acceptability of failures in experimentation and demonstration programmes**

Innovation journeys are often very long and the goals tend to change during the process. Hypes and disappointments alternate. The management of failures is difficult. It will always be hard to tell, when unsuccessful projects should be stopped and when it is be better to push further. Demonstrations are powerful and visible experiments but expectations need to be managed to avoid backlashes and ensure learning.

Sometimes experiments and demonstrations fail because of wrong decisions or lack of knowledge in the project group. In other cases failures are caused by external barriers or structures that exist regardless of project group. Especially the latter ones are important to recognise from the transition point of view as they are the ones that prevent radical systemic change.

Media tends to follow (and cause) hypes and disappointments as shown in the ongoing (2013-2014) testing of electric buses in Espoo (part of EVE program), where the expectations were originally high in the media. Initial, serious problems with the bus caused major headlines in the newspapers about a failure. The company and its partners nevertheless continue the experiment because the goals are considered to be realistic.

During studies on demonstration programmes in solar energy, three types of demonstrations were identified based on their internal and external goals. Test version demonstrations create prototypes in laboratories and provide learning through exploring by testing the technical performance, while field trials test a selected new path with a focus on learning, reducing costs and improvements in performance. Finally, commercial rollout demonstrations test whether the previously tested options can be up-scaled and mainstreamed.[114]

The following aspects should be emphasized in all experimentation and demonstration programmes

- Request that the organisers of demonstrations provide plans for major or minor failures of experiments and demonstrations not only to revise plans and actions but also to document lessons learned.
- Require a proper debriefing and exchange of information of both successes and failures as part of all experimentation and demonstration programmes.
- Support a culture of frank reporting of both successes and failures in all funded projects.

### Recommendation 3: **Support multiple complementary niches**

Transitions require multiple complementary solutions for change. It is generally not possible to pick the winners at an early stage. Typically competing and complementary options develop simultaneously with varying interests and levels of commitment by actors. The new "dominant design" may emerge as a combination of parts from different niches. For example, a combination of (private) electric vehicles, new public transport with park and ride facilities, and new opportunities for light traffic may achieve greater change than any of the solutions in isolation. The needs and preferences of users vary and, therefore, a broad selection of products and services for improving the sustainability of transport should be available, provided by both public services and private actors.

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113 www.itsfactory.fi

114 Heiskanen et al., 2013

The principle of technology neutrality suggests that policymakers should only set the societal goals. Private actors then develop the technologies, products and services to fulfil these goals. This principle is well based on theory and practical examples of the capabilities of different actors. It is, however, extremely difficult to design completely technology neutral policies, and seemingly technology neutral policies often tend to support existing technologies leading to incremental innovation.[115] For example, in Finland, the support for biofuels has been successful, because the technology is incremental from the point of view of the transport system. If radical changes are attempted at, choices will have to be made concerning infrastructure, which in the transport sector is costly and clearly not technology neutral.

The principle of technology neutrality should therefore be interpreted to mean the following

- Support experimentation in multiple complementary or competing novel technologies, services and practices rather than avoidance of open support to new technologies.
- Continue the support to multiple niches for sufficiently long periods. It is crucial that the technologies and solutions are ready to be exposed to the selection pressures of the market.

### Recommendation 4: **Enhance broad networking, creation of generic knowledge and mutual learning in innovation programmes**

There are already many good examples of networking and information exchange in connection to technology programmes. However, to enhance the use of experiences obtained through experiments, there is a need for broader and deeper networking leading to mutual learning and creation of generic knowledge[116] of the socio-technical system.

An example of efficient and fruitful networking between governmental and private actors in the transport research area was the TransEco programme (2009-2013).[117] All four relevant ministries were present in the steering group, which increased co-operation between the ministries. Therefore, TransEco has been able to organise support for experimentation (Box 14) and impact policies by providing information, for example, on the feasibility of the high biofuel target and the renewal of fuel taxation by the Ministry of Finance. However, the networks consisted mainly of regime actors, which entails that some of the risks connected to the acceptability of the technologies (e.g. the raw materials of biofuels) may not have become sufficiently visible.[118] One possibility to broaden the networks is to combine working spaces of different actors (Box 15).

BOX 15.

### How to enhance new networks: shared working stations

In Helsinki there are more and more different size enterprises sharing office premises, as the renting costs would otherwise be too high. In these shared spaces new type of businesses can find each other, discuss business ideas and even share each other's networks.

What if researchers of radical innovation programmes, the municipalities and the national ministries would rent a table or two from such working stations? Civil servants from transport, city planning and housing divisions could work from a few weeks to a few months or even longer at these premises and there meet new business people and also help small enterprise to meet crucial regulators and planners. Also international networks of different people could be shared, therefore helping Finnish companies to enter the international markets.

115 Virkamäki and Temmes, 2013

116 Generic knowledge is defined here as "sufficiently general, abstracted and packaged, so that it is no longer tied to specific contexts." following Geels and Deuten, 2006

117 www.transeco.fi

118 Temmes and Lovio, 2012

In creating generic knowledge the role of intermediary actors is crucial.[119] An example is the ElectricTraffic[120] consortium of the EVE programme,[121] coordinated by Eera Oy, a consultant company with connections to both the private sector and politicians. The network fosters learning between various local experiments, gathers user experience, and agrees on guidelines. Through these activities the network has been able to enhance the development of infrastructure and related services in the electric vehicles field.[122]

The role of regional and municipal actors has also been found to be important. They provide insights and practical knowledge how to use land use planning and other regional-municipal policies in promoting innovation.[123] The involvement of cities in the development of electric vehicles has, for example, improved the understanding of the challenges of public charging stations. Another example of fruitful cooperation in regions and municipalities is the INKA (innovative cities) programme. INKA promotes demand-based innovations that combine several areas of expertise. Local actors, both public and private, are in key position and they have lot of freedom to create testing platforms. Cities themselves have been active in programme preparation, together with higher education institutions, enterprises, research institutions and various funding and development organisations.

Networking, the creation of widely applicable knowledge and mutual learning can be enhanced in innovation programmes by the following actions:

- Actively expand the networks linked to innovation programmes to include established firms, public bodies, new entrants with novel businesses and non-governmental organizations, and welcome any interested actors.
- Enhance the involvement of regional and municipal actors e.g. as critical reviewers or testers of suggestions emerging from programmes.
- Involve strategic and systemic intermediaries set up by the public sector in all major innovation programmes. Their role includes facilitation of active diffusion and further modification of successful experiments.[124]

## 6.2 Policy integration and coherence for regime change

### Recommendation 5: **Strengthen cooperation between policy domains to improve coherence of policies and create policy mixes for sustainability transitions**

The ways in which policies of different domains (e.g. innovation, transport, environment, energy) together influence actors and innovation processes are important from the perspective of transitions (Figure 10). Mixes of different policies are incoherent if their goals undermine each other, but even if the goals are in line, incoherence can occur in the implementation phase. For example, some policies aimed at increasing work force mobility, such as mileage allowance, may increase the use of private cars[125]. Incoherent policies may confuse actors and deter investments and other inputs into innovation.

Coherence between policies implies, at a minimum, attempts to identify and remove (where possible) policies that give conflicting messages to actors and that create barriers for innovation. For example, policies supporting the building of highways encourage car-based economies and higher speeds, although fuel economy clearly drops at speeds going over 100 km/h[126] . Also, present land use policies may often support car based solutions instead of innovations minimising transport demand. While some attempts to reduce incoherent policies

[119] Innovation intermediaries comprise a range of actors, such as consultants, research funders, science parks, quasi-autonomous agencies, etc. that operate between producers and users, innovators and adopters (e.g. Stewart and Hyysalo, 2008). In transitions, they can adopt roles in facilitating vision creation, networking, learning, and policy development and implementation (Kivimaa, 2013).

[120] www.sahkoinenliikenne.fi

[121] http://www.tekes.fi/ohjelmat-ja-palvelut/ohjelmat-ja-verkostot/eve/

[122] Temmes et al., 2013.

[123] Kivimaa and Virkamäki, 2014.

[124] Kivimaa, in press.

[125] NAO, 2011

[126] http://www.nrcan.gc.ca/energy/efficiency/transportation/cars-light-trucks/fuel-efficient-driving-techniques/7513

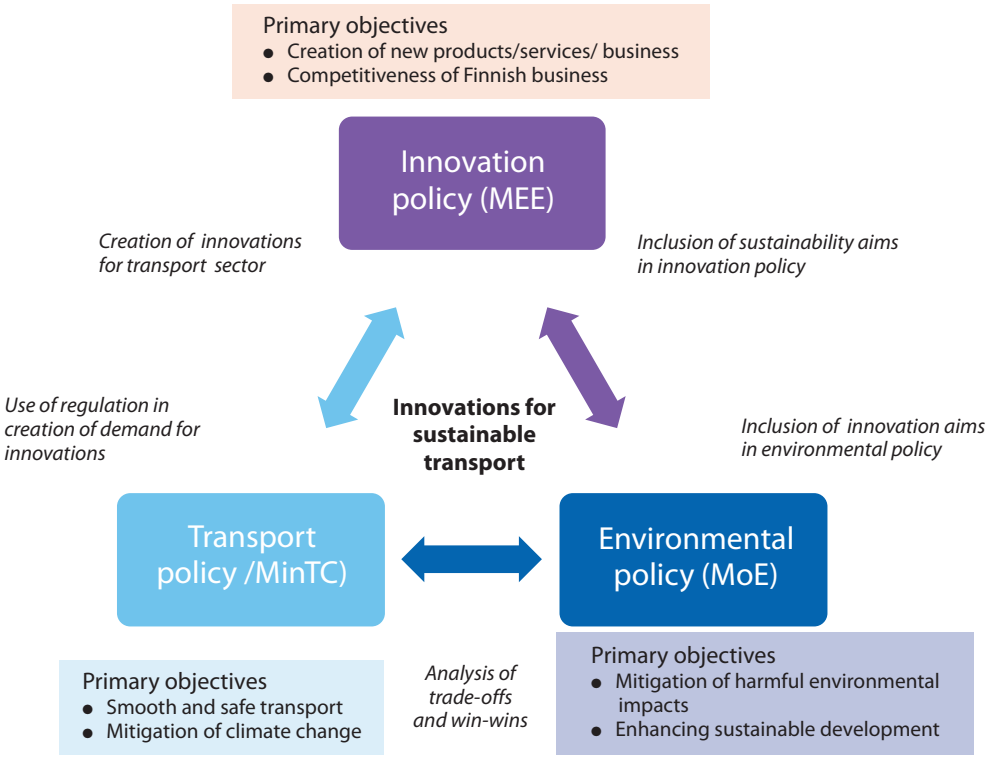
have been made, stakeholders call for speedier responses to incoherence problems present in the legislation.[127]

The identification of conflicts implies not only top-down scoping or evaluation of policy instruments affecting a given niche or regime across policy domains, but also examining the problems from the perspective of actors facing and responding to policies. Stronger forms of coherence involve active cooperation between actors in different policy domains and the creation of policy mixes that favour system transitions. For example, combinations of policies that support niche experiments with policy measures that remove support for incumbent technologies or change existing regulation can foster system change.[128] Processes aimed at improving policy coherence can also benefit from stakeholder consultations.

The following measures are likely to improve the coherence between innovation and other policies.

- Encourage cooperation of actors from different policy domains.
- Carry out policy scoping exercises covering multiple policy domains to analyse how policies may jointly influence sustainable innovation and system transitions, and to identify policies sending conflicting messages.
- Carry out evaluations of how policies from multiple domains promote or hinder transitions to low-carbon transport system. Such evaluations should incorporate the bottom-up perspectives of actors, in particular innovators and policy target groups, to reveal how combinations of policies influence transitions. Evaluations should take into

**Figure 10. Interaction of innovation, environmental and transport policy in enhancing sustainable transport**




[127] Stakeholder discussions at FIPTrans workshop, 27.1.2014.

[128] Kivimaa and Kern, unpublished.

account (a) how policies at multiple levels – the EU, nation state, and regions and municipalities together facilitate or hinder transitions to low-carbon transport systems, and (b) the (mis)match of supply and demand oriented policies.
- Include sustainability aims, particularly those noted in government programmes, in all levels of innovation policy – from strategies to policy instruments and funding decisions.
- Combine policies supporting new niche creation with policies that reduce the inertia of existing structures and phase out old technologies and solutions.

### Recommendation 6: **Map carefully and reduce barriers to niche innovations**

The barriers formed by the existing regime range from major issues, such as transport infrastructure, to seemingly minor issues (see Table 5) that may still create a situation in which a niche innovation process is halted. Often barriers to niche innovations in transport are created by policies in other domains. For example, insurance policy influences innovations utilising the sharing of private cars or land use policies affects the demand for transport and related innovations.[129] Assessments of policies to reveal barriers should not take place only before the policy is accepted but also after it has been implemented as some barriers are not detected until the implementation phase. Ways to transfer findings on innovation barriers revealed by experiments should be developed so that they also reach policy makers.

One type of barrier to niche innovations is the support given by governments to existing, dominant technologies and practices. The support can be direct subsidies, indirect support by taxation or, for example, support by the Structural Funds to the fossil fuel based transport system. Also the current application of legislation and rules concerning public procurement may favour existing, large companies through demands on the ability to provide large scale solutions and by primarily stressing price and not innovativeness.

Barriers of innovation often arise in the intersection of policy domains and may involve, for example, infrastructure, or smaller policy measures that are not in line with more general innovation policy goals for new technologies and services (see Table 4). Novel business models often meet these barriers; see Boxes 14 and 16.

**Table 5. Examples of barriers caused by existing regulation**

| Technology /service innovation | Barrier | Nature of the barrier | Problem for the innovation |
|---|---|---|---|
| Autonomous vehicles | Legislation demands that there has to be a responsible holder in the vehicle and therefore a car cannot run by itself | Legislative: Vehicle Act 1090, 2002 | Companies cannot test their vehicles in Finland at the moment |
| Electric vehicles | Legislation demands that in driving schools there has to be a clutch in the car used for teaching | legislative | Driving schools cannot use electric vehicles and familiarize youngsters to electric vehicles |
| Electric vehicles | Tax value for company cars | Financial | Electric vehicle as a company car reduces the salary excessively. |
| Shared rides for goods | Transport licensing needed; taxation | Legislative and financial | Compliance cannot be guaranteed. |
| Renting of private cars | Insurance policy | Financial | Current insurance policies are too expensive for private owners and limited lending activity. |
| Low-cost bus services (such as Onnibus) | Old legislation concerning bus and coach transport | Legislative and functional (the role of Matkahuolto in organizing ticketing and information systems) | There was virtually no competition in the field as bus companies were given the rights to manage certain routes. Ticketing and information systems were under Matkahuolto. |

[129] Marhall and Banister, 2007

For example, the investment support program of MEE the Ministry of Employment and Economy for electric vehicles has not been able to increase the number of new registrations of electric vehicles as expected. Partly this is explained by policy barriers caused by the tax rules for company cars.[130] Some barriers may be surprising. For example, the use of autonomous vehicles is currently hindered in Finland by legislation stating that there always needs to be a driver in a car (Box 16).

BOX 16.

### Autonomous vehicles ("Nokia-cars" or "Google-cars")

An acute problem for autonomous or self-driving vehicles is that current legislation demands that there has to be a responsible holder in the vehicle and therefore a car cannot run by itself (Vehicle Act 1090, 2002). This law is based on international legislation and, thus, needs to be handled at the international level.

It would be possible to open up test areas nationally. There would be a person with a driving license in the vehicle during the test period. Robot transport technology tested in the domestic market can become a significant export industry. Nokia Here, which is the Map application by Nokia, has recently started a cooperation together with Mercedes Benz to work on a driverless vehicle.[131]

Innovation policy instruments should take into account the strength of the barriers caused by the existing regime

- When designing and implementing new innovation programmes, analyse carefully the impact of the existing legislation and financial support mechanisms on the niche as many of the barriers are invisible and seemingly not connected to the niche.
- Reduce the recognized barriers either temporarily or permanently as part of protecting the niche.
- Evaluate niche experiments to recognize and reduce the barriers of the regime based on interests of incumbents, user practices or cultural norms.

### Recommendation 7: **Design and implement environmental and transport policies to increase demand for innovative technologies, products and services**

Transport, environmental and innovation policies strongly influence potential transitions of the transport system. The primary objectives of these domains are different, while in combination they influence the push and pull for transport innovations. Traditional innovation policy measures, such as technology programmes, have largely focused on technology push, while other policy domains – in this case transport and environment – can have a significant role in creating demand-pull for innovations.

The regulation creating a market for liquid biofuels (see Section 4.1.) is a successful example for creating market demand for niche innovations. In other countries, tax exemptions for electric vehicles have contributed to market formation[132]. Finland has also experience of $CO_2$-based taxation of vehicles and its positive effects have been documented[133], but further analysis on possibilities to increase its effectiveness from the perspective of creating market pull for niche innovations should be carried out.

Experience has, however, shown that environmental policies are not always sufficiently foreseeable, flexible and demanding in order to support innovation aims; this has been the case for forest sector product innovations in the past.[134] Other countries are clearly more advanced than Finland in promoting innovation through combinations of policies. In the UK, for example, taxation has been complemented with plug-in car grants and a plug-in places programme to enforce market formation for ultra-low emission vehicles, and also other market formation instruments exist, such as funds to increase procurement of sustainable innovations by local authorities' transport providers. This aspect has been much

130 Temmes et al., 2013; Steinhilber et al., 2013
131 http://www.talouselama.fi/nokialandia/nokia+testaa+mercedesin+kanssa+itseohjautuvia+autoja/a2203091
132 http://www.acea.be/images/uploads/files/Electric_vehicles_overview_2013.pdf
133 Perrels and Tuovinen, 2012
134 Kivimaa, 2008

weaker in the development of electric vehicles in Finland that has so far been driven almost solely by innovation policy objectives, and therefore measures creating demand are rather scarce[135]. Another concern is how environmental and transport policies can support market pull for niche creation and up-scaling for modal change and transport demand reduction focused niche innovations. Thus, there is a need for more active policy development based on the following.

- Innovation aspects should be considered as an integral part of the planning and implementation of any new policy in the domain of environment and transport.
- New policy instruments should be created with the purpose of creating demand for innovative and sustainable technologies, products and services that help to facilitate the reduction of transport volumes, facilitate modal change from private passenger vehicles to public transport or cycling and walking, and reduce the emissions of vehicles.
- Public procurement, and government support for local authorities to fulfil innovative green public procurement, should be used to increase the demand for sustainability innovations. Also other measures, such as deployment subsidies, are needed to create demand for innovations to be adopted directly by the general public.
- Steeper progression of vehicle taxation should be considered in order to support cars with zero emissions and to reduce cars with very high emissions levels.
- Evaluations should be made of broad policy mixes that can influence new niche development and transport system change.

## 6.3 Market formation for consolidating regime shifts

### Recommendation 8: **Design policies for market formation**

Policies for market formation in the Finnish transport innovation system are few compared to supply-side innovation policies. In addition to environmental and transport policies (Recommendation 7), market formation can be enhanced through a broad set of measures for demand-driven innovation policy, which already has been promoted on a strategic level in Finland.[136] These tools include tax exemptions, market-based policy instruments, public procurement, demand-side management and town planning, but also indirect measures such as the development of competence and public sector operating models.[137] Information measures favoured in market formation have a potential in creating public support for the implementation of more controversial policies, such as product bans, even if they rarely are sufficient to change behaviour on their own.[138]

Scrappage schemes are a way of supporting markets for new vehicles (Box 17) through reducing the post-use cost (see Figure 9). When connected to schemes enhancing low-emission vehicles, they might be effective in countries such as Finland, where the average age of cars is high.

BOX 17.

### The Bonus-Malus scheme[139]

France introduced a Bonus-Malus scheme in 2007, under the Grenelle de L'Environnement. It was mainly meant to boost the car industry by promoting the purchase of new vehicles. Basically, under the Bonus-Malus, the buyer is provided a price cut on clean vehicles while vehicles emitting too much $CO_2$ are charged with extra taxes. The amount of the rebate varies depending on the class of the vehicle with a maximum of 1000 euros and even 7000 euros for electric cars. In 2009, this system was coupled with a 300 euros car-scrap allowance called "super bonus" if the purchaser wanted to buy a new vehicle emitting less than 160 g of $CO_2$ (a figure, which then was considered ambitious).

135 Temmes et al., 2012
136 MEE, 2010a
137 MEE, 2010a
138 Anable and Bristow, 2007; Vieira et al., 2007
139 Sirquey, 2013

Based on existing legislation[140] and current policy plans, public procurement should increasingly be used to make transport more sustainable, which creates market for low-carbon vehicles and fuels. Guidance by the government for public procurement sets strict limits for emissions of public service cars, promotes employers' allocation of public transport tickets to employees, and supports working from home and video-conferencing.[141] However, market formation for innovations reducing transport demand or new public transport options is not much addressed by current national policies.[142]

The following measures should be considered to support markets for developing niches

- Design policies that reduce the total customer cost for more sustainable transport services (e.g. through influencing the switching cost, use cost and post-use cost).
- Develop methods, such as labelling and product declarations to support the choice of consumers. Support the creation of services, which help to reduce the cost of switching to novel vehicles or transport modes. These could include information about infrastructure and equipment, flexible payment systems for electric vehicle charging or public transport services, advisory and training services.

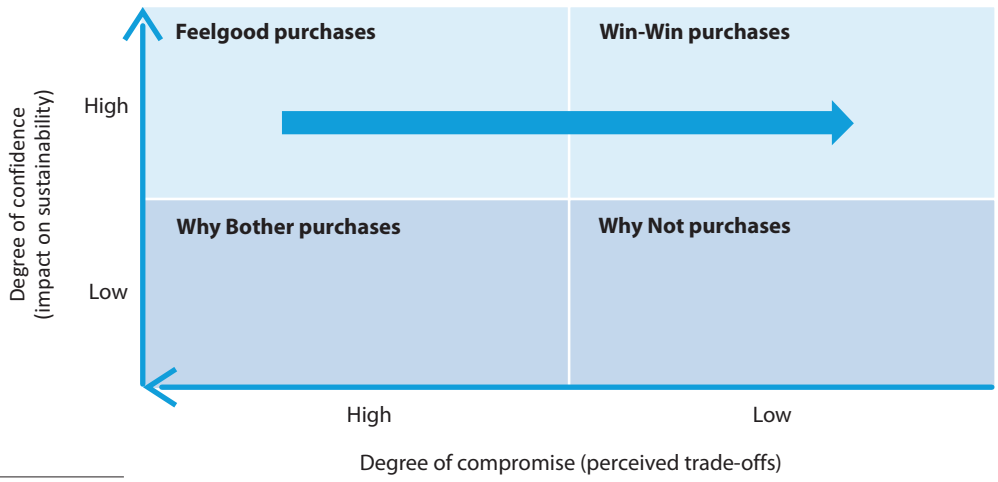
### Recommendation 9: Design policies to improve access of consumers to affordable high quality sustainable products and services

Users cannot be forced to use certain services or to choose a certain transport mode (see also Section 4.3.). This emphasises the need to pay attention to the quality and availability of products and services (i.e. the service aspects illustrated in Figure 8, Section 5.2.).

The choices of consumers are influenced by 1) the degree of compromise, i.e. perceived trade-offs, such as higher price, lower level of product performance, difficulty of purchase (e.g. travelling to non-standard distribution outlet) and 2) the degree of confidence in the benefit offered, e.g. agreement on the role of the sustainability impact or the trust towards the actor offering the product or the service (see Figure 11)[143].

Examples of services decreasing the degree of compromise include the efforts of electric vehicle actors in Liikennevirta Oy to make electric vehicles charging easy (Box 1), the Route Planner of Helsinki Metropolitan Public Transport Service (Section 4.4), maps supporting travel planning for bikers and the city of Helsinki's plans on major biking routes.

**Figure 11. Factors influencing consumers' purchases based on sustainability arguments** (Peattie, 2001)




[140] Laki ajoneuvojen energia- ja ympäristövaikutusten huomioon ottamisesta julkisissa hankinnoissa 1509/2011

[141] http://www.tem.fi/files/35530/Valtioneuvoston_periaatepaatos_uusien_ja_kestavien_ymparisto-_ja_energiaratkaisujen_%28Cleantech-ratkaisut%29_edistamisesta_julkisissa_hankinnoissa.pdf

[142] Kivimaa and Virkamäki, 2014

[143] Peattie, 2001

Sustainability arguments are often used in a vague manner in innovation programmes and in marketing. This reduces the level of confidence of consumers in the relevance of the improvements. Much more rigorous treatment of sustainability aspects in innovation programmes is needed to convince consumers of the usefulness of sustainable choices.

Both marketers and policymakers are needed in efforts to make users and consumers make sustainable choices. The following innovation policy measures should be considered.

- Include well-managed stakeholder dialogue in the preparative phases of all innovation programmes in order to ensure the relevance of the sustainability issues to be developed for the consumers. The receivers of innovation funding should be required to carry out a proper assessment of the relevance of the sustainability issues to be developed, and a plan for proving it to the consumers through e.g. credible certification schemes or quality control.
- Require systematic and documented efforts and tools to improve the sustainability, accessibility, affordability and high quality of the products and services developed in all projects receiving innovation funding.

## 6.4 Increase specific protection of "Neglected niches"

### Recommendation 10: **Start specific innovation programmes for enhancing entrepreneurial experimentation reducing transport demand and promoting seamless intermodal transport**

Innovations for reducing transport demand, fostering modal change and improving public and intermodal transport do not easily arise in conventional transport innovation programmes.[144] They require profound changes in the regime and the business opportunities are more difficult to detect than programmes promoting, for example, change of fuels or technology.[145]

Therefore, there is a need for specific innovation initiatives aimed at developing novel business models for the reduction of transport demand and enhancing intermodal transport. Such initiatives should include a focus on the realisation of the 'traffic as service' concept (see Figure 12), and especially on ways to improve the relative position of public transport and cycling and walking.

This kind of activities should be connected to initiatives of smart traffic, which are included in, for example, the Tekes programmes Smart city (2013-2017) and Smart Green Integrated Traffic (2014-), as well as the VTT programme TransSmart (2013-). However, there is also a need for focused efforts to support solutions providing a broad spectrum of sustainability advantages in transport. Such a programme should aim for innovations reducing all sustainability pressures caused by transport, i.e. energy use, emissions, demands on land use and congestions. Such a programme would meet the demands highlighted in Finland's Second Generation Intelligent Strategy for Transport.[147] It would also dovetail with related European initiatives and programmes[147] and thereby provide Finnish innovators with additional incentives and opportunities to participate in European activities.

To progress with entrepreneurial experimentation reducing transport demand and promoting seamless intermodal transport the following measures should be taken.

- Initiate an innovation programme aimed at developing novel business models for reducing transport demand and enhancing intermodal transport.
- The programme should support hitherto less developed areas of research and business models for new services and infrastructure solutions. These include business models based on cycling, new arrangements of work to reduce traffic on rush hours and long-distance commuting.
- The programme should build on local, national and European initiatives and business models enhancing intermodal transport and it should be developed through an active dialogue with stakeholders.

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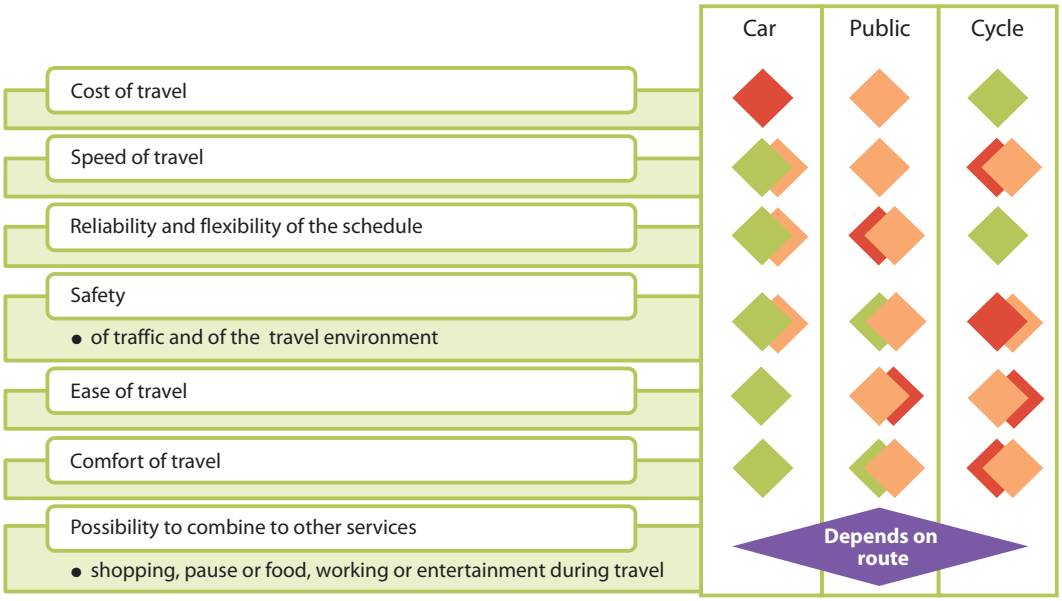
144 Kivimaa and Virkamaki, 2014

145 Upham et al., 2013

146 MINTC, 2013b

147 For example, see the European Initiative on Smart Cities initiative http://setis.ec.europa.eu/set-plan-implementation/technology-roadmaps/european-initiative-smart-cities

**Figure 12. Capability to meet the service aspects by selected transport modes (green = good, red = poor) by private car, public transport and cycling and walking. The evaluations are generalizations for commuting within a city. However they vary vastly depending on the distance, route, congestion and service arrangements.**



# 7 Appendices

## 7.1 Preparation and evaluation of the document

The research has been carried out and the report has been prepared by the FIPTrans project group. The results and draft documents have been discussed by the FIPTrans steering group. The final draft has been presented and discussed in a stakeholder seminar organised 27 January 2014 in Helsinki.

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