

## ASSIST

Assessing the social and economic impacts of past and future sustainable transport policy in Europe



## ASSIST Deliverable D3.1: Future challenges for European transport policy

Assessment of the implications of future challenges for transport policy

Due date of submission: 30.06.2012  
Actual date of submission: 16.10.2012  
Dissemination level: **Public**  
Start date of project: 01.04.2011 Duration: 24 months

Lead contractor for this deliverable: **Panteia/NEA**  
Work package: WP3 Revision: 2.0  
Grant Agreement Number: 265381  
Contract No: MOVE/FP7/265381/ASSIST  
Instrument: Coordination and support actions – Support – CSA-SA



Project co-funded by the  
European Commission – DG MOVE  
7<sup>th</sup> Research Framework Programme





## ASSIST

**Assessing the social and economic impacts of past and future sustainable transport policy in Europe**

---

### Co-ordinator:



#### **Fraunhofer-ISI**

Fraunhofer Institute Systems and Innovation Research, Karlsruhe, Germany  
Dr. Wolfgang Schade

### Partners:



#### **FÖMTERV**

Mernoki Tervezo ZRT, Budapest, Hungary



#### **CNRS-LET**

Centre National de la Recherche Scientifique, Lyon, France



#### **NEA**

NEA Transportonderzoek en – Opleiding BV, Zoetermeer, The Netherlands



#### **ProgTrans**

ProgTrans AG, Basel, Switzerland



#### **TRT**

Trasporti e Territorio SRL, Milan, Italy

## ASSIST

Assessing the social and economic impacts of past and future sustainable transport policy in Europe

---

### Report information:

Report no: D3.1                      Workpackage no: 3

Title: Future challenges for European transport policy - Assessment of the implications of future challenges for transport policy

Authors: Jan Kiel, Hedi Maurer, Francesca Fermi, Davide Fiorello, Michael Krail, with contributions from partners

Version: 2.0                      Date of publication: 07-01-2013

This document should be referenced as:

Kiel J., Maurer H., Fermi F., Fiorello D., Krail M. (2013): *Future challenges for European transport policy - Assessment of the implications of future challenges for transport policy*. Deliverable D3.1 of ASSIST - Assessing the social and economic impacts of past and future sustainable transport policy in Europe. Project co-funded by European Commission 7<sup>th</sup> RTD Programme. Fraunhofer-ISI, Karlsruhe, Germany.

---

### Project information:

Project acronym: ASSIST

Project name: Assessing the social and economic impacts of past and future sustainable transport policy in Europe

Contract no: MOVE/FP7/265381/ASSIST

Duration: 01.04.2011 – 31.03.2013

Commissioned by: European Commission – DG MOVE – 7<sup>th</sup> Research Framework Programme.

Lead partner: Fraunhofer-ISI - Fraunhofer Institute Systems and Innovation Research, Karlsruhe, Germany.

Partners: FÖMTERV - Mernoki Tervezo ZRT, Budapest, Hungary  
CNRS-LET - Centre National de la Recherche Scientifique, Lyon, France  
NEA - Transportonderzoek en – Opleiding BV, Zoetermeer, The Netherlands  
ProgTrans - ProgTrans AG, Basel, Switzerland  
TRT - Trasporti e Territorio SRL, Milan, Italy.

Website: <http://www.assist-project.eu/>

---

### Document control information:

Status: Public

Distribution: ASSIST partners, European Commission

Availability: Restricted

Filename: ASSIST\_D3.1\_Future\_challenges\_for\_European\_transport\_policy.doc

Quality assurance: Yves Crozet (LET)

Coordinator's review: Wolfgang Schade, Michael Krail

Signature: Michael Krail                      Date: 16.10.2012



## Table of Contents

|  |           |
|--|-----------|
| <b>Executive summary</b> .....                                       | <b>I</b>  |
| <b>1 Introduction</b> .....  | <b>1</b>  |
| <b>2 Identification of the future challenges</b> .....               | <b>3</b>  |
| 2.1 Introduction.....  | 3         |
| 2.2 The transport system and its macro-environment .....             | 3         |
| 2.3 Approach to select future challenges .....                       | 8         |
| 2.4 Relevant future challenges .....                                 | 10        |
| 2.4.1 Introduction.....  | 10        |
| 2.4.2 Environment .....  | 13        |
| 2.4.3 Society .....  | 15        |
| 2.4.4 Technology.....  | 18        |
| 2.4.5 Economy .....  | 19        |
| 2.5 Linkages between the future challenges.....                      | 21        |
| <b>3 Implication of future challenges for transport policy</b> ..... | <b>25</b> |
| 3.1 Introduction.....  | 25        |
| 3.2 Linking future challenges to the transport system .....          | 25        |
| 3.3 Linking transport policy to the transport system .....           | 27        |
| 3.4 Implications of future challenges for transport policy.....      | 29        |
| 3.5 Changes in the impacts of TPMs .....                             | 33        |
| <b>4 Cases for selected transport policy measures</b> .....          | <b>35</b> |
| 4.1 Introduction.....  | 35        |
| 4.2 Pricing .....  | 35        |
| 4.3 Taxation .....   | 37        |

---

|          |   |           |
|----------|---|-----------|
| 4.4      | Research and innovation.....                            | 38        |
| 4.5      | Efficiency standards and flanking measures.....         | 40        |
| 4.6      | Internal market .....                                   | 42        |
| 4.7      | Infrastructure.....                                     | 43        |
| 4.8      | Transport planning .....                                | 44        |
| 4.9      | Other measures .....                                    | 45        |
| 4.10     | Policy responses.....                                   | 47        |
| <b>5</b> | <b>Conclusions and recommendations .....</b>            | <b>49</b> |
| 5.1      | Conclusions .....                                       | 49        |
| 5.2      | Recommendations .....                                   | 53        |
| <b>6</b> | <b>References.....</b>                                  | <b>55</b> |
|          | <b>Annex 1: Descriptions of future challenges .....</b> | <b>61</b> |
|          | Fighting climate change .....                           | 61        |
|          | Shortage fossil fuels and other natural resources.....  | 62        |
|          | Fighting increasing air pollution and noise.....        | 63        |
|          | Urbanisation and sprawling .....                        | 64        |
|          | Ageing of the European society.....                     | 65        |
|          | Migratory pressure .....                                | 66        |
|          | Unemployment.....                                       | 67        |
|          | Income inequality and distortions .....                 | 68        |
|          | Terrorism and feeling of insecurity.....                | 69        |
|          | Individualism .....                                     | 70        |
|          | Diffusion of ICT and technological innovation .....     | 71        |
|          | Third manufacturing revolution .....                    | 72        |
|          | Globalisation and outsourcing .....                     | 73        |

---

|   |           |
|---|-----------|
| Public and private debt .....                                       | 75        |
| Fragility of the EMU .....  | 76        |
| <b>Annex 2: Impacts from transport policy measures .....</b>        | <b>77</b> |
| Economic impacts.....   | 77        |
| Social impacts .....  | 78        |
| Environmental impacts.....  | 79        |
| <b>Annex 3: Implications of challenges for selected TPMs .....</b>  | <b>81</b> |
| Eurovignette .....  | 81        |
| Inclusion of air transport into the EU-ETS in 2012.....             | 83        |
| Energy Taxation Directive (2003/96/EC).....                         | 85        |
| Reduction of TEN-T network cross border missing links .....         | 87        |
| Eliminating TEN-T network bottlenecks .....                         | 89        |
| Green transport corridors.....                                      | 91        |
| Bus priority measures .....   | 93        |
| Implementation of SESAR .....                                       | 95        |
| European Road Safety Action Programme .....                         | 97        |
| Park & Ride systems .....   | 99        |
| Introduction of city logistics and urban freight distribution ..... | 101       |
| Electro-mobility of road transport vehicles.....                    | 103       |
| Development of E-Freight.....                                       | 105       |
| Teleworking .....   | 107       |



**List of tables**

|            |   |    |
|------------|---|----|
| Table 2-1: | Selected challenges and the driver they belong to.....  | 10 |
| Table 2-2: | Relevance of challenges with reference to TPMs and their implications.....  | 12 |
| Table 3-1: | Assessment of the implications of future challenges for the demand and supply in the three markets of the transport system..... | 26 |
| Table 3-2: | Assessment of the impact of TPM categories on demand and supply in the markets of the transport system.....                     | 28 |
| Table 3-3: | Linking the TPM Infrastructure to the challenge global warming in the three markets of the transport system.....                | 29 |
| Table 3-4: | Linking TPM Pricing to the future challenges in the three markets of the transport system.....                                  | 30 |
| Table 3-5: | Assessment of the implications of the future challenges for TPMs.....   | 31 |
| Table 3-6: | Assessment of the impacts of TPM categories upon the future challenges .....  | 33 |
| Table 4-1: | Selected cases per TPM category .....   | 35 |



**List of figures**

|             |  |    |
|-------------|--|----|
| Figure 2-1: | Conceptual framework of markets in the transport system.....                     | 4  |
| Figure 2-2: | Input and output of the transport system.....                                    | 6  |
| Figure 2-3: | Implication of drivers in the macro environment for the<br>transport system..... | 8  |
| Figure 2-4: | Linkages between future challenges in the ASSIST context .....                   | 22 |
| Figure 3-4: | Impact of the transport system on the macro environment.....                     | 34 |



## Executive summary

The ASSIST project aims at providing the EU with advice on the possible social and economic impacts of transport policies that have been applied in the EU, the Member States or in other countries in the past or are planned to be applied in the future. Additionally, future challenges for the transport system are taken into consideration.

The implications of future challenges for European transport policy are the subject of this report. An analysis of the implications on the transport system and transport policy is made, in order to derive possible policies from the future challenges. To perform the analysis we used a categorisation of policies adopted earlier in the project. Further, the report elaborates on the possible adaptations of policy impacts caused by the future challenges.

The most important challenges with an implication for transport policy were addressed. They include *fighting climate change, fossil fuel shortage, air pollution and noise, urban sprawling/urbanisation, ageing of the European society, migratory pressure, unemployment, income inequality, terrorism and insecurity, individualism, diffusion of ICT and technological innovation, third manufacturing revolution, globalisation/outsourcing, fragility of European Monetary Union (EMU), and public and private debt.*

An analysis is made of the implication of future challenges on categories of Transport Policy Measures (TPMs). These TPM categories consist of *Pricing, Taxation, Research and innovation, Efficiency standards and flanking measures, Internal market, Infrastructure, Transport Planning and Other.* This categorisation follows the categories of transport policies used in the White Paper 2011.

The analysis starts with a conceptual framework that links the future challenges and TPM categories to the transport system. In this report, the transport system is regarded as a set of three markets: the trip market, the transport market and the traffic market. Each market has a demand (e.g. passenger transport) and supply side (e.g. infrastructure). For each of the markets there the implications of the challenges and the possible TPMs are described.

After this step, the implications of the future challenges on the TPM as well as the further social and economic impacts are explored for a selection of distinct transport policy measures. This selection consists of one or more cases in each of the TPM categories. For each TPM, the following questions are discussed:

1. Which future challenges are relevant for the different TPM categories or individual transport policy measures?

2. Against the background of these challenges, how would each of them affect the social, economic and environmental impacts of the TPM? Are there any new impacts that might have to be taken into consideration?
3. Given the (possible) implication(s) of a trend in the context of a particular TPM, should the existing policy be adapted? Is there a necessity to introduce new policies in order to attenuate the (negative) implications?

Based upon the cases, conclusions and recommendations were made.

Concerning the first question, literature has been browsed and furthermore a number of experts have assessed the implications. These are presented in Table 3-5 and Table 3-6 of this report. The most important future challenges for the transport system and transport policy measures are *shortage of fossil fuels* and *diffusion of ICT*. It is expected that these two challenges have a high implication for both, the demand and supply side, in the different markets of the transport system. Challenges that have a moderate implication are: *climate change*, *ageing of the European society*, *public and private debt*, *globalisation*, *fragility of the EMU* and *urbanisation and sprawling*. These challenges are prominent enough to be taken into account when developing transport policy measures.

Concerning the second question, the future challenges affect the transport system and the TPMs in different ways, and thus the further impacts on society, economy and environment. Although it is possible to isolate challenges, TPMs or impacts, the analysis becomes complex as soon as interdependencies occur between the different aspects. We have shown this for the challenge 'ageing' which has interdependencies with 'migration', 'diffusion of ICT' and 'Third Manufacturing Revolution' (see section 4.10). Sometimes the challenge reinforces the TPM and its impacts. In other cases the challenge has a negative implication for the TPM and its impacts. Due to the interdependencies between the challenges, different implications may occur. For this purpose, the application of the ASTRA-EC model, which will be developed for ASSIST, is planned. The ASTRA-EC model will help to support the understanding on implications of various future challenges upon the transport system, the TPMs and further impacts. The ASTRA-EC model is able to simulate the dynamics between a number of future challenges in terms of impacts on major transport, economic, social and environmental indicators.

It is obvious that changes in the transport system itself as well as in the output of the transport system can cause changes for society, economy and environment. By connecting the different challenges to the input of the transport system, the markets in the transport system and to the output of the transport system, some further impacts could

be identified. But again, things start becoming complex when interdependencies between the challenges are taken into account.

Concerning the impacts on society, economy and environment, the analysis shows once again that economic and environmental impacts can be quantified to a certain extent. The impacts on society need a more qualitative approach when analysed and taken into account in drafting policy responses.

The answer on the third question is diffuse. In some instances, the TPM (category) is good for now and needs only little extra attention, like promotion of the Telework incentive. On the other hand, some TPMs need to be reviewed in the light of some challenges. For example, the European Road Safety Action Programme (ERSAP) should be reviewed in order to see whether it takes the challenge of ageing sufficiently into account. Also the Energy Taxation Directive does not include air and maritime shipping. Hence, this may need some extra attention as well.

Concerning the different challenges in the macro-environment of the transport system, the following conclusions can be drawn:

In the field of environment, four challenges were identified as important. These are *fighting climate change, shortage of fossil fuels, increasing air pollution and noise and urbanisation and sprawling*.

- The challenges climate change and air pollution are already taken into account in different TPMs as the transport system is one of the determinants of these challenges.
- Fossil fuel shortage has an important implication for TPMs, maybe surprisingly often a positive effect for the different TPMs.
- The implication of urbanisation and sprawling concern trips, transport and traffic markets of the transport system. The volume of passengers by purpose and mode may change.

In the field of society, the following challenges were identified: *ageing, migratory pressure, unemployment, income inequality, terrorism and insecurity, and individualism*.

- These challenges are partly interdependent which makes isolation of implications difficult. According the literature, most challenges are already addressed in policy documents. Individualism is the only challenge that has not been addressed in policy documents.
- Ageing, migration and unemployment have an implication for the inflow of labour into the transport system. On one hand the inflow diminishes due to ageing, on the other hand the inflow may increase due to migration and unemployment.

- Income inequality has an implication for the budgets needed for travel or buying equipment such as a car. In turn, this has an impact upon the volume of passengers and the costs or revenues on the output side. It is expected that the volume and revenues may decrease, while the costs increase.
- Terrorism and insecurity has an implication for the perception of passengers and freight shippers using (parts of) the transport system. After an incident the volumes drop, but these will usually recover. On the supply side more damage and victims are expected, bringing along costs for health and repair. Further impacts concern health and competitiveness.

In the field of technology, two challenges were identified: *diffusion of ICT* and *Third Manufacturing Revolution*.

- The field of technology provides different opportunities with a positive implication for the transport system. It is expected that the field of technology could support different TPMs.
- In the long run, the Third Manufacturing Revolution might become an alternative for freight transport. On the input side of the transport system, this will diminish freight volume and labour. On the output side, this may bring changes in volumes by mode, and in the costs and revenues. Concerning implications for energy use and emissions no further evidence has been found.

In the field of economy three challenges were identified: globalisation and outsourcing, public and private debt, and fragility of the EMU.

- The overall pattern of the challenges seems to be on the negative side. Public and private debt, fragility of the EMU, globalisation and outsourcing seem to have negative implications in the sense of extra costs or in the sense of a lack of sufficient finance to develop or maintain infrastructure or to get access to modes.
- Globalisation and outsourcing has an impact upon freight volumes and energy use. Both may increase. Also, the volume of passengers by specific modes such as air is expected to increase. Globalisation may bring extra transport costs. Furthermore, due to outsourcing an outflow of labour may occur, thus causing unemployment as a social impact.
- Private and public debt, both have implications for the budget available for transport, access to modes, and infrastructure. A lack of sufficient budget will lead to a decrease in volume on the demand side. On the supply side, this will lead to a decrease in access to modes, and to fewer investments in the development or maintenance of infrastructure. Concerning the social impacts, unsafe infrastructure may lead to extra victims. Concerning the economic impacts, this may have consequences for the competitiveness, both on sector and spatial level.

The fragility of the European Monetary Union may have some implication for the volume of passengers and freight on long distances within the EU. This may diminish.

Also, in case of a collapse, costs and revenues from the transport system will change. In the end the change in the transport system will have an impact upon the competitiveness of the EU.

It is recommended to carry out a monitoring for drivers and challenges outside the transport system, in order to keep an eye on the developments and to be able to change transport policy (measures) whenever this is needed. This relates to the first question raised at the beginning of this summary.

It is also recommended to further explore and quantify the implications of the challenges for the TPMs and thus on society, economy and environment. In the ASSIST project, a test with the ASTRA-EC model is foreseen. Finally, the qualitative findings of this part of the project and the quantitative findings of the simulation with the ASTRA-EC model are inputs for the synthesis in ASSIST in terms of the *Handbook of Social and Economic impacts of Sustainable Transport Policy*.

Concerning TPMs, it is hard to just look at TPMs and transport sector only. If we would like to fight the future challenges, policy measures in other fields also need to contribute. After all, the transport system is usually affected by the macro-environment, while the system itself has a limited impact on the macro-environment.

It is therefore recommended to make a policy response as a combined effort of the different Directorates of the EC. After all, the transport system is a derived system (see chapter 2). This implies that the challenges should be approached from an integral perspective instead of just from the perspective of DG MOVE. As a policy response, a horizontal approach across the different Directorates would help to respond to different challenges from different perspectives.

Policy measures outside the transport system might be:

- Re-urbanisation (making cities more compact) in combination with facilities for elderly people to reduce travel;
- Redefining the prosperity and welfare, this includes health, quality of life, income distribution within and amongst EU member states;

New policy measures within the transport system are hard to find. But one could think to put a focus on certain categories, e.g.:

- Reduction of car ownership by creating more opportunities for and better access to public transport, slow modes or car sharing. This could be done in combination with re-urbanisation.
- More attention to transport planning in combination with re-urbanisation. This should lead to more compact, energy and transport efficient urban areas.

To fight or enforce the future challenges it is recommended to make use of a horizontal approach across different disciplines such as Transport, Planning, Healthcare, Employment, Education, Economy and Technology. Dealing with future challenges requires an integrated, horizontal policy approach.

# 1 Introduction

The ASSIST project aims at providing the EU with advice on the possible social and economic impacts of transport policies that have been applied in the EU, the Member States or in other countries in the past or are planned to be applied in the future. Additionally, future challenges for the transport system are taken into consideration.

ASSIST concentrates on the social, economic and environmental impacts<sup>1</sup> of transport policy measures. The social impacts are regarded as impacts that change the social conditions of an individual (such as choice of travel mode and accessibility) or a society (such as community cohesion and employment). The economic impacts are those that change the economic conditions of an individual (such as time savings and individual costs of mobility) or the society (such as tax revenues for governments and modal share). The environmental impacts (such as pollutants and noise) are considered if they have a relation with social or economic impacts.

This report is devoted to the identification of the relevant future challenges, to analyse their implications<sup>2</sup> for the transport system and transport policy and to derive possible policies from the future challenges, using the categorisation of policies adopted in the project, as well as providing a policy radar for emerging new policies. Further, the document elaborates on the possible adaptations of policy impacts caused by the future challenges.

This report is structured as follows:

In chapter 2 the relevant future challenges are identified. The chapter starts with an overview of the transport system and its macro-environment. From the macro-environment, different future challenges are selected that affect the transport system. A short explanation about the approach to select the future challenges is given. Furthermore, the linkages and interactions between the different challenges are discussed.

Chapter 3 explores the potential implications of the challenges on the transport system and thus the transport policy measures (TPMs). The chapter links the challenges and the TPMs to the different parts of the transport system. Then the challenges and TPMs are combined to see where the impacts occur. Finally, the further changes in social, economic and environmental impacts are discussed.

---

<sup>1</sup> In ASSIST we use the term '*impact*' to indicate the effects of transport policy measures upon the transport system and the drivers outside the transport system

<sup>2</sup> In ASSIST we use the term '*implication*' to indicate the impact of future challenges upon the transport system and transport policy measures.

Chapter 4 reports the analysis of the implications of future challenge for selected transport policy measures, summarising relevant interactions and (possible) needs for revision or adjustment of TPMs.

Finally, chapter 5 provides conclusions and recommendations on the implication of future challenges on transport policy.

## **2 Identification of the future challenges**

### **2.1 Introduction**

This chapter starts with an overview of the transport system and its macro-environment in order to create a baseline for identifying relevant future challenges. This overview provides a conceptual framework of the transport system and the way it is affected by its macro-environment.

The macro-environment consists of different categories of drivers, such as demography and economy, which affect the transport system. These drivers also contain the so-called future challenges. These are trends outside the transport system which can already be observed and are assumed to have an implication for the transport system and transport policy.

In Section 2.3 a short explanation is given about the approach to select the future challenges. Different challenges from different drivers have been chosen, mainly based upon the relevance for the transport system.

The relevant future challenges are presented in Section 2.4. A short description of the relevance is provided. More details on the future challenges are presented in Annex 1.

The future challenges have a mutual interaction as well. On the one hand this may enforce implications for the transport system. On the other hand the challenges may have reversed effects. The mutual interaction is discussed in Section 2.5.

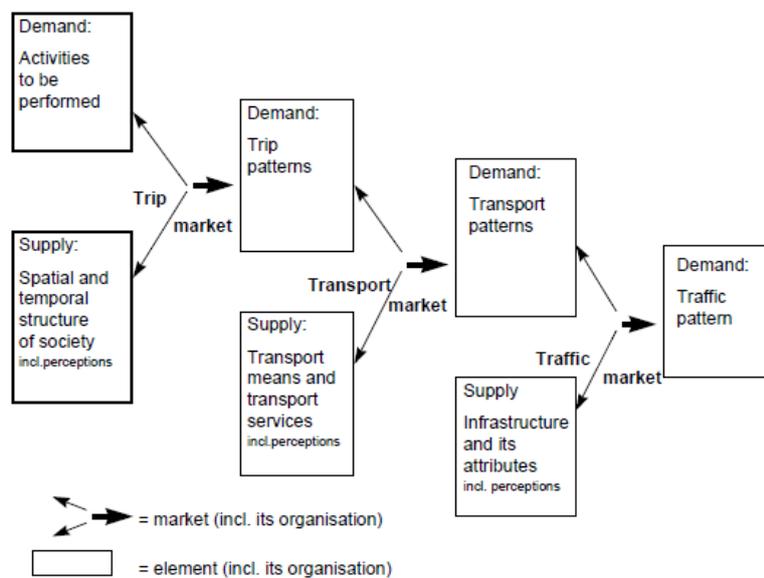
### **2.2 The transport system and its macro-environment**

Every introductory textbook on transport economics states that the essence of transport is derived demand. In order to satisfy needs or activities, people and goods travel or move between geographical different locations. As Button (2003:4) puts it: 'Possibly the most important characteristic of transport is that it is not really demanded in its own right. (...) The derived nature of demand for transport is often forgotten in everyday debate but it underlies all economics of transport'. The essence implies that the drivers for transport lie outside the transport system, in the macro-environment.

Therefore, the developments in the transport system cannot be understood without a good knowledge of the development of the drivers in the macro-environment. The drivers include different aspects such as: technical and scientific development, economic growth and demographic and social trends. It is important to analyse the macro-

environment of the transport system, because this is where the future challenges can be found. This section describes the transport system and its macro-environment.

The transport system consists of different elements that can be assigned to transport demand and transport supply. The demand side of the transport system comprises trip patterns, transport patterns and traffic patterns. The supply side comprises transport means and services, and infrastructure and its attributes. Van de Riet & Egeter (1998) developed a conceptual framework for the transport system. They regard travel and transport as a set of markets with a dynamic interaction between demand and supply. In this interaction choices are made on both the demand and supply side of the markets. Within the transport system therefore, three different markets are distinguished, the trip market, the transport market and the traffic market (see Figure 2-1).



Source: van de Riet & Egeter (1998) and OECD (2002)

Figure 2-1: Conceptual framework of markets in the transport system

The *trip market* consists of activities to be performed, whose location and time are as yet unknown. The supply side consists of the spatial and temporal distribution of the locations where the activities could be performed and the trips associated with them, as well as how this distribution is perceived. The output of this market consists of a set of trip patterns, an allocation of the activities to locations and times. The trip patterns become the demand side of the transport market.

The *transport market* consists of trip patterns, which demand for vehicles to transport people and freight. The supply side consists of vehicles and services to make the trips. The output of this market is an allocation of trips to vehicles and services, the transport patterns. The transport patterns form the demand side for the traffic market.

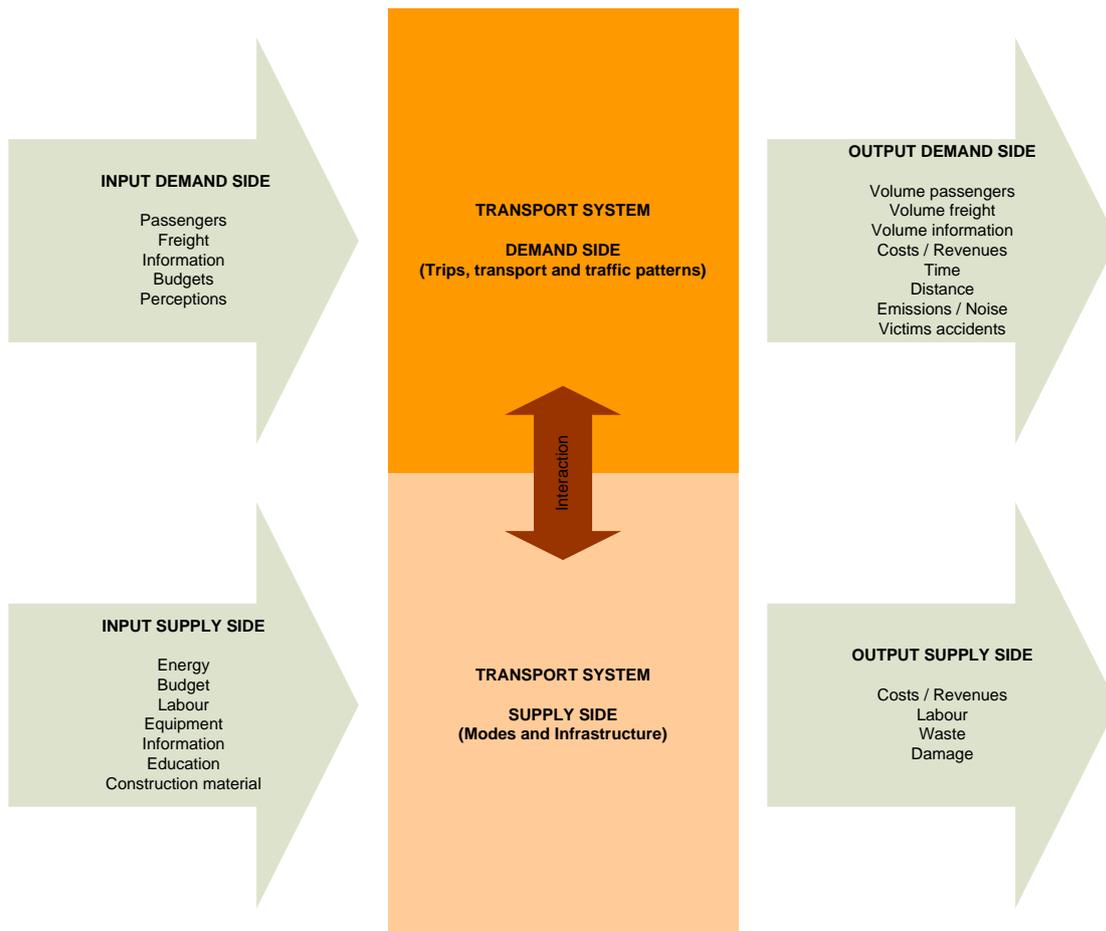
The *traffic market* comprises the transport patterns, which demand for infrastructure to accommodate the vehicles and services. The supply side consists of infrastructure and all its attributes such as traffic control systems or timetables. The output is a traffic pattern (see OECD, 2002).

In each of these markets, the balance between demand and supply is affected by changes in volume of freight and passengers, distance, time, costs and perceptions. Except for perception, these variables can be quantified. Perception consists of a qualitative view on different elements in the transport system such as comfort in public transport. For example, if a measure is taken to reduce congestion, this leads to a reduction in travel time and travel cost. Also, the perception using car improves. Together, these key variables provide an important guidance in thinking about the implications for the transport system and transport policy.

To keep the transport system running, different input is needed. These inputs can be distinguished into input for the demand side and input for the supply side. Concerning the demand side, the input consists of volume of passengers, freight and information, and budgets of households and businesses. On the supply side the input consists of energy for different modes, budgets of governments, operators and providers, manpower for governments, operators and providers (inflow of personnel), equipment such as vehicles, information, education and construction material to build infrastructure.

The transport system also produces output. On the demand side one needs to think of different output such as volumes of freight and passengers, travelled time, travelled distances, costs (variable, fixed, energy, external) and revenues, emissions and noise, and victims of accidents. On the supply side output can be found like costs and revenues (for example from pricing), outflow of manpower (think of retirement), waste and damages. Figure 2-2 provides an overview.

The input and output of the transport system consists of key variables with a relation to the macro-environment. Knowledge of the key variables helps to understand which levers exist that may influence the transport system. Also, it helps to understand what output is produced by the system. Both input and output of the transport system are affected by future challenges, but also by policy measures. Especially the output has further impacts on society, economy and environment.



Source: Panteia/NEA

Figure 2-2: Input and output of the transport system

The transport system is continuously affected by external drivers. As Goodwin (2002) states: to understand the developments in the transport system it is important to identify the fundamental drivers that affect the system. The drivers are beyond the control or influence of the organisations in the transport system. The drivers are not directly subject to transport policy control. On the other hand it is important to be aware of the drivers for carrying out different activities, such as the development of transport policy measures. In other words, it is important to analyse the macro-environment of the transport system.

The drivers of the transport system can be categorised as Economic, Social-Cultural, Technological and Environmental (ESTE). This is in line with management and organisation theory, where the analysis of the macro-environment of an organisation follows

similar categories (Paul, 2010)<sup>3</sup>. It helps organisations to think about their environment and the opportunities and threats that lie within it. It incorporates the different perspectives and provides a logical structure for further discussions and proactive decision making. It is as a strategic starting point in thinking about what the drivers mean and how they affect an organisation, or as in our case, the transport system.

The drivers in the macro-environment contain several challenges. They all affect the transport system in one way or another. These challenges have different implications for the transport system. Some affect mainly the demand side, some will affect the supply side and some affect both. It is important to show where the implication occurs in the transport system, as this eases to make a link between the challenges and transport policy.

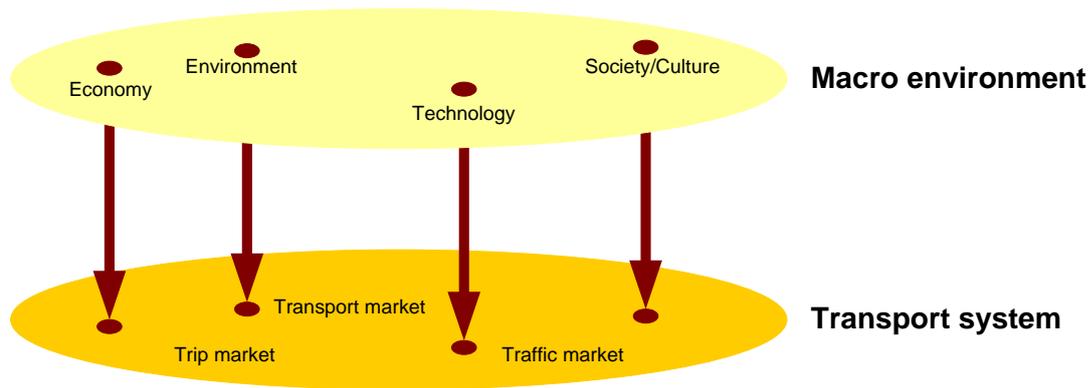
As an example, it is expected that ageing will have an implication for the demand side of the transport system. Elderly people will perform different activities, such as more leisure and less work. This will have a further implication for the transport and traffic patterns. Also, more elderly people imply fewer youngsters. This may have an implication for the use of modes such as public transport to school.

The challenges do not necessarily have an implication for all markets of the transport system. In some cases the traffic market is affected in the first place. For example, it is expected that 'Security and Terrorism' affect the transport services and the infrastructure in the first place. These concern the supply side of the transport and traffic market. Furthermore, it is expected that the demand for activities (for both passenger and goods) may change, thus creating different trip patterns.

The figure below shows the implication of the fundamental drivers and thus the challenges for the transport system and its markets (see Figure 2-3). The implications of the challenges for the transport system will be further elaborated in chapter 3, after the identification of the challenges.

---

<sup>3</sup> Several categories exist like DESTEP, PEST or STEP. In some cases Demography and Politics are seen as separate fields. We chose this categorisation for reasons of simplicity. A different category does not have an impact upon the outcomes in this report.



Source: Panteia/NEA

Figure 2-3: Implication of drivers in the macro environment for the transport system

## 2.3 Approach to select future challenges

For the purpose of the ASSIST project, a 'challenge' is defined as *an exogenous condition or change at a structural level, already taking place or expected for the future, which brings about structural modifications of the current state or that requires an adaptation of current habits and policies to be addressed.*

Here are some explanations for this definition:

The term 'exogenous' means that the condition or change is originated in the macro-environment outside of the transport system (e.g. thus the development of electric cars is a response not a challenge).

'Structural level' means the involvement of a fundamental aspect rather than a specific circumstance.

'Challenge' is used rather than 'trend' for two reasons. First, a 'challenge' communicates that attention should be paid to what is going on and the way transport policy is affected. Second, trend provides more the idea of some 'natural' movement towards one direction, while the challenges considered here are in most cases not 'natural' but policy driven. Some of them are not evolving conditions, but existing or foreseen circumstances that might exist in a certain time and disappear afterwards (for example the debt issue).

Transport policies are therefore confronted by the challenges of sustainability (Banister, 2008). These challenges, environmental, social and economic, involve in particular the crucial questions of energy costs and climate change, but also relate to financial con-

straints. The transport sector is directly concerned and it is interesting to observe how the priorities of transport policies are changing in many European countries. Instead of encouraging road and motorised traffic the goal of transport policies is now to promote sustainable mobility. But up to what extent are transport policies ready to constraint and even to reduce passenger and good mobility? What are the consumer behavioural changes to set up considering all the coming challenges?

Several other external challenges can affect the transport system in the future. Most of such challenges are already recognisable (such as globalisation, urbanisation and sprawling, debt), others can become very relevant in the near future (such as diffusion of ICT, migration pressure) others are longer term issues that nevertheless should be addressed (such as shortage of fossil fuels, climate change).

Most of the challenges are already recognised by policy makers and have been addressed in several documents by the European Commission. Especially in the White Paper 2011, references to climate change, fossil fuels shortage, ageing and migratory pressure, globalisation, urbanisation, air and noise pollution are included. Also the Commission staff working document "REGIONS 2020" reports the implication of various future challenges, such as climate change, fossil fuel scarcity, ageing, migratory pressure and globalisation. The debt problem (even if especially the public debt) is at the top of the EU agenda when this report is being written.

In order to identify the list of future challenges which are relevant with respect to social and economic impacts, we collected information on challenges from various references, classified these challenges with reference to their relevance according to the ASSIST purposes, and produced a list of selected future challenges. The classification of the challenges includes the following elements:

- field of the challenge: environment, society, technology, and economy;
- probability: high, medium or low;
- scale: European or global;
- time horizon: short (2020), medium (2030), long (2050);
- relevance with respect to transport policy and its social and economic impacts.

To enlarge the scope of the analysis of such a wide theme as future challenges, the types of references scrutinised vary from literature to public debate, as well as suggestions from discussions within the ASSIST consortium and workshops. Therefore, not only reports are included but also newspaper articles, websites, etcetera. The full list of references is available in chapter 6 of this report. Also, Annex 1 provides an overview of the challenges and their specific references.

## 2.4 Relevant future challenges

### 2.4.1 Introduction

Based upon the approach described above fifteen relevant challenges were selected. Table 2-1 provides an overview of these challenges, together with a short description reported in this section. Annex 1 provides a description each of the challenges in Table 2-1, including its relevance for ASSIST.

Table 2-1: Selected challenges and the driver they belong to

| Drivers     | Challenges   |
|-------------|--|
| Environment | Fighting climate change                              |
|             | Shortage of fossil fuels and other natural resources |
|             | Increasing air pollution and noise                   |
|             | Urbanisation and sprawling                           |
| Society     | Ageing of the European society                       |
|             | Migratory pressure                                   |
|             | Unemployment   |
|             | Income inequality or income distortions              |
|             | Terrorism and the feeling of insecurity              |
|             | Individualism  |
| Technology  | Diffusion of ICT                                     |
|             | Third manufacturing revolution                       |
| Economy     | Globalisation and outsourcing                        |
|             | Public and private debt                              |
|             | Fragility of the European Monetary Union             |

Source: TRT

Other challenges were revealed from the analysis, with reference to a variety of contexts: e.g. earthquakes and volcanic eruptions, geopolitical conflicts, illicit trade and organised crime, growth of global population, resurgence of nationalisms, power shift eastward, obesity, etc<sup>4</sup>. These other challenges were considered to be less relevant for the purposes of the ASSIST project and were therefore not included in the analysis. In some cases they might belong to other challenges included in the selection: e.g. accel-

<sup>4</sup> See Watson (2010) for several other identified trends

eration of lifestyle / trans-nationalisation is strictly related to globalisation and outsourcing, panic in case of lack of information (due to internet or mobile network collapse) might also belong to the challenge *feeling of insecurity*. It should be clear that this judgment of relevance is strictly related only to the scope of ASSIST. For instance, we believe that *power shift eastward* is of utmost importance, but at the same time we consider that, as far as transport policy is concerned, its implications are not significantly different from those addressed by the challenge of globalisation.

The relevance of the future challenges with respect to the transport system and the economic and social impacts of the related TPM categories is summarised in Table 2-2. Per challenge different questions are addressed, such as '*Does the challenge increase mobility and does have a negative impact on the environment?*'. For this question it can be seen that it is expected that the challenges urbanisation, migratory pressure and globalisation lead to more mobility, with a negative impact upon the environment.

Different other questions are raised as well to get an idea of the relevance of the challenges by several dimensions: some claims for new policies, other could provide more tools for implement policies, but some put resources for transport policy in danger. Most of them can have social and economic impacts or the policies that are needed to tackle them can have social and economic impacts to be considered in policy design.

Table 2-2: Relevance of challenges with reference to TPMs and their implications

| Relevance for the transport system  | Climate change | Shortage resources | Pollution and noise | Urbanisation | Ageing | Migratory pressure | Unemployment | Income inequality | Terrorism/insecurity | Individualism | Diffusion of ICT | Third manufact. revolution | Globalisation/Outsourcing | Fragility of EMU | Debt |
|---|----------------|--------------------|---------------------|--------------|--------|--------------------|--------------|-------------------|----------------------|---------------|------------------|----------------------------|---------------------------|------------------|------|
| Can increase mobility and thus negative impact on environment                           |                |                    |                     | ■            |        | ■                  |              |                   |                      | ■             |                  |                            | ■                         |                  |      |
| TPMs required are intense enough that their <i>social</i> impact should be considered   | ■              | ■                  | ■                   |              | ■      | ■                  | ■            | ■                 |                      |               |                  |                            |                           |                  |      |
| Can change mobility needs   |                |                    |                     | ■            | ■      | ■                  | ■            | ■                 | ■                    | ■             | ■                | ■                          | ■                         | ■                | ■    |
| Can require changes of mobility habits  | ■              | ■                  | ■                   | ■            |        |                    | ■            | ■                 |                      | ■             |                  |                            | ■                         |                  |      |
| TPMs required are intense enough that their <i>economic</i> impact should be considered | ■              | ■                  | ■                   |              |        |                    |              |                   |                      |               |                  |                            |                           |                  |      |
| Increase of role of transport in society  |                |                    |                     | ■            |        |                    |              |                   |                      |               |                  |                            | ■                         |                  |      |
| Affect technological development of transport   | ■              | ■                  | ■                   |              |        |                    |              |                   | ■                    |               | ■                |                            | ■                         |                  |      |
| Require more resources for the transport system   | ■              |                    |                     | ■            | ■      | ■                  | ■            | ■                 | ■                    |               |                  |                            |                           |                  |      |
| Reduce public resources available for policy  |                |                    |                     |              |        |                    |              |                   |                      | ■             |                  |                            | ■                         | ■                | ■    |
| Reduce private resources available for transport  |                |                    |                     |              |        |                    |              |                   |                      |               |                  |                            | ■                         | ■                | ■    |
| Can make mobility unsustainably expensive or unfeasible                                 |                | ■                  |                     |              |        |                    |              |                   |                      |               |                  |                            |                           | ■                | ■    |
| Require dedicated TPMs  | ■              | ■                  | ■                   | ■            | ■      |                    |              |                   |                      |               |                  |                            |                           |                  |      |
| Can require revisions of current TPMs   |                | ■                  | ■                   | ■            | ■      | ■                  | ■            | ■                 |                      | ■             | ■                | ■                          |                           | ■                | ■    |
| Require innovative TPMs   |                | ■                  | ■                   |              |        | ■                  |              |                   |                      |               | ■                |                            |                           |                  |      |

Legend: ■ = Large implication, ■ = small implication.

Source: TRT

## 2.4.2 Environment

In order to **contrast climate change**, drastic cuts of GHG emissions are required (IPCC, 2007). Transportation is one of the major responsible sectors for greenhouse gas emissions and has not reduced its burden in the last years. This is one of the main objectives of the EU transport policy, as suggested by the 2011 White Paper (EC, 2011a), in order to achieve the target of reducing GHG emission by 20% in the EU in 2020 with respect to 1990. Therefore, effective policy measures should promote research on technology to improve vehicles efficiency as well as changes of mobility and transport habits. In addition, adaptation measures might be needed in the transport sector to face the effects of climate change: global warming resulting in a rising sea level would amplify the vulnerability of coastal infrastructures and ports, extreme weather events would affect the safety of all modes, etc (EC, 2009).

As a result, the TPMs required to contrast climate change, especially those based on economic incentives, are intense enough that their economic and social impact should be considered. The **shortage of fossil fuels** might have a considerable implication for the transport system. Currently, the sector is dependent upon oil-based fuels and responsible for about 67% of the final oil demand in the EU (EC, 2011b). As a response to oil scarcity, the EU policies should stimulate the development of alternative technologies, as well as strong adaptations involving also mobility behaviours (EC, 2010). Limiting mobility of people could have a drastic effect on the possibility to participate in economic and social activities. Finally, an increase of freight transport costs would entail a revolution in the industrial logistic, which is based on the relative very low incidence of transport costs (TRT, 2005). On the other hand, in case of sharp rise of resource costs due to oil shortage, these policy measures can help to smooth the pressure on transport oil demand. Therefore, in order to be effective, dedicated policies have to be quite strong, resulting in strong adaptations. This implies that they might have an uneven impact on different social groups (e.g. road pricing measures might be very penalising for people who have no or poor alternatives to use a car). As mentioned above, policies addressing transport behaviour need to be coupled by those acting on the technology of the transport system. Research on alternative fuels is being carried out and some innovative vehicles are entering the market (and needs supporting policies). However, alternative technologies are also dependent on some raw materials (e.g. Platinum, Cobalt, etc.) which are also finite (EC, 2010a).

Finally, it should be mentioned that limiting the energy consumption in Europe would also increase energy security, reducing the energy dependence from a limited number of foreign countries, many of which face threats to stability (Belkin, 2008).

In the end, it can be concluded that the economic and social impacts in this context have to be evaluated carefully.

The transport sector contributes to both **air and noise pollution**. Motorised vehicles are a significant source of air pollution, in particular private vehicles in urban areas. The road mode covers more than two thirds of the overall transport contribution to pollutant emissions, despite progress have been made over the year also based on the gradually more stringent EURO emission standards for road vehicles. Nevertheless, the concentration of NO<sub>x</sub>, ozone and particulate matters in many areas are still beyond the limits (EC, 2009). Therefore, innovative or stricter policies should be developed to effectively contribute to the reduction of air pollutant emissions, for road and the other transport modes. If tight traffic restrictions should be needed to respect emission limits, the impact on economy and social activity could be quite significant and transport policy should find a balance between health and positive implications of transport (Petersen et al (2008)).

The noise related to transportation systems (including motor vehicle, aircraft, rail, etc.) is one of the main sources of outdoor noise. Poor urban planning may exacerbate noise pollution in the residential area. Transport policy can contribute to mitigate or remove noise. Standards can be defined to prompt research on vehicle construction in a similar way as for pollutants. Rules can also be introduced for infrastructure design and land-use planning (e.g. noise barriers, limitation of vehicle speeds, limitation of heavy duty vehicles, tyre and vehicle design, etc.) to limit citizens exposure. Again, a balance between economic and social costs and benefits should be found.

In Europe, a variety of powerful factors drive the **urban sprawling**, including individual housing preferences, increased mobility, commercial investment decisions, and the coherence and effectiveness of land use policies at all levels (EEA, 2006). As an example, the improvement of transportation links and enhanced personal mobility accelerates this process, making possible to live increasingly farther away from city centres (while retaining all the advantages of a city location), or even to live in one city and work in another. A question may therefore arise for transport policy whether improving transport supply ends always up with benefits or can become undesirable beyond a certain point for the sake of other objectives. Indeed, changes in lifestyle associated with urban sprawl contribute to increase the use of resources, e.g. the growing consumption of energy and other negative environmental impacts. Increased transport related energy consumption is in turn leading to an increase in the emission of CO<sub>2</sub> to the atmosphere. Urban sprawl also increases the length of trips and emphasises the problems of automobile dependency. From a social perspective urban sprawl gener-

ates greater segregation of residential development according to income. From an economic perspective, it implies:

- increased household spending on commuting from home to work over longer distances;
- the cost to business of the congestion in sprawled urban areas with inefficient transportation systems;
- the additional costs of the extension of urban infrastructures including utilities and related services, across the urban region.

To face these impacts, measures focusing on infrastructure and transport services have to be implemented very carefully. In addition, combined land-use and transport policies should be taken into account to avoid unregulated expansion of the cities.

### 2.4.3 Society

Over the next decades, the significant increase in the adult population aged 65 or more will place new and growing demands on transport systems in the European Union. **Ageing** and transportation, viewed as a public health issue, have two main dimensions: safety and mobility. On the mobility side, older people who drive will prefer to continue doing so for as long as possible, expecting also to have access to alternative transport modes that meet their individual needs, especially as they approach 80 years of age (OECD, 2001). Future transport systems and services need to play an essential role in supporting independent, healthy ageing without social exclusion. Specific circumstances will have to be taken into account such as the possible change of travel patterns (e.g. health districts will be attracting an increasing amount of trips, while school districts will lose demand) and the reduced driving capabilities (on average) of even healthy elderly individuals. The latter aspect is strictly related to safety (Hakamies-Blomqvist, 2003), which will be also an important concern for frailty and consequent vulnerability to personal injury or death in a crash (e.g. older people account for nearly half of all pedestrian fatalities in many countries). As a result, dedicated TPMs should be implemented and their social impact should be considered.

A last implication of Ageing is the fact that a shortage of skilled labour may occur in general (see for example Constant & Tien, 2010) or more specific in the transport sector (see ABN-AMRO, 2012). A reduction of skilled lorry drivers or personnel in the logistics sector may lead to less productivity and even outsourcing of activities. Shortages of skilled labour might put extra pressure upon migration.

**Migratory pressure** challenges reception capacities and asylum systems of the countries on one hand but eases shortage of skilled labour on the other hand. The integra-

tion of migrants in the social context (society) gives rise to needs in terms of additional services provided, also in the transport sector (Assum, 2011). As an example, public transport services might face an increase of the users as the mobility choice of migrants would rather concentrate on this mode of transport than on private modes, since most of them could not afford to purchase a car. Furthermore, many users would need time to be fluent in a new language and therefore specific attention should be paid regarding service rules, communication to customers, help desks and so on. Therefore, on one hand the social impacts of TPMs would affect a different social context with respect to the reference trend; on the other hand additional measures might be required to face the needs of this segment of population. Nevertheless, it should be taken into account that while migrants at the beginning of their experience generally travel less and mostly by public transport due to economic reasons, in the long term the mobility patterns can change significantly becoming similar to resident habits. Anyhow, providing additional measures and services can require more resources. However, migratory pressure is especially felt by unskilled workers, who face a stronger competition in the labour market as well as benefit from social programmes. This group of population can become particularly reluctant to support higher taxes (or tariffs) to finance new services which are largely enjoyed by immigrants. In the end, the social impacts should be considered in this particular context. In addition, it should be noticed that the resulting increase of mobility can emphasise the negative environmental impact generated by transport. It should also be pointed out that this challenge may be connected with the challenge of climate change (EC, 2010b), though this seems to be a longer term issue. Climate science has coined the term climate refugee to point out that climate change may affect some regions severely e.g. causing droughts or flooding them such that no agriculture is possible anymore as well as that the water resources for drinking water will be depleted in the former case. This means population living in such areas will have to migrate somewhere else.

Migration also may have a positive impact upon the foreseen shortages of labour in the transport and logistics sector (ABN-AMRO, 2012, EC, 2009 and Constant & Tien, 2011). Immigrants with the right skills may ease shortages of labour such as truck drivers or employees in logistics services.

In the last 20 years the average **unemployment** rate in the EU27 countries has never fallen below the 7% (Eurostat database), with some countries experiencing higher unemployment rates and with a growing share of precarious employment also in those economies and sectors where some shortage of specific skilled labour was noted. For instance, in the transport sector, scarcity of skilled workers are often raised (EC, 2009). Despite mass unemployment, labour shortage in a specific sector can exist simultaneously, but the former seems a much more serious threat for the future in Europe.

At the same time, over the last three decades in a large majority of OECD countries, household incomes of the top 10% grew faster than those of the poorest 10%, leading to widening **income inequality** (OECD, 2011). Unemployment is one cause of such a growing inequality, but it is a challenge in itself. It damages economic performance, quality of life and social inclusion. More specifically, it brings about a reduction of the households income, therefore also the budget for mobility is affected and transport services might face a different distribution of demand: in fact, a larger share of households might have less resources for mobility and therefore less money to operate an own car. As recent trends suggest (The Economist, 2012) they will be probably reducing the trips for leisure purposes and shifting toward a larger use of public transport modes, which however could have problems to update tariffs to cover their production costs.

One obvious potential consequence of the **feeling of insecurity** linked to transport is that people tend to travel less or to avoid some destinations. Actually, aviation suffered from a decrease of number of passengers after 9/11 events. Even if evidence seems demonstrating that travel habits are fast restored after the initial fall (European Travel Commission, 2006), if terrorism will continue to represent a mass fear, the transport sector - and especially aviation – could see a reduced demand trend. Either because passengers are concerned or because they are discouraged by higher costs and annoying procedures to ensure security (ECMT, 2003).

The costs of potential damage from terrorism are substantial but improving security is not cheap (OECD, 2009). Especially when resources are scarce, cost-effective air passenger screening policy should be developed. For instance, voluntary registration in programs that would involve voluntarily submitting to security profiling could be attractive for frequent travellers who would avoid queuing time at airports. These programs would need a reference legal framework and probably managed by public authorities responsible for data confidentiality to work. Also maritime transport is involved by security (both as target of attacks as it has increasingly happened recently and because it can be vehicle for moving weapons and terrorists). Being this sector complex, not very transparent, and by its nature strongly international, establishing a systematic and coordinated approach to the regulation of security is a challenging goal for the transport policy. Nevertheless this trend has the attention of the EC (see for example EC, 2010c)

**Individualism** impacts directly on mobility behaviours, supporting an extensive use of private modes (symbol of the 'freedom of individual') and resulting in a reluctant attitude toward the use of public transport alternatives (see for example Petersen, 2009). As a consequence, an increase of private mobility might be observed, emphasising the negative environmental impacts generated by transport in terms of air pollution, noise and fuel consumption. At the same time, individualism is characterised by a low accep-

tance of taxation, especially to finance services which are not directly used. Therefore if some demand leaves public transport also public resources for this service might be reduced. Finally, the search for private space might give rise to an increase of sprawling, increasing distance travelled by private mode. As a result, Transport Policy measures should be adjusted to face the individualist attitude of transport users, in order to reduce and/or mitigate the negative impacts on environment, economy and society.

#### 2.4.4 Technology

Over the years, **Information and Communication Technologies (ICT) and technological innovation** are penetrating all sectors of activity. ICT applications are endless, with manifold implications for the economy and life habits. One potential of ICT that has been only partially explored so far is the chance to avoid or drastically limit physical moves of people and goods. Tele-conferences with easy on-line shared real time access to data and presentations are already feasible, but further improvements can be expected in terms of visual and vocal connection (e.g. holographic interfaces), making interaction between participants more and more similar to real meetings. Remote uploading and unloading is more and more used instead of physical supports for a number of services, including tele-medicine and even tele-surgery. ICT can therefore shape a world where personal mobility is more and more a matter of will than a matter of need. Although at least at the beginning this opportunity would only be available for some social segments. Transport policy would therefore adapt itself. ICT could help if mobility is reduced. However, literature suggests that ICT can even lead to more trips (Litman, 2011). For instance, if compulsory trips are replaced by leisure trips, the pressure on transport supply could be even higher, since travel patterns could become more and more erratic in time and space. And at the same time, limitations to personal mobility would be more and more perceived as limitation of personal choices. From a different perspective, a transportation system enabled by advanced information and communications technology could significantly reduce accidents, save lives, reduce traffic, optimise good delivery etc. Most of these implications could be market driven, but some might need suitable regulation. ICT can also help to enforce transport rules. For instance vehicles speed can be monitored by means of on-board units. The monitoring can be extended to other elements (e.g. distance, time of the day, location) allowing to implement sophisticated (and therefore efficient) pricing policies. Looking at technological innovation in vehicle design and engine, consistent improvements in terms of efficiency and fuel consumption might be achieved (World Transport Forum, 2011). The 'definition' nevertheless may include a wider range of applications: an example is the implementation of new transport modes (e.g. Segway, etc.) which might provide new alternatives to individuals and affect mode choice and mobility behaviour.

**Third manufacturing revolution** refers to the 3D printing out of physical objects using digital design file. In time, these amazing machines may be able to make a variety of products, anywhere, with a consequent implication for the transport system. Due to relocation and new production facilities, change in trade flows might occur, affecting on one hand transport route and congestion and on the other hand transport supplier (facing a reduction of demand). Since companies want to be closer to their customers to respond more quickly to changes in demand, it is also expected that the average distance travelled for goods distribution will decrease in the sectors affected by this revolution (see The Economist, 2012a).

### 2.4.5 Economy

Increasing **globalisation** leads to an increase in international transport activity involving all transport modes (OECD, International Transport Forum, 2008a, 2008b). Transport services need to face an increasing demand with requirements for high-quality, fast and reliable international transport. In other words, greater mobility and access are required, but with substantial differences from the past regarding different types of passengers and cargoes, different places and different distances. As a result, the transport sector will have to apply specific measures for facing the needs of demand or to revise current policies; at the same time, appropriate actions have to be implemented to mitigate the undesired effects e.g. produced on environment (CO<sub>2</sub> emissions) and economy (e.g. due to the additional pressure on local firms for the increasing competition). At the same time, modern globalisation has the effect to drastically reduce public control of capital and greatly increases competition, both between countries (to attract investments) and within the global labour market (Stiglitz, 2006). This way, the role of the state in the economy has been weakened, the relative contribution of capital to fiscal revenues has diminished and an increasing share of income has been transferred from labour to capital (Palma, 2009). As a result public resources for financing investment and services are more and scarcer and also the transport sector has to face this problem. The pressure on labour income can let private transport expenditure (e.g. car purchase and maintenance) become a challenge for a growing amount of people.

One side of globalisation is **outsourcing** of production in lower wage countries, which is a concrete possibility mainly based on cheap transport. Other challenges – such as fighting climate change and scarcity of fossil fuels – may imply a substantial increase of transport costs, sometimes as result of deliberate policies. Whatever policy influencing significantly transport costs – especially for long distance transport of goods – can have severe economic impacts. Despite the share of transport on production costs is on av-

erage limited, there is a point beyond which the outsourcing is not convenient anymore. Therefore transport measures need to be framed within a wider policy environment<sup>5</sup>. In the last decades, outsourcing has been one of the most relevant mechanisms that has put European wages under pressure and contributed to the shift of income from labour to capital (Franzini, 1999). In turn, this shift has contributed to the increasing problems in public budgets and to the increasing hostility towards fiscal pressure. As far as the transport sector needs public resources outsourcing can be seen a serious obstacle.

When the **private debt** is largely transformed in **public debt** – as it resulted from the recent bailouts of banks and financial institutions – and public debt exceeds the level considered sustainable by the existing public institutions, market conditions and regulation, the result is the request for a severe public expenditure restriction and/or an increase of taxation (De Grauwe, 2011). Being the latter alternative much more challenging, also given the risk of capital escapes, drastic expenditure cuts are generally put into practice. Therefore, also the public transport sector suffers from lack of resources for investment and also for managing services. At the same time the negative implication for the aggregate demand can easily induce a recession. Freight flows are reduced such as haulers and logistics operators face a shrinking of their turnover. Privatisation of public transport companies (among other publicly owned companies) is another possible measure applied attempting to reduce the debt. This requires changes to the institutional framework (regulation) in order to maintain the non-profitable services that cater for (more sustainable) mobility needs. Of course this goal is affected by financial constraints mentioned above. Recession or even low economic growth induced by severe public budget cuts increase unemployment (privatisations can directly contribute as well) and reduces disposable income. Therefore households have fewer resources for transport. They can hardly afford to have a car (or a second family car) and will depend more on public transport. At the same time they will probably travel less for leisure purposes. The same problems of households can be originated by unsustainable private debt. Furthermore, private debt can be often associated with house mortgages insolvency. Many households can be forced to move such as travel patterns in urban areas are significantly changed.

---

<sup>5</sup> Even more, one should consider also policies outside the transport sector, which play a major role not only in addressing the challenges considered here, but more generally in affecting transport demand. However, this enlargement is beyond the scope of ASSIST.

The **fragility of the European Monetary Union (EMU)** might end in a break up<sup>6</sup> (Cesaratto, 2012). Low performing economies might be forced to leave the EMU. This event could have dramatic consequences for such countries but also for the rest of the Union given the existing interdependencies (e.g. Germany largely depends on exports to other EU countries). Countries leaving the EMU would most likely leave the internal market as well. The European integration would be completely stopped or even withdrawn. In the transport sector, the physical integration of the territory by means of the Trans European Network would become much more challenging. Both financial and political problems might crowd many investments out. Trade barriers would probably be raised and therefore the extent of international transport would drastically change. At the same time, the likely recession resulting in most of the countries would also reduce transport activity. Public resources for financing transport service would be probably cut. Increased unemployment would negatively affect also personal mobility: lower car ownership, less leisure trips. International business flight within Europe might be substantially reduced.

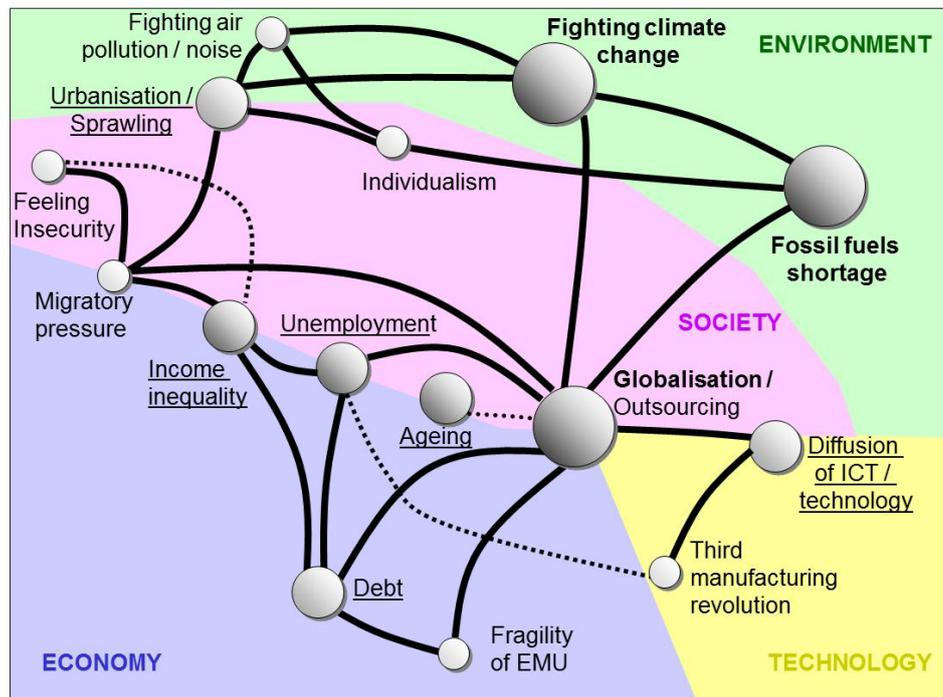
## 2.5 Linkages between the future challenges

The challenges identified are in some way linked to each other, directly or indirectly. Globalisation can be considered as a major hub of the connections between different dimensions. Figure 2-4 provides an overview of the potential linkages. The figure represents the main challenges selected from the analysis, underlying where overlap and interactions might be observed.

The linkage between **globalisation** and the **fight to climate change** is quite clear: without globalisation the economic growth of countries like China and India would be much slower and, by this, their contribution to global GHG emissions would not increase significantly. Actually, any strategy to contrast global warming should consider the global perspective. Even the effort of a whole continent like Europe might be ineffective if other large world regions do not limit emissions. At the same time, globalisation is heavily dependent on transport, which is a significant source of emissions.

---

<sup>6</sup> We consider that the scenario where EMU breaks up is the most challenging one. However, similar consequences would emerge also in one scenario where no countries leave the EMU but at the price of dramatic cuts in the public balance. Of course the most desirable scenario is that EMU remain united and problems are solved, but in such a case this would not be a challenge anymore.



Source: TRT

Figure 2-4: Linkages between future challenges in the ASSIST context

The same linkage exists between globalisation and **scarcity of fossil fuels and other raw materials**. The economic growth significantly increased the demand for oil and other commodities, thus accelerating depletion of resources and inducing scarcity lead to high resource prices.

While globalisation has promoted growth in different world regions, such a growth is all but evenly distributed. Most of the inhabitants in most of the less developed regions are not benefitting from globalisation. On the contrary, disparities have increased between regions and within single countries, including those where the total income has grown. One result of the increasing disparities is the contribution to the **migratory pressure** on the richer economies like Europe's.

Larger disparities are also experienced in most developed regions, including Europe. Modern globalisation means especially free capital flow and **outsourcing**. Both of these elements put wages, welfare state and social rights under pressure, together with free trade, shift power and income from labour to capital. There is therefore a tight relationship between **globalisation, unemployment** and rising of **income inequality**. Implications might occur on both individual life plans (including fertility rates) and habits (including food consumption). Therefore, globalisation is somewhat linked also to **age-**

**ing**, even if quite indirectly. In addition, income inequality might be enhanced by **migration**: in turn, implications for **terrorism** and **insecurity** might occur.

Direct is also the linkage between globalisation and **debt**. The shift of income from labour to capital tends to decouple the trend of aggregate demand and the trend of aggregate supply in industrialised countries, with the former growing much slower than the latter. In order to contrast the depressing implication of such diverging trend debt has been widely increased both in its private and, especially lately, in its public form. Policies to reduce public debt based on austerity have a worsening implication for **unemployment** and **income inequality**, while at the same time income inequality is one of the determinants of the debt, which has been used – primarily in the US but also in some European countries like UK – to sustain aggregated demand depressed by stagnating wages.

The use of debt instead of addressing the increasing income inequalities is explained by the priority given to the free circulation of goods, services and capital. The choice of more open economies has obviously fostered economic growth and therefore transport flows as a derived demand. But it is also clear that free capital circulation has been a strong factor of debt increase. Nowadays, the burden of debt is so heavy in some countries and the cost of economic adjustment is so high for some members of the EMU, that a new tendency could occur, leading to some limits to free capital circulation. But such a decision is not just a tilt in the current way of managing the economic relations between countries and namely within EU. It is a threat on the principle of globalisation and a risk for EU taking into account the **fragility of EMU**. While globalisation can be considered as a generator or accelerator of many challenges, the linkage with the **diffusion of Information Communication Technologies** is rather the other way round: the latter contributes to globalisation. Indeed, without the technical possibility of transferring and storing information in real time, some significant treats of globalisation would not be the same, in particular outsourcing.

Several relationships between challenges do not imply a role of globalisation. Fighting climate change is linked to the scarcity of fossil fuels and other raw materials as there is a clear overlap of their determinants, but also synergies in the policies that might be used to address these problems. In fact, fighting climate change includes measures leading to a shift from fossil to renewable energies. Migratory pressure is linked to **urbanisation and sprawling** as a large part of immigrants has cities as their final destinations. In many cases, the presence of immigrants is concentrated in some neighborhoods from which the indigenous people tend to move away, increasing the tendency to expand the peripheral areas.

At the same time, concentrations of immigrants are often associated by many citizens to the **feeling of insecurity**. Such association is more a matter of prejudice than of matter of fact, as poor life conditions nurture criminality and terrorism much more than nationality and race. However, given the correlation between the status of immigrant and social marginality some events feed the prejudice.

Urbanisation & sprawling are also connected to **fighting local pollution** as this is mainly concentrated in urban areas and which increases the car dependency and the travel distances. A higher car dependency is affecting the greenhouse gas emissions negatively. Therefore a link exists also between urbanisation & sprawling and the fight to climate change.

**Migration** is connected with ageing because most of the immigrants are young and have higher fertility rates than European citizens. Thus, immigration can contrast the rise of the aged dependency ratio in the European countries (although increasing the child dependency ratio). Also Migration may reverse the negative impacts of Ageing such as shortage of skilled labour.

**Individualism** is linked to sprawling as people searches for private space; in addition, air pollution and fossil fuel shortage are connected to individualism as well, because car use (and therefore fossil fuel consumption) is increased.

**Third manufacturing revolution** is linked to technological innovation as supporting instrument for its diffusion. In addition, some people state that implications in terms of unemployment might result from a wide application of this new concept of production.

## **3 Implication of future challenges for transport policy**

### **3.1 Introduction**

In section 2.2 we provided an overview of the transport system and its macro-environment. The macro-environment consists of different drivers that have an implication for the transport system. In sections 2.3 to 2.5 we presented the selected challenges and their relevance for the transport system. This chapter links the selected future challenges to the transport system and transport policy.

In Section 3.2 the link between the future challenges and the transport system is described. This is done by exploring the way the challenges have an implication for the three markets in the transport system. For each future challenge the implication for the demand or supply side of these markets is provided.

In a similar way in section 3.3 the transport policy categories are linked to the markets in the transport system. For both the demand and supply side an indication is given whether the policy is intended to have an impact on these markets.

In section 3.4 the implication of the future challenges for TPM categories is assessed in a qualitative way. Based upon the findings in section 3.2 and 3.3 the challenges are confronted with the TPM categories. This approach stimulated thinking about how the challenges are related to the TPM categories, which challenges affect what category or which TPM category is affected by what challenges.

Section 3.5 discusses the changes in social, economic and environmental impacts of the TPM categories, given the fact that the TPM categories are affected by one or more future challenges.

### **3.2 Linking future challenges to the transport system**

The implication of the challenges for the transport system can be further detailed to the three markets of the transport system. Table 3-1 shows which challenges have an implication for the three markets of the transport system, differentiated to demand for passenger and freight transport and supply of infrastructure and transport services. As can be seen, the challenges are assumed to have different implications for the transport system.

Table 3-1: Assessment of **the implications** of future challenges for the demand and supply in the three markets of the transport system

| Challenge                                     | Trip market  | Transport market   | Traffic market  |
|---|--|--|---|
| Fighting climate change                       | Passenger & freight trip patterns  | Transport means and services   | Infrastructure and its attributes   |
| Shortage fuel and resources                   | Passenger & freight trip patterns  | Passenger & freight transport patterns<br>Transport means and services | Passenger & freight traffic patterns<br>Infrastructure and its attributes |
| Increasing pollution and noise                | Spatial and temporal structure of society                                      | Transport means and services   | Infrastructure and its attributes   |
| Urbanisation and sprawling                    | Passenger & freight trip patterns  | Passenger & freight transport patterns                                 | Infrastructure and its attributes   |
| Ageing  | Passenger trip patterns  | Passenger transport patterns<br>Transport means and services           | Passenger traffic patterns<br>Infrastructure and its attributes           |
| Migratory pressure                            | Passenger trip patterns  | Passenger transport patterns   | Passenger traffic patterns  |
| Unemployment                                  | Passenger trip patterns  | Passenger transport patterns   | Passenger traffic patterns  |
| Income inequality/distortion                  | Passenger trip patterns  | Passenger transport patterns   | Passenger traffic patterns  |
| Terrorism and insecurity                      | Passenger & freight trip patterns  | Transport means and services   | Infrastructure and its attributes   |
| Individualism                                 | Passenger trip patterns  | Passenger transport patterns   |   |
| Diffusion of ICT and technological innovation | Passenger & freight trip patterns  | Passenger & freight transport patterns<br>Transport means and services | Passenger & freight traffic patterns<br>Infrastructure and its attributes |
| 3 <sup>rd</sup> manufacturing revolution      | Passenger & freight trip patterns  | Passenger & freight transport patterns                                 | Passenger & freight traffic patterns                                      |
| Globalisation/Outsourcing                     | Passenger & freight trip patterns<br>Spatial and temporal structure of society | Passenger & freight transport patterns<br>Transport means and services | Passenger & freight traffic patterns<br>Infrastructure and its attributes |
| Public and private debt                       | Passenger & freight trip patterns<br>Spatial and temporal structure of society | Passenger & freight transport patterns<br>Transport means and services | Infrastructure and its attributes   |

|                  |                                   |                              |                                   |
|------------------|-----------------------------------|------------------------------|-----------------------------------|
| Fragility of EMU | Passenger & freight trip patterns | Transport means and services | Infrastructure and its attributes |
|------------------|-----------------------------------|------------------------------|-----------------------------------|

For example, for **climate change** it is expected that especially the supply side of the traffic market will change. This concerns the infrastructure. It may well be that the Rhine river bed needs extra dredging as an adaptation measure for infrastructure to overcome a problem such as drought. This is typically a measure on the supply side.

Concerning **ageing** it is expected that the demand for activities will shift from work to leisure. This in return also will have consequences for the transport and traffic market, like travel in different periods of the day. A measure could be to influence the demand for transport and traffic in order to stimulate travel in the off-peak. Furthermore, ageing could lead to a shortage of skills, which are needed to keep the transport system running. These concerns for example skilled lorry drivers, bus drivers, but also training and education in the transport sector (see ILO-EC, 2011 or ABN-AMRO, 2012).

As can be seen from Table 3-1, different drivers and future challenges have different implications for the markets of the transport system. Concerning the drivers we can conclude that all drivers affect both, supply and demand side.

### 3.3 Linking transport policy to the transport system

Transport policy measures aim at affecting the demand or supply side of the three markets that comprise the transport system (see previous chapter). By influencing one of the markets, the next market is affected as well (though this could be seen as a second level implication). Each market has its own distinct TPMs. TPMs for the trip market aim at influencing the desire to travel or to move goods, as well as influencing the destination choice or the choice of departure time. TPMs for the transport market aim at influencing the mode choice, such as modal shift policy. These include TPMs like taxation or pricing. TPMs for the traffic market aim at influencing the route choice. Examples are abundant, such as speed limits, increasing capacity of removing missing links.

In Table 3-2 for each TPM category an assessment per market is made whether the category has an impact and if so, whether it concerns demand and/or supply. For example, Pricing is a TPM that intends to influence demand in the transport and traffic market. In the transport market this category tries to influence the user to choose another transport mode. In the traffic market it tries to influence the route choice. Another example is Infrastructure. These measures typically try to have an impact on the traffic market, such as adding road capacity to reduce congestion or enlarging port facilities to ease the transfer of goods and commodities.

Table 3-2: Assessment of the impact of TPM categories on demand and supply in the markets of the transport system

| TPM category                               | Trip market  | Transport market   | Traffic market  |
|--|--|--|---|
| Pricing                                    |  | Passenger & freight transport patterns                                 | Passenger & freight traffic patterns                                      |
| Taxation                                   | Passenger & freight trip patterns  | Passenger & freight transport patterns                                 |   |
| Research and innovation                    | Passenger & freight trip patterns<br>Spatial and temporal structure of society | Passenger & freight transport patterns<br>Transport means and services | Passenger & freight traffic patterns<br>Infrastructure and its attributes |
| Efficiency standards and flanking measures |  | Passenger & freight transport patterns<br>Transport means and services |   |
| Internal market                            | Spatial and temporal structure of society                                      |  |   |
| Infrastructure                             |  |  | Passenger & freight traffic patterns<br>Infrastructure and its attributes |
| Transport planning                         | Passenger & freight trip patterns<br>Spatial and temporal structure of society |  |   |
| Other                                      | Passenger & freight trip patterns<br>Spatial and temporal structure of society | Passenger & freight transport patterns<br>Transport means and services | Passenger & freight traffic patterns<br>Infrastructure and its attributes |

Source: Panteia/NEA

The assessment helps to structure thinking about TPM categories and the way they try to influence or change the transport system. This leads to different questions such as: What is the intention of a TPM? In what part of the transport system should the TPM have an effect? Is the intention to influence passenger transport demand? Is the intention to facilitate or extend the supply side of a market by introducing new infrastructure? Table 3-2 provides guidance, where a TPM intends to bring a change in the markets of the transport system.

### 3.4 Implications of future challenges for transport policy

The challenges in the macro-environment affect the transport system and thus transport policy measures in an unintended way. Concerning these drivers, Goodwin (2002) remarks that transport policy which ignores these wider concerns is likely to be ineffective. The future challenges affect the transport system and thus the TPMs. All future challenges have an implication for the transport system. In relation to the transport policy measures, the following questions are important:

1. How do future challenges change transport policy or the TPM categories?
2. How can TPM categories change the implications from the challenges?

To bring together these two questions, we can combine the results from Table 3-1 and Table 3-2. This provides guidance on how challenges affect TPMs and how TPMs can change the impacts. For each challenge a table can be made to show on which TPM category a future challenge has an implication.

Table 3-3: Linking the TPM Infrastructure to the challenge global warming in the three markets of the transport system

| Challenge               | Trip market  | Transport market   | Traffic market  |
|-------------------------|--|--|---|
| Climate change          |  |  | Infrastructure and its attributes   |
| TPM category            | Trip market  | Transport market   | Traffic market  |
| Research and innovation | Passenger & freight trip patterns<br>Spatial and temporal structure of society | Passenger & freight transport patterns<br>Transport means and services | Passenger & freight traffic patterns<br>Infrastructure and its attributes |
| Infrastructure          |  |  | Passenger & freight traffic patterns<br>Infrastructure and its attributes |
| Other                   | Passenger & freight trip patterns<br>Spatial and temporal structure of society | Passenger & freight transport patterns<br>Transport means and services | Passenger & freight traffic patterns<br>Infrastructure and its attributes |

Source: Panteia/NEA

Table 3-3 provides as an example which TPM categories are affected by climate change. As can be seen, in the traffic market climate change is expected to have an implication upon the supply side of the traffic market. This relates to three different TPM categories: Research and innovation, Infrastructure and Other. Due to climate

change, it is expected that adaptation measures for infrastructure are needed to overcome extreme weather conditions such as flooding, icing or drought.

Table 3-4: Linking TPM Pricing to the future challenges in the three markets of the transport system

| TPM category                                  | Trip market  | Transport market   | Traffic market  |
|---|--|--|---|
| Pricing                                       |  | Passenger & freight transport patterns                                 | Passenger & freight traffic patterns                                      |
| Challenge                                     | Trip market  | Transport Market   | Traffic market  |
| Shortage fuel and other natural resources     | Passenger & freight trip patterns  | Passenger & freight transport patterns<br>Transport means and services | Passenger & freight traffic patterns<br>Infrastructure and its attributes |
| Urbanisation and sprawling                    | Passenger & freight trip patterns  | Passenger & freight transport patterns                                 | Infrastructure and its attributes   |
| Ageing  | Passenger trip patterns  | Passenger transport patterns<br>Transport means and services           | Passenger traffic patterns<br>Infrastructure and its attributes           |
| Migratory pressure                            | Passenger trip patterns  | Passenger transport patterns   | Passenger traffic patterns  |
| Unemployment                                  | Passenger trip patterns  | Passenger transport patterns   | Passenger traffic patterns  |
| Income inequality/distortion                  | Passenger trip patterns  | Passenger transport patterns   | Passenger traffic patterns  |
| Individualism                                 | Passenger trip patterns  | Passenger transport patterns   |   |
| Diffusion of ICT and technological innovation | Passenger & freight trip patterns  | Passenger & freight transport patterns<br>Transport means and services | Passenger & freight traffic patterns<br>Infrastructure and its attributes |
| 3 <sup>rd</sup> manufacturing revolution      | Passenger & freight trip patterns  | Passenger & freight transport patterns                                 | Passenger & freight traffic patterns                                      |
| Globalisation/Outsourcing                     | Passenger & freight trip patterns<br>Spatial and temporal structure of society | Passenger & freight transport patterns<br>Transport means and services | Passenger & freight traffic patterns<br>Infrastructure and its attributes |
| Public and private debt                       | Passenger & freight trip patterns<br>Spatial and temporal structure of society | Passenger & freight transport patterns<br>Transport means and services | Infrastructure and its attributes   |

Source: Panteia/NEA

Table 3-4 visualises the opposite way. For the TPM category 'Pricing', a combination is made with the different challenges. As a TPM, Pricing has an intended impact upon the demand side of the transport and traffic market. Different challenges however have an implication for the transport system which may conflict with the Pricing category. It concerns fuel shortage, urbanisation and sprawling, ageing, migratory pressure, unemployment, income inequality, individualism, diffusion of ICT and technological innovation, Third Manufacturing Revolution, globalisation and outsourcing, and public and private debt. The overlap shows the challenges that will most probably interfere with the TPM category Pricing.

Table 3-5: Assessment of the implications of the future challenges for TPMs

| Implication for →                             |         |          |                         |                      |                 |                |                    |
|---|---------|----------|-------------------------|----------------------|-----------------|----------------|--------------------|
| Challenge ↓                                   | Pricing | Taxation | Research and innovation | Efficiency standards | Internal market | Infrastructure | Transport planning |
| Fighting climate change                       | +       | ++       | ++                      | ++                   | 0               | ++             | ++                 |
| Shortage fuel and resources                   | +++     | +++      | ++                      | +++                  | +               | +++            | +++                |
| Increasing pollution and noise                | +       | +        | +                       | +                    | 0               | +              | +                  |
| Urbanisation and sprawling                    | +       | ++       | +                       | +                    | +               | ++             | ++                 |
| Ageing  | +       | ++       | +                       | +                    | +               | ++             | ++                 |
| Migratory pressure                            | +       | +        | 0                       | +                    | 0               | +              | +                  |
| Unemployment                                  | +       | +        | +                       | +                    | 0               | +              | 0                  |
| Income inequality/distortion                  | +       | +        | +                       | +                    | 0               | 0              | 0                  |
| Terrorism and insecurity                      | 0       | +        | +                       | +                    | +               | +              | +                  |
| Individualism                                 | +       | +        | 0                       | +                    | +               | +              | +                  |
| Diffusion of ICT and technological innovation | +++     | +        | ++                      | +++                  | +               | +++            | +++                |
| 3 <sup>rd</sup> manufacturing revolution      | 0       | 0        | +                       | ++                   | 0               | 0              | 0                  |
| Globalisation/Outsourcing                     | ++      | ++       | ++                      | ++                   | +               | ++             | ++                 |
| Public and private debt                       | ++      | ++       | +                       | +                    | +               | ++             | +                  |
| Fragility of EMU                              | 0       | ++       | +                       | +                    | +               | ++             | +                  |

Legend: 0 : No implication, +: Small, ++: Moderate, +++: High

Source: Panteia/NEA, with help participants workshop 13 June 2012

Although TPM categories and future challenges may conflict with each other, it does not necessarily mean that the implication is high. For all TPM categories an assessment is given of the implications of the challenges in Table 3-5. The assessment is based on professional judgements<sup>7</sup>. As the table shows, a strong implication for TPMs is expected from the challenges fuel shortage and the diffusion of ICT and technological innovation. To a lesser extent also an implication is expected from climate change, increasing air pollution and noise, urbanisation, ageing, globalisation and outsourcing, private and public debts, and the fragility of the EMU. All other challenges are expected to have a smaller implication. For those challenges that are assumed to have a high implication, the TPMs need to be reviewed, developed or adapted in the first place.

Table 3-6 presents the impact of TPM categories upon the challenges outside the transport system. As can be seen, for most of the challenges there are no TPM categories that have an impact. TPM categories that have an impact upon the future challenges lie mainly in the field of Environment. It is expected that the TPM categories 'Pricing', 'Taxation' and 'Efficiency standards and flanking measures' have a moderate to high impact upon climate change, fossil fuel shortage, increasing air pollution and noise, and urbanisation and sprawling. The TPM categories 'Infrastructure' and 'Transport planning' are expected to have a moderate to high impact upon urbanisation and sprawling. The TPM category 'Research and innovation' will have impacts upon different challenges, though these are usually indirect impacts.

---

<sup>7</sup> These judgements have been checked and further elaborated at an ASSIST Workshop on 13 June 2012 in Brussels

Table 3-6: Assessment of the impacts of TPM categories upon the future challenges

| TPM category →                                |         |          |     |                      |                 |                |                    |
|---|---------|----------|-----|----------------------|-----------------|----------------|--------------------|
| Impact upon ↓                                 | Pricing | Taxation | R&D | Efficiency standards | Internal market | Infrastructure | Transport planning |
| Fighting climate change                       | ++      | ++       | ++  | +                    | 0               | 0              | 0                  |
| Shortage fuel and resources                   | +++     | +++      | +++ | ++                   | 0               | 0              | 0                  |
| Increasing pollution and noise                | ++      | ++       | ++  | +                    | 0               | ++             | +                  |
| Urbanisation and sprawling                    | +       | +        | +   | +                    | 0               | ++             | ++                 |
| Ageing  | 0       | 0        | 0   | 0                    | 0               | 0              | 0                  |
| Migratory pressure                            | 0       | 0        | 0   | 0                    | 0               | 0              | 0                  |
| Unemployment                                  | 0       | 0        | +   | 0                    | 0               | +              | +                  |
| Income inequality/distortion                  | 0       | 0        | +   | 0                    | 0               | 0              | 0                  |
| Terrorism and insecurity                      | 0       | 0        | +   | 0                    | 0               | +              | +                  |
| Individualism                                 | 0       | 0        | 0   | 0                    | 0               | 0              | 0                  |
| Diffusion of ICT and technological innovation | 0       | 0        | +   | 0                    | 0               | 0              | 0                  |
| 3 <sup>rd</sup> manufacturing revolution      | 0       | 0        | +   | 0                    | 0               | 0              | 0                  |
| Globalisation/Outsourcing                     | 0       | 0        | 0   | 0                    | 0               | +              | 0                  |
| Public and private debt                       | +       | +        | 0   | 0                    | 0               | 0              | 0                  |
| Fragility of EMU                              | 0       | 0        | 0   | 0                    | 0               | 0              | 0                  |

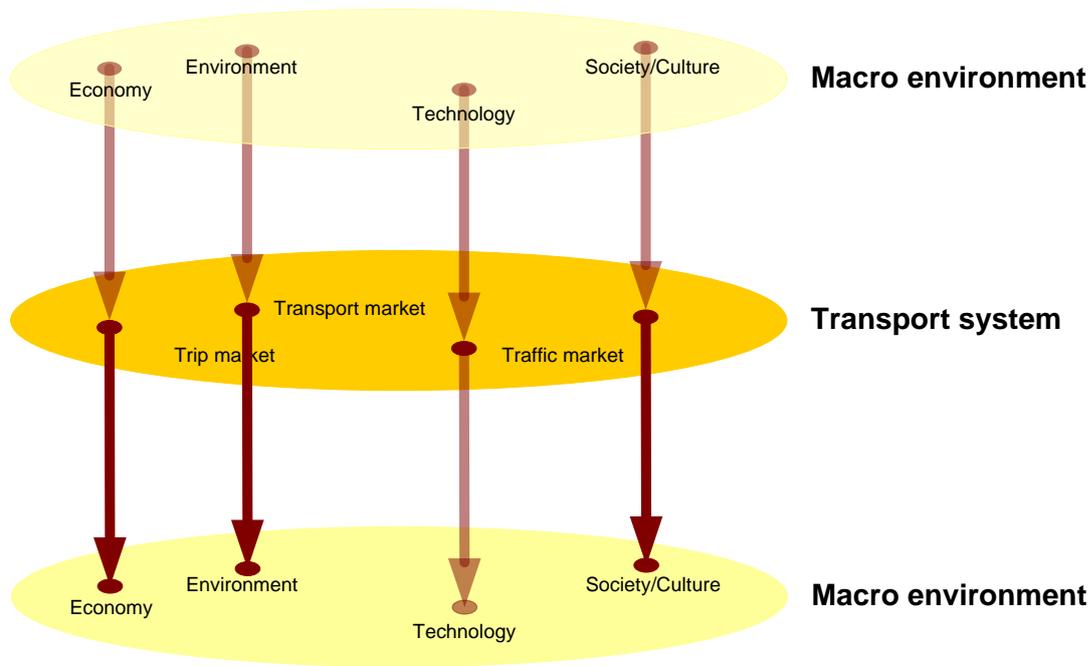
Legend: -0: No impact, +: Small, ++: Moderate, +++: High

Source: Panteia/NEA, with help participants workshop 13 June 2012

### 3.5 Changes in the impacts of TPMs

In the previous sections a link has been made between the future challenges and transport policy measures. However, in ASSIST we also look at the impacts of TPMs on economy, society and environment. So, if we know what future challenges have an implication upon the different TPMs, then how do the TPMs have a further impact upon economy, society and environment? This question relates to the focus of ASSIST, to explore the economic, social and environmental impacts of transport policy. Figure 3-4

visualises the impacts from the transport system and thus transport policy measures, upon the economy, environment and society.



Source: Panteia/NEA

Figure 3-5: Impact of the transport system on the macro environment

As can be seen in Figure 3-4, the transport system has an effect upon the macro-environment as well. The impacts upon economy, environment and society have been explored in report D2 of the ASSIST project. Annex 2 provides a short summary of these impacts. Other impacts are not further explored in the ASSIST project.

Different impacts are identified. These concern economic impacts such as housing expenditures, sectoral competitiveness or public income. Concerning social impacts these include impacts such as health, safety or social inclusion. Concerning environmental impacts examples are emissions, noise or climate change. Annex 2 provides an overview of the identified impacts. The impacts are related to the elements and the output of the transport system on both demand and supply side. A change in variables such as volume, time, distance, costs and revenues, lead to further impacts upon society, economy and environment.

## 4 Cases for selected transport policy measures

### 4.1 Introduction

Having introduced the challenges in chapter 2 and the general implication analysis in chapter 3, we now will turn to different cases of transport policy measures. For all cases, the implication of future challenges upon the TPM category is shown, as well as the impacts of the TPM upon economy, environment and society. The cases addressed in this chapter are summarised in Table 4-1. Annex 3 provides further details of the different categories of TPMs.

Table 4-1: Selected cases per TPM category

| TPM category                              | Case   |
|---|--|
| Pricing                                   | Eurovignette<br>Inclusion of air transport into the EU-ETS in 2012   |
| Taxation                                  | Energy Taxation Directive (2003/96/EC)   |
| R&D                                       | Electro-mobility of road transport vehicles<br>Development of E-Freight  |
| Efficiency standards<br>Flanking measures | European Road Safety Action Programme<br>Introduction of city logistics and urban freight distribution   |
| Internal market                           | Implementation of SESAR  |
| Infrastructure                            | Reduction of TEN-T network cross border missing links<br>Eliminating TEN-T network bottlenecks<br>Green transport corridors<br>Bus priority measures |
| Transport planning                        | Park & Ride systems  |
| Other                                     | Teleworking  |

Source: Panteia/NEA

### 4.2 Pricing

In the TPM category 'Pricing' two cases were chosen to explore the implications of the future challenges for the transport policy measures. These measure concern 'Eurovignette' and 'The inclusion of air transport into the EU-Emission Trading System in 2012'. Annex 3 shows details about these two cases. This section presents an outline of the main results.

The Eurovignette charges heavy vehicles for the use of the road network. In 2011 the external effects were internalised. The TPM leads to more costs for the users of freight transport. The impact is that this may lead to less freight road transport. A shift to other freight modes might be the consequence. Partly, the extra costs might be passed on to the clients.

The inclusion of air transport into the EU Emission Trading System (EU-ETS) in 2012 means that emissions from all domestic and international flights that arrive or depart from an EU airport are included in the system. The inclusion of air transport aims at tackling the climate impact of aviation, by a reduction of CO<sub>2</sub> emissions. The TPM leads to more costs for the users of air transport, both freight and passengers. This may lead to less freight and passenger air transport. Concerning freight transport it is expected that the extra costs will be passed on to the clients.

Table 3-2 shows that for the category 'Pricing', an impact is expected upon the passenger and freight transport patterns and the passenger and freight traffic patterns.

Table 3-5 shows the expected implications from future challenges. Of these challenges, fuel shortage and diffusion of ICT and technological innovation are expected to have a high implication. Other challenges that have a moderate implication are globalisation and public and private debt.

Table 3-6 shows that Pricing is expected to have moderate to high impacts upon the future challenges climate change, fossil fuel shortage and increasing air pollution and noise.

Concerning the impacts of the two TPMs, it can be concluded that there is an overlap in the expected social, economic and environmental impacts between the two TPMs. Also, the future challenges with an implication for these two TPMs are more or less similar. See annex 3 for details.

Fossil fuel shortage has a positive implication for both TPMs. It reinforces the implementation and supports modal shift and the increase of fuel efficiency. On the other hand one needs to keep in mind that this may lead to less revenues. The diffusion of ICT and technological innovation may have another important implication. The improvement of ICT may support the implementation of both TPMs.

The overall impression is that both TPMs induce whether less transport or more fuel efficient transport.

The combined implications from the challenges and the impact from TPMs lead to the following transport, economic, social and environmental impacts for the two cases:

- Higher transport costs, potentially leading to a shift from road to other modes if the costs cannot be passed on to clients;
- A change in sectoral competitiveness of transport companies;
- Less revenues due to less transport or more efficient transport;
- Improved health situation due to cleaner modes and less transport;
- Improved safety on the road network due to less trips in road freight transport;
- Less air pollution and noise emissions, due to a reduction of trips or due to fuel efficiency;
- Reduced use of non-renewable resources (fossil fuel), due to a reduction of trips in road freight transport;

Concerning the implications of the most important future challenges, a policy response is not required.

### **4.3 Taxation**

In the TPM category 'Taxation' one case was chosen to explore the implications of the future challenges upon the transport policy measures. This measure concerns 'Energy Taxation Directive (2003/96/EC)'.

The Energy Taxation Directive (2003/96/EC) introduces a minimum rate system for all energy products, including coal, natural gas and electricity. The directive aims to reduce distortions of competition between Member States and between oil and other energy products. Also it contains incentives to use energy more efficiently and to allow Member States to offer tax incentives to reduce emissions. The TPM leads to a change in costs. Both an increase and a decrease in transport costs are expected. These will be imposed on both passenger and freight transport.

Table 3-2 shows that for the category 'Taxation', an impact is expected upon the passenger and freight trip patterns and the passenger and freight transport patterns.

Table 3-5 indicates that moderate and high implications from future challenges are expected from fossil fuel shortage, diffusion of ICT and technological innovation, urbanisation and sprawling, ageing, globalisation / outsourcing, public and private debt and fragility of the EMU.

Table 3-6 shows that Taxation has a moderate to high impact upon the future challenges climate change, fossil fuel shortage, and increasing air pollution and noise.

Annex 3 provides details about the Directive and its impacts on transport, society, economy and environment.

Summarising, the TPM has the following social, economic and environmental impacts

- The Directive is in force since 2003, therefore it does not have any implications for the transport system.
- The transport costs will change if other modes are added to the Directive. For air and shipping the costs will increase.
- Due to fossil fuel shortage and climate change, it is likely that the costs will be mitigated by more fuel efficient technologies.
- Concerning environmental impacts, the Directive has a positive impact. However, due to challenges like globalisation and outsourcing, some extra transport demand is expected, especially in freight transport. This will reduce the impacts from the Directive.

Concerning the policy response, the TPM should be reviewed in the light of fossil fuel shortage. Also, it needs to take into consideration whether Aviation and Maritime Shipping should be included somehow. This however needs to be done by international agreements.

#### **4.4 Research and innovation**

In the TPM category 'Research and innovation' two cases were chosen to explore the implications of the future challenges for the transport policy measures. These measures concerns 'Electro Mobility of Road Transport Vehicles' and 'Development of E-Freight'. Details of the TPMs and their impacts are presented in annex 3.

The category 'Research and innovation' has an impact on all markets in the transport system (see Table 3-2). R&D usually prepares or supports TPMs. In this sense, R&D has an indirect impact. Nevertheless, we choose to show the impact of 'Research and innovation' as were it direct impacts.

Table 3-5 shows that moderate and high implications from future challenges are expected from fighting climate change, fossil fuel shortage, diffusion of ICT and technological innovation and globalisation / outsourcing. Other challenges have a minor implication.

Table 3-6 shows that 'Research and innovation' has moderate to high impacts upon the future challenges climate change, fossil fuel shortage and increasing air pollution and noise.

The TPM 'Electro-mobility of road transport vehicles' fosters research and innovation leading to an increase of efficiency, safety and reliability of vehicles with electronic propulsion. The TPM is developed for both passenger and freight transport.

The TPM 'Development of E-Freight' aims at the simplification of the information exchange regarding freight and freight transportation, by the creation of a single transport document.

Both TPMs do not directly lead to a change in costs or trips, as it concerns a preparatory measure for the implementation of future transport policy on electro-mobility or eFreight. Indirectly, both may lead to a change in costs. E-Mobility leads to an increase in costs, but this can be mitigated by a reduction of the external costs. In the implementation phase the TPM needs to be at least cost neutral in order to become successful. The eFreight concept should lead to diminished transport costs as transport flows will become more efficient.

Both TPMs have a positive impact upon fighting climate change shortage of fossil fuel and increased air pollution and noise. The TPMs will reduce emissions and decrease the energy use from fossil fuels.

The TPMs in itself do not have any *direct* social, economic and environmental impacts. However, after implementation one can spot different impacts, dependent upon the TPM taken. As Research and innovation in theory can support any TPM, the expected impacts vary. In the case of E-Mobility this concerns the following impacts

- The TPM may have some effect on the distances travelled, as the distance range is limited.
- Lower noise emissions may lead to a decrease in safety on roads, especially for elderly people. This can be mitigated by adding sound (Fender, 2011)
- Fossil fuel shortage will enforce the introduction of electric vehicles. The comparable costs of fossil fuels and electricity will be positive for electricity. This will ease the introduction of TPMs on electro-mobility. However, one needs to keep in mind that the production of electricity still needs energy, which is not abundant available (Matthew-Wilson, 2010).
- The sectorial level of competitiveness will increase as well as the inclusion of lower income groups to environmental friendly road transportation.

The E-Freight TPM may lead to the impacts such as:

- The freight transport costs will diminish. It increases the level of service. Furthermore it may help to shift transport from road to rail and inland navigation.
- Unemployment might be reinforced, as a single transport document will lead to less administrative work.

- The decrease in transport costs will lead to increasing revenues for transport operators. Also, it will increase spatial and sectoral competitiveness.
- Concerning the environment, fewer emissions are expected from this TPM.

Both TPMs do not require a direct policy response due to its R&D characteristics. However, one needs to think about the implementation of the TPMs after the R&D phase. A TPM like E-Freight is able to diminish negative implications of the future challenges. E-Mobility should be introduced as a cost-neutral TPM in order to be successful. The instalment of charging for infrastructure use needs to be addressed.

## 4.5 Efficiency standards and flanking measures

In the TPM category 'Efficiency standards and flanking measures' the TPMs 'European Road Safety Action Programme' and 'Introduction of City Logistics and Urban Freight Distribution' were chosen to explore the implications of future challenges. Annex 3 describes the TPMs and their impacts in detail, this section provides a summary.

Table 3-2 shows that for the category 'Efficiency standards and flanking measures', an impact is expected upon the passenger and freight transport patterns and the transport means and services.

Table 3-5 shows that moderate and high implications can be expected from fossil fuel shortage, diffusion of ICT and technological innovation, fighting climate change, Third Manufacturing Revolution and globalisation / outsourcing.

Table 3-6 shows that Efficiency standards and flanking measures have a moderate impact upon the future challenges fossil fuel shortage.

The 'European Road Safety Action Programme (ERSAP)' proposes a series of measures to deploy new road safety technologies, to improve road infrastructure and to improve the user behaviour. This TPM leads to a change in general costs. The external costs for safety will decrease due to fewer casualties.

The TPM 'Introduction of City Logistics / Urban Freight Distribution' incorporates many activities between different actors, which appear in the form of inner urban goods transport or distribution of interurban freight. Overall urban freight distribution aims to decrease freight traffic passing cities and urban areas, by means of the implementation of technical and planning measures. The TPM leads in general to more travel time, as extra transfer of goods might be needed. Ideally the TPM should be cost neutral. If not, then it can be expected that transport operators will pass on the extra costs to their clients.

As can be seen the efficiency standards and flanking measures comprise different TPMs. As a consequence it will be difficult to come up with general conclusions concerning the TPM category.

The TPM ERSAP has the following social, economic and environmental impacts (Bosetti, 2010):

- The TPM leads to less casualties, which has a positive impact on health of individuals.
- The TPM leads to less external costs, due to less casualties.
- Concerning the environment, it is expected that there will be no impact.

A policy response might be to review the ERSAP in the light of ageing. This future challenge will lead to more elderly people, who ask for a safe transport system.

The TPM 'Introduction of City Logistics / Urban Freight Distribution has an impact upon the quality of life in cities. The transport system becomes safer and cleaner. In that sense the TPM helps to reduce pollution and noise, and thus contributes to reduce the speed of climate change.

The TPM has the following social, economic and environmental impacts:

- A positive impact on health, directly for residents and indirectly for the society, due to a decrease in air pollution and noise.
- The security level and quality of life are also positively affected.
- Urbanisation leads to lesser inclusion of lower income groups, due to a decelerated valorisation of urban areas being negatively influenced by traffic.
- Transport costs will be equal or reduced by the challenges of diffusion of ICT, which will improve logistical systems
- The environment will improve due to a decrease in pollution and noise.

The policy response for this TPM can be limited. The TPM seems to have a positive impact on air pollution and noise and thus on climate change. The TPM is also positively affected by the challenge of fossil fuel shortage and urbanisation, as there is a distinct need for TPMs like these. The diffusion of ICT will enforce the TPM by technological developments. Only public and private debt may have a negative impact in the sense that financial sources must be secured for this TPM.

## 4.6 Internal market

In the TPM category 'Internal market' the case of 'Implementation of SESAR' was chosen to explore the implications of the future challenges for the transport policy measures.

Table 3-2 shows that for the category 'Internal market', an impact is expected upon spatial and temporal structure of society.

Table 3-5 shows that moderate to high implication from future challenges are expected from diffusion of ICT and technological innovation. Other challenges have a minor implication.

Table 3-6 shows that it is assumed that the TPM category 'Internal market' has no impacts upon the future challenges.

The 'Implementation of SESAR' accelerates and simplifies the exchange of information for air transport. SESAR brings ground and air control closer together. The improvement concerns air traffic controllers, pilots, airline operation centres, airports and meteorological services. The TPM leads to a change in transport costs. As a consequence of the TPM, on the longer term it may lead to lower costs, more competition and more air transport. On the other hand, the introduction of the system will lead to higher costs on the short term.

The TPM has the following social, economic and environmental impacts:

- On the short term transport costs will increase due to the implementation. On the longer term the transport costs will decrease due to less administrative work.
- Lower income groups will be affected by the higher transport costs on the short term. Social inclusion, equality and opportunities will be impaired
- Some pressure will be on the employment in the aviation sector.
- Due to higher costs, demand may decrease on short term.
- A fuel and efficiency gain of -35% is expected for the future, thus leading to less emissions
- A decrease in air pollution and noise is expected..

It is difficult to base conclusions for this TPM category, upon one TPM. However, the TPM fits in the overall structure as presented in tables 3.2, 3.5 and 3.6.

## 4.7 Infrastructure

In the TPM category 'Infrastructure' four cases were explored concerning the implications of the future challenges upon the transport policy measures. These measure concern 'Reduction of the TEN-T network cross border missing links', 'Eliminating TEN-T network bottlenecks', 'Green Transport Corridors' and 'Bus Priority Measures'.

Table 3-2 shows that for the category 'Infrastructure', an impact is expected upon the passenger and freight traffic patterns and the infrastructure and its attributes.

Table 3-5 shows that moderate and high implications from future challenges are expected fossil fuel shortage, diffusion of ICT and technological innovation, climate change, urbanisation and sprawling, ageing, globalisation / outsourcing, public and private debt and fragility of the EMU.

Table 3-6 shows that Pricing receives a moderate impact from the challenges increasing air pollution and noise and urbanisation and sprawling.

The 'Reduction of TEN-T network cross border missing links' aims at the improvement of cross border links, thus supporting the integration of the internal market. The TPM leads to a change in travel distance, travel time, and travel costs. All elements will face a reduction, which in return will lead to more transport demand.

The 'Elimination of TEN-T bottlenecks' concerns large infrastructure improvements in Europe, by eliminating bottlenecks and missing links. The TPM leads to a change in travel distance, travel time, travel costs, and general costs. Distance, time and costs will decrease. As a consequence it is expected that the demand for transport over longer distances will increase.

The 'Green Transport Corridors' is marked by a concentration of freight transport between major hubs a by relatively long distances of transport. Along these corridors industry will be encouraged to rely on co-modality and advanced technologies to accommodate increasing traffic volumes. The TPM leads to a change in distance, time, costs and trips. Altogether, freight transport will become cheaper and more efficient.

The 'Bus Priority Measures' gives any kind of priority to public transport by bus, such as bus priority lanes and high occupancy vehicle lanes. The aim is to make public transport more reliable, reduce travel time, to provide a higher level of service and to help a mode shift (as a second level impact). The TPM leads to a change in distance and time. Furthermore, the TPM leads to an improved perception of public transport. Public transport by bus becomes more attractive.

The TPMs in the category 'Infrastructure' have some social, economic and environmental impacts in common:

- The infrastructure will be improved, leading to a more efficient transport system, with shorter distances, less travel time and less travel costs.
- The changes in distance, time and costs lead to an increase in demand.
- The accessibility will be improved.
- Due to an increase in efficiency, emissions and noise will decrease.
- A decrease of emissions and noise will lead to an improvement of the health situation.
- Safety will improve in all cases.
- The networks at small and large scale become more sustainable.
- Where it concerns large scale projects, the TPMs have a positive impact upon the social cohesion within the EU.
- During the construction phase, the large scale projects have a positive effect upon employment.
- Large scale projects will improve competitiveness.
- People living nearby large scale projects may envisage a decrease in health and safety circumstances.
- Cases may show a mode shift towards the TPM that is implemented.
- In the case of bus priority measures, lower income groups may profit.

Concerning the policy responses, especially the green transport corridors and the bus priority measures are at stake. For the green transport corridors, a review is needed to explore the implications of some of the future challenges, such as Globalisation and Fragility of the EMU. These challenges may have negative implications for the TPM. Concerning bus priority measures, public transport by bus is still relying upon fossil fuels, the question is what alternatives should be implemented. The use of fossil fuels may have implications for the TPM. In case of electric powered vehicles such as trolley buses, the bus priority measures may need extra attention.

## **4.8 Transport planning**

In the TPM category 'Transport Planning' one case was chosen to explore the implications of the future challenges upon the transport policy measures. This measure concerns 'Park and Ride Systems'.

Table 3-2 shows that for the category 'Transport Planning', an impact is expected upon the passenger and freight trip patterns and the spatial and temporal structure of society.

Table 3-5 shows that moderate to high implications from future challenges are expected from fossil fuel shortage, diffusion of ICT, climate change, urbanisation and sprawling, ageing, and globalisation / outsourcing.

Table 3-6 shows that 'Transport Planning' has a moderate impact upon the future challenges urbanisation and sprawling.

The Park & Ride systems (P&R) are parking facilities at the periphery of cities, linked to public transportation. The TPM aims mostly at commuters, but it also supports people with irregular trips to the city centres, like tourists. The TPM leads to a change in travel time, travel costs and in some instances travel distance. Altogether, the TPM may lead to more travel time, at less travel costs.

The TPM has the following social, economic and environmental impacts:

- In general the TPM leads in the first place to more travel time and less travel costs.
- The quality of health and safety improves for residents, and the society as a whole.
- Public transport operators may expect increasing revenues.
- The TPM is fuel efficient, which is positive for the challenge fossil fuel shortage.
- P&R mitigate the negative environmental circumstances from the challenges, the speed of climate change may decrease.
- The visual quality of the landscape improves.

The policy response of 'Park&Ride systems' in combination with the future challenges is in general positive. The TPM helps to reduce the negative implications of the future challenges. Therefore, no direct policy response is needed.

## **4.9 Other measures**

In the TPM category 'Other Measures' one case was chosen to explore the implications of the future challenges for the transport policy measures. This measure concerns 'Teleworking'.

Table 3-2 shows that for the category 'Other Measures', an impact is expected upon all markets in the transport system. This is due to the fact that 'Other Measures' concern all TPMs that do not fit in one of the other categories. Therefore, this TPM category cannot be explored like the other TPMs.

The TPM category 'Other Measures' receives in theory implications from all future challenges. However, the size of the implications needs to be assessed per TPM in more detail. This category is not shown in Table 3-5 as nothing can be said in general about it.

The TPM category 'Other Measures' may have impacts upon the future challenges, but the impact itself needs to be assessed per TPM. The category is not shown in Table 3-6 as TPMs in this category need to be assessed case by case.

The TPM 'Teleworking' supports teleworking at home. For passengers the TPM leads to a reduction of travel costs and trips. Travel distance and travel time become zero. Also, the TPM may have a positive effect on the perception concerning Telework.

Teleworking has the following social, economic and environmental impacts

- Less travel costs and travel time, thus more leisure time
- It may improve the quality of life of workers who have more flexibility.
- The rise of individualism leads to more control of ones own life.
- Telework could be considered as a solution to the Ageing society: due to later retirement, older people may profit to handle the problem of less mobility.
- Social life will become different. Instead of face-to-face, people meet more on the Internet (see for example Facebook).
- Competition among workers will arise as telework widens the potential labour supply.
- Telework is assumed to improve an effective and efficient staff utilisation in companies. Both Diffusion of ICT and Outsourcing may amplify this effect.
- Reduction in trips lead to a reduction in fuel use and emissions and could therefore be seen as an incentive.

As a policy response, Telework should receive more promotion and attention. It not only enforces positive social impacts, but it also has positive economic and environmental impacts. It is expected that the future challenges have in general a positive implication on this TPM.

Concerning policy responses in general, the conclusion must be that this TPM category is too diverted to make some recommendations. They should be assessed per TPM.

## 4.10 Policy responses

The previous sections showed different responses to the future challenges. In some cases the challenges enforced TPMs. In other cases the challenges had negative implications for the TPMs, thus asking for a policy response. The question then is: what response is needed? This section provides some analytical steps towards a response.

When analysing the implications of the different future challenges, the question is: where does the challenge occur first? Usually, the challenge will have an implication upon the input of the transport system (see Figure 2-2). It may have an impact on either the supply side or the demand side. A change in the input of the transport system will affect the system itself. On the demand side the trip, transport or traffic patterns change, on the supply side the modes and services, and the infrastructure and its attributes (see Figure 2-1). Changes in the input and output of the transport system caused by the future challenges, provides an answer where the policy response should put its focus.

Take for example the future challenge of ageing society. Concerning the input this challenge has an implication on the volume of passengers on the demand side and on the inflow of labour on the supply side. The volume of passengers and their purpose will change. It may lead to fewer trips, trips with another purpose or trips on a different time of the day or week. The inflow of labour may diminish as well, thus having an implication for skilled workers in the transport system. The transport sector is influenced even more than the average as the average age of workers in this sector is comparably high. Concerning the output, ageing will also show a change in the output. On the demand side the volume of passengers by purpose, mode and time-of-day will show different traffic patterns. Furthermore, the costs of transport will change as elderly people will have other priorities than workers. Finally, one could expect more victims due to accidents. On the supply side, one may expect an outflow of labour due to retirement. Furthermore, the amount of costs and revenues may change. Think for example of subsidising the use of public transport for retired or elderly people.

Next to the analysis of the input and output of the transport system, an analysis should be carried out for the elements in the transport system itself. See for example the tables in chapter 3. Due to changes in the input, ageing will have an implication for passenger trip, transport and traffic patterns on the demand side, as well as transport means and services, and infrastructure and its attributes on the supply side (see Table 3-1).

As the example shows, the analysis of the implications of future challenges consists of different steps. However, having analysed the implications, this does not mean that a

policy response is already available. It only shows where at first sight problems may occur. Due to challenges that have an implication upon each other, the analysis becomes more complex. In the example of ageing, the inflow and outflow of labour has been indicated as a potential implication or problem. However, migratory pressure may mitigate the challenge of ageing to a certain extent. This is also true for the Third Manufacturing Revolution and the diffusion of ICT. This example makes clear that the challenges outside the transport system influence each other as well.

Having pointed out a way to analyse the implications of the future challenges for the transport system and its policy response, this does not mean that new TPMs are clear. The analysis only provides a way towards new TPMs. ASTRA-EC could help to analyse the implications of the future challenges and their mutual interdependencies. ASTRA-EC can cover implications of ageing as a future challenge in terms of changing age structure leading to less labour force, higher government expenditures for retired people and for health care, less revenues from direct taxes and of course changing trip making behaviour of different age cohorts. The lack of skilled workers can be simulated indirectly via decreasing labour productivity. Unemployment is an endogenous indicator within the ASTRA-EC economic module. Public and private debt is part of the economic module in ASTRA-EC and influences interest rates for investments and private household consumption. ASTRA-EC considers as well the distribution of income such that income inequality is an endogenous outcome of different drivers like age, labour market characteristics and the distribution of skills among the population. The possibility to cover the dynamics between several of these future challenges are the main value added of applying the ASTRA-EC model to check the policy response of different TPM.

Concerning all future challenges, the policy response does not necessarily have to come from transport policy makers. In fact it requires a horizontal policy response across the different Directorates of the EU<sup>8</sup>. A combined effort across all Directorates will help to come to a co-ordinated policy response, not only for the transport sector, but also for the other sectors. In the case of ageing one could think of a joint policy response across Directorates such as EAC, ECFIN, EMPL, EEAS, HR and MOVE.

---

<sup>8</sup> Or similar departments at national, regional or local level.

## 5 Conclusions and recommendations

### 5.1 Conclusions

This report presents a summary of the most important future challenges and its implications for the transport system and on transport policy. The relevant challenges for the transport system and thus transport policy analysed in this report include fighting climate change, fossil fuel shortage, air pollution and noise, urban sprawling / urbanisation, ageing of the European society, migratory pressure, unemployment, income inequality, terrorism and insecurity, individualism, diffusion of ICT and technological innovation, Third Manufacturing Revolution, globalisation / outsourcing, fragility of European Monetary Union, and public and private debt.

Furthermore, this report provides a qualitative analysis of the implication of future challenges for Transport Policy Measures (TPMs) categories from two perspectives. This is done on a conceptual level by linking (separately) future challenges and TPM categories to the transport system via the trip market, the transport market and the traffic market. In a next step, the future challenges and the TPM categories were directly linked through the analysis of the transport system, in order to see the overlaps between the two. This structured thinking about the impacts of the transport policy categories and the implications from the future challenges.

The following questions were discussed:

1. Which future challenges are relevant for the different TPM categories or individual transport policy measures?
2. Against the background of these challenges, how would each of them affect the social, economic and environmental impacts of the TPM? Are there any new impacts that might have to be taken into consideration?
3. Given the (possible) implication(s) of a trend in the context of a particular TPM, should the existing policy be adapted? Is there a necessity to introduce new policies in order to attenuate the (negative) implications?

Concerning the first question, a literature has been scanned and a first selection of challenges has been made. Furthermore, a workshop with experts has been held to discuss the challenges. Both literature and workshop served as input for the assessment of the implications of the future challenges upon the transport system. These are presented in Table 3-5 and Table 3-6. We may conclude from these tables, that the most important future challenges for the transport system and transport policy measures are shortage of fossil fuels and diffusion of ICT and technological innovation.

These two challenges seem to have a high implication for both the demand and supply side in the different markets of the transport system.

Challenges that have a moderate implication are: fighting climate change, ageing, public and private debt, globalisation / outsourcing, fragility of the EMU and urbanisation / sprawling. These challenges are prominent enough to be taken into account when developing policy responses.

The other challenges are of minor importance, though they may have an implication specific TPMs. However, overall the implication seems to be small.

Concerning the second question, the future challenges affect the transport system and TPMs, and thus the further impacts on society, economy and environment in different ways.

In the analysis different steps were used to connect the future challenges, the transport system, the TPMs and the different impacts. Although it is possible to isolate challenges, TPMs or impacts, the analysis becomes complex as soon as interdependencies occur between the different aspects. We have shown this for the challenge ageing which has interdependencies with migratory pressure, diffusion of ICT and Third Manufacturing Revolution (see section 4.10). Sometimes a challenge reinforces the TPM, in other cases the challenge has a negative implication on the TPM. Due to the interdependencies between the challenges, different implications may occur. For this purpose the ASSIST project foresees an application of the ASTRA-EC modelling tool. The ASTRA-EC tool will help to get more insights in the implications of the future challenges upon the transport system, the TPMs and further impacts. ASTRA-EC enables the assessment of a number of TPMs in terms of transport, economic, environmental and societal indicators. For a selected number of TPMs the ASTRA-EC model will be used to simulate the dynamics between future challenges and their different implications on a certain TPM.

It is obvious that changes in the transport system itself as well as in the output of the transport system, causes changes for society, economy and environment. By connecting the different challenges to the input of the transport system, the markets in the transport system and to the output of the transport system, some further impacts could be identified. But again, things start becoming complex, if the interdependencies between the challenges are taken into account.

Concerning the impacts on society, economy and environment, the analysis shows once again that economic and environmental impacts can be quantified to a certain

extent. The impacts on society need a more qualitative approach when analysed and taken into account in drafting policy responses.

The third question has a diffuse answer. In some instances, the TPM (category) is good for now and needs some extra attention, like promotion of the Telework incentive. On the other hand, some TPMs need to be reviewed in the light of some challenges. For example the ERSAP should be reviewed in order to see whether it takes the challenge ageing sufficiently into account. Also, the Energy Taxation Directive does not include air and maritime shipping. This may need extra attention as well.

The literature search and the workshops have not given strong evidence for new TPMs. However, given the complexity of the relations between the challenges, the transport system, the TPMs and their impacts, an integral approach is recommended. The next section provides some details.

Concerning the different challenges in the macro-environment of the transport system, the following conclusions can be drawn:

In the field of environment, four challenges were identified as important. These are fighting climate change, shortage of fossil fuels, increasing air pollution and noise and urbanisation and sprawling.

- The challenges climate change and air pollution are already taken into account in different TPMs as the transport system is one of the determinants of these challenges.
- Fossil Fuel Shortage has an important implication for TPMs, maybe surprisingly often a positive effect for the different TPMs.
- The implication of urbanisation and sprawling concern trips, transport and traffic markets of the transport system. The volume of passengers by purpose and mode may change.

In the field of society, the following challenges were identified: ageing, migratory pressure, unemployment, income inequality, terrorism and insecurity, and individualism.

- These challenges are partly interdependent which makes isolation of implications difficult. According the literature, most challenges are already addressed in policy documents. Individualism is the only challenge that has not been addressed in policy documents.
- Ageing, migratory pressure and unemployment have an implication for the inflow of labour into the transport system. On one hand the inflow diminishes due to ageing, on the other hand the inflow may increase due to migration and unemployment.

- Income inequality has an implication for the budgets needed for travel or buying equipment such as a car. In turn, this has an impact upon the volume of passengers and the costs or revenues on the output side. It is expected that the volume and revenues may decrease, while the costs increase.
- Terrorism and insecurity has an implication for the perception of passengers and freight shippers using (parts of) the transport system. After an incident the volumes drop, but these will usually recover. On the supply side more damage and victims are expected, bringing along costs for health and repair. Further impacts concern health and competitiveness.

In the field of technology, two challenges were identified: diffusion of ICT and Third Manufacturing Revolution.

- The field of technology provides different opportunities with a positive implication for the transport system. It is expected that the field of Technology could support different TPMs.
- In the long run, the Third Manufacturing Revolution might become an alternative for freight transport. On the input side of the transport system, this will diminish freight volume and labour. On the output side, this may bring changes in volumes by mode, and in the costs and revenues. Concerning implications for energy use and emissions no further evidence has been found.

In the field of economy three challenges were identified: globalisation and outsourcing, public and private debt, and fragility of the European Union.

- The overall pattern of the challenges seems to be on the negative side. Public and private debt, fragility of the EMU, globalisation and outsourcing seem to have negative implications in the sense of extra costs or in the sense of a lack of sufficient finance to develop or maintain infrastructure or to get access to modes.
- Globalisation and outsourcing has an impact upon freight volumes and energy use. Both may increase. Also, the volume of passenger demand by specific modes such as air is expected to increase. Globalisation may bring extra transport costs. Furthermore, due to outsourcing an outflow of labour may occur, thus causing unemployment as a social impact.
- Private and public debt, both have implications for the budget available for transport, access to modes, and infrastructure. A lack of sufficient budget will lead to a decrease in volume on the demand side. On the supply side, this will lead to a decrease in access to modes, and to fewer investments in the development or maintenance of infrastructure. Concerning the social impacts, unsafe infrastructure may lead to extra victims. Concerning the economic impacts, this may have consequences for the competitiveness, both on sector and spatial level.

- The fragility of the European Union may have some implication for the volume of passengers and freight on long distances within the EU. This may diminish. Also, in case of a collapse, costs and revenues from the transport system will change. In the end the change in the transport system will have an impact upon the competitiveness of the EU.

## 5.2 Recommendations

A general recommendation is that a more quantitative analysis should be made to underpin the conclusions. This will be done partly with the development of the ASTRA-EC model in the ASSIST project. This exercise needs to support the conclusions of this report.

For question one in the previous section it is recommended to make a monitor for drivers and challenges outside the transport system, in order to keep an eye on the developments and to be able to adapt transport policy (measures) whenever this is needed. This is essential for Fossil Fuel Shortage. But also the other challenges with a moderate implication upon the transport system need attention. By constantly exploring the macro-environment of the transport system, a timely response is better secured.

For the second question it is recommended to further explore and quantify the implications of the challenges on the TPMs and thus on society, economy and environment.

The third question relates to new TPMs. However, it is hard to just look at TPMs alone. If we would like to also fight different challenges, policy measures in other fields also need to be taken into account. After all, the transport system is usually affected by the macro-environment, while the system itself has a limited impact on the macro environment.

It is therefore recommended to make a policy response as a combined effort of the different Directorates of the EC. After all, the transport system is a derived system (see chapter 2). This implies that the challenges should be approached from an integral perspective instead of just DG MOVE. A horizontal approach across the different Directorates would help to respond to different challenges.

Policy measures outside the transport system might be

- Re-urbanisation (making cities more compact) in combination with facilities for elderly people to reduce travel
- Redefining the concept of prosperity and welfare, this includes health, quality of life, income distribution within and amongst EU member states

New policy measures within the transport system are hard to find. But one could think to put a focus on certain categories, e.g.:

- Reduction of car ownership by creating more opportunities for public transport and slow modes or car sharing. This could be done in combination with re-urbanisation.
- More attention to transport planning in combination with re-urbanisation. This should lead to more compact, energy and transport efficient urban areas.

The last conclusion of the previous section leads to the conclusion that Governments needs to fight or enforce the future challenges not only from the Department of Transport, but from all Departments together. This requires a horizontal approach across different disciplines such as Transport, Planning, Healthcare, Employment, Education, Economy, and Technology. To deal with the future challenges an integrated, horizontal policy approach is recommended.

## 6 References

- ABN-AMRO (2012), *Logistieke Arbeidsmarkt, Uw Uitdaging (Logistics Labour Market, Your Challenge!)*. Amsterdam: ABN-AMRO.
- Assum T. (2011): *Immigrants in Europe, their travel behaviour and possibilities for energy efficient travel*, Deliverable D2.1 of Together on the Move, funded by EC.
- Banister D., 2008, *The sustainable mobility paradigm*, Transport Policy 15, pp. 73-80.
- Belkin P. (2008, Update), *The European Union's Energy Security Challenges*, CRS Report for Congress, prepared for Members and Committees of Congress
- Bestufs II (2006), *Deliverable 5.2 – Quantification of urban freight transport effects II*, p.5.
- Bosetti, Simone, Caterina Corrias, Rosario Scatamacchia, Alessio Sitran, Eef Delhaye (2010). *Ex-post Evaluation of the RSAP. Final report Volume 1*. Leuven: Transport & Mobility Leuven.
- Button, Kenneth J. (1982), *Transport economics (2<sup>nd</sup> edition, 2003)*. Cheltenham: Edgar Elgar Publishing Inc.
- Cesaratto S. (2012): *Controversial and novel features of the Eurozone crisis as a balance of payment crisis*, Quaderni del Dipartimento di Economia Politica e Statistica n. 640, May 2012.
- Chartered Institute of Logistic and Transport (UK) (2011), *Logistics and transport - Vision 2035*, Corby, Northamptonshire
- Constant, Amelie F. & Bienvenue N. Tien (2011). *Germany's Immigration Policy and Labor Shortages*. IZA Research Report no. 41. Bonn: IZA.
- De Grauwe P. (2011): *Balanced budget fundamentalism*, CEPS commentary 05 September 2011
- EC (2008), *REGIONS 2020. An Assessment of Future Challenges for EU Regions*. Commission Staff Working Document
- EC (2009), *A sustainable future for transport: Towards an integrated, technology-led and user friendly system*. Communication from the Commission
- EC (2010a), *Critical raw materials for the EU*. Report of the Ad-hoc Working Group on defining critical raw materials.

- EC (2010b), Thematic Programme "Cooperation with Third Countries in the areas of Migration and Asylum". 2011-2013 Multi-Annual Strategy Paper.
- EC (2010c), *Recommendations. Commission Recommendation on 11 March 2010 on measures for self-protection and the prevention of piracy and armed robbery against ships (2010/159/EU)*. Brussels: European Commission.
- EC (2011a), *WHITE PAPER-Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system*. COM (2011) 144 final, Brussels.
- EC (2011b), EU Transport in figures. *Statistical pocketbook 2011*, Luxembourg.
- EC, DG Research (2003), *Hydrogen Energy and Fuel Cells – A vision of our future*. Final report of the high level group
- ECMT (2003), *Vandalism, Terrorism and Security in Urban Transport*. Round Table 123. Paris: ECMT.
- EEA Report N° 10 (2006), *Urban sprawl in Europe - The ignored challenge*. EEA, Copenhagen
- European Trade Union Confederation (2008), *Reforming the Budget, Changing Europe*. Adopted by the ETUC Executive Committee in their meeting held in Brussels on 4-5 March 2008
- European Travel Commission (2006), *Tourism Trends for Europe*. Brussels
- Fender, David, L. (2011), *Electric Vehicle Noise. Are they too quiet?. In: Professional Safety*, January 2011, p34-38. American Society for Safety Engineers.
- Fenichell S., Maxwell J.C. - Beetle Capital (2010), *The 2020 race to post oil*
- Forrester, Jay W (1968), *Principles of Systems* (reprint 1990). Waltham: Pegasus Communication Inc.
- Franzini M. (1999), *Globalizzazione, profitti e salari. Globalizzazione, istituzioni e coesione sociale* ed. by Felice Roberto Pizzuti, Donzelli, Roma
- Goodwin, Phil (2003), *Conclusions for Ministers, in: Managing the Fundamental Drivers of Transport Demand. Proceedings of the International Seminar, December 2002*. Paris: ECMT publications.

Havik K., Mc Morrow K. (2006), *Global Trade Integration and Outsourcing : How Well is the EU Coping with the New Challenges ?*. European Commission - Directorate-General for Economic and Financial Affairs, Economic Paper n. 259

<http://articles.latimes.com/2011/mar/21/news/la-heb-bus-obesity-weight-load-20110321>

[http://www.healthcareglobal.com/healthcare\\_technology/obesity-crisis-hits-car-manufacturing-industry](http://www.healthcareglobal.com/healthcare_technology/obesity-crisis-hits-car-manufacturing-industry)

<http://www.jetwhine.com/2009/07/as-obesity-grows-faa-sticks-to-170-pounds/>

ILO-EC (2011), *Comparative Analysis of Methods of Identification of Skill Needs on the Labour Market in Transition to the Low Carbon Economy*. Geneva: ILO-EU.

IPCC (2007), *Fourth Assessment Report: Climate Change 2007 (AR4)*

Kritzinger, S; Beullens, P.; Limbers, J.; Bonilla, D.; Navajas-Cawood, E. et al. (2011), *LogMan project - deliverable 2 - Report on external factors*

Hakamies-Blomqvist, Liisa (2003), *Ageing Europe: the challenges and opportunities for transport safety*

Litman T. (2011), *The Future Isn't What It Used To Be Changing Trends And Their Implications For Transport Planning*, Victoria Transport Policy Institute, Victoria, BC (Canada)

Manifesto of the Appalled Economists (2010). *Crisis and Debt in Europe: 10 Pseudo "Obvious Facts", 22 Measures to Drive the Debate Out of the Dead End*.

Martin H.-P., Schumann H. (1996), *Die Globalisierungsfalle. Der Angriff auf Demokratie und Wohlstand*. Rowohlt Verlag. Reinbek bei Hamburg.

Matthew-Wilson, Clive (2010). *The Emperors New Car. A critique of the economic and environmental value of electric cars*. CarAdvice.com.au,

Meyer-Rühle O., Beige S., Greinus A., Erhardt T., Bozuwa J., Harmsen J., Kok R., Kille C., Hua-Kellermann N., Roth M., Burg R., Röhling W. (2008), *SEALS project - final report*

Minsky H. (2008), *John Maynard Keynes*. McGraw-Hill, New York

Navajas, E.; Mongelli, I.; Kritzinger, S.; Helmreich, S.; Morgenstern, C.; Dennisen, T. (2011), *LogMan project - deliverable 3 - Carbon footprint (preliminary analysis)*

OECD (2001), *Ageing and Transport. Mobility Needs and Safety Issues*

- OECD (2002), *Road Travel Demand, Meeting the Challenge*. Paris: OECD Publications.
- OECD, International Transport Forum (2009), *Security, Risk Perception and Cost-Benefit Analysis. Summary and conclusions*. Discussion Paper n. 2009-6, March 2009.
- OECD, International Transport Forum (2008a), *The Impacts of Globalisation on International Road and Rail Freight Transport activity*. Global Forum on Transport and Environment in a Globalising World 10-12 November 2008, Guadalajara, Mexico.
- OECD, International Transport Forum (2008b), *The Impacts of Globalisation on International Maritime Transport Activity*. Global Forum on Transport and Environment in a Globalising World 10-12 November 2008, Guadalajara, Mexico.
- Ortúzar, Juan de Dios & Luis G. Willumsen (1990), *Modelling Transport* (4<sup>th</sup> edition, 2011). Chichester: John Wiley & Sons Ltd.
- Palma J.G. (2009), *The Revenge of the Market on the Rentiers. Why neo-liberal reports of the end of history turned out to be premature*. Cambridge Journal of Economics 33(4), July 2009.
- Patel R. (2007): *Stuffed and Starved*. Portobello Books Ltd., London
- Paul, Debra, Donald Yeates & James Cadle (eds) (2010), *Business Analysis*. Swindon: British Informatics Society Ltd.
- Petersen, Morten Steen, Carlo Sessa, Riccardo Enei Andreu Ulied, Efrain Larrea, Oriol Obisco Paul M. Timms, Christian O. Hansen (2009). *Report on Transport Scenarios with a 20 and 40 year horizon*. TRANSVisions. Copenhagen: Tetraplan.
- Petersen R., Hook W., Zimmer W. (2008), *Discussion Paper - Symposium "Future Challenges of Transport and Environment"*
- Riet, Odette van de & Bart Egeter (1998). *Systeemdiagram voor het beleidsveld vervoer en verkeer. Beschrijving vervoer- en verkeerssysteem ten behoeve van het project Questa*. (RE-98.003). Leiden/Delft: Rand Europe/TNO Inro.
- Rifkin J. (2000), *The Age of Access*. Tarcher, Los Angeles
- Schade W., Fiorello D., Beckmann R., Fermi F., Köhler J., Martino A., Schade B., Walz R., Wiesenthal T. (2008): *High Oil Prices: Quantification of direct and indirect impacts for the EU. Deliverable 3 of HOP! (Macro-economic impact of high oil price in Europe)*. Funded by EC

- SILENCE project (2008), *Practitioner Handbook for Local Noise Action Plans*
- Stiglitz J. E. (2006), *Making globalization work*. W.W. Norton & C.
- Tiemann, T. K., P. Miller, E. Lamanna (2008-09), *Active Transport, Public Transportation, and Obesity in Metropolitan Areas of the United States*. Elon University
- The Economist (2012a), *Manufacturing and Innovation. The Third Industrial Revolution*. Special Report, April 21<sup>st</sup> 2012.
- The Economist (2012b), *Seeing the back of the car. In the rich world, people seem to be driving less than they used to*. September 22<sup>nd</sup> 2012.
- TRT Trasporti e Territorio (2005). *ECOTRA: Energy use and COst in freight TRANsport chains*. Internal report, study conducted on behalf of DG Joint Research Centre/IPTS.
- Watson, Richard (2010), *Future Files. A brief history of the next 50 years*. London: nowandnext.com
- World Economic Forum (2011), *Global Risks 2011 - Sixth Edition: An initiative of the Risk Response Network*. Geneva, Switzerland
- World Economic Forum (2011), *Repowering Transport*. Geneva, Switzerland
- [www.activetravel.org.uk](http://www.activetravel.org.uk) , *Active travel and adult obesity*



## Annex 1: Descriptions of future challenges

### Fighting climate change

| Challenge   |        |                             |             |
|---|--------|-----------------------------|-------------|
| <b>ENVIRONMENT - Fighting climate change</b>  |        |                             |             |
| Description   |        |                             |             |
| <p>Climate change is a significant and lasting change in the statistical distribution of weather patterns over long periods of time: it may be a change in average weather conditions or the distribution of events around that average (e.g. more or fewer extreme weather events). In the context of environmental policy, the term is synonymous with anthropogenic global warming.</p> <p>The scientific consensus on this topic is that climate is changing and that these changes are in large part caused by human activities, and it is largely irreversible.</p> <p>Of most concern in these anthropogenic factors is the increase in CO<sub>2</sub> levels due to emissions from fossil fuel combustion, followed by aerosols (particulate matter in the atmosphere) and cement manufacture. Other factors, including land use, ozone depletion, animal agriculture and deforestation, are also of concern in the roles they play - both separately and in conjunction with other factors - in affecting climate, microclimate, and measures of climate variables.</p>  |        |                             |             |
| Field   | Scale  | Time horizon                | Probability |
| Environment   | Global | Medium / long (2030 / 2050) | High        |
| Relevance for the transport system  |        |                             |             |
| <ul style="list-style-type: none"> <li>- Transport sector is one of the major responsible for the greenhouse emissions</li> <li>- Need for effective policy measures to promote research on technology efficiency</li> <li>- Need for changing mobility and transport habits</li> <li>- Extreme weather events may change trade flows and make transport infrastructures unusable</li> <li>- Transport system should be constructed and developed in order to deal with extreme weather events</li> </ul>   |        |                             |             |
| Main references   |        |                             |             |
| <p>EC (2008), <i>REGIONS 2020. An Assessment of Future Challenges for EU Regions. Commission Staff Working Document</i></p> <p>IPCC (2007), <i>Fourth Assessment Report: Climate Change 2007 (AR4)</i></p> <p>EC (2009), <i>A sustainable future for transport: Towards an integrated, technology-led and user friendly system</i></p> <p>Petersen R., Hook W., Zimmer W. (2008), <i>Discussion Paper - Symposium "Future Challenges of Transport and Environment"</i></p> <p>EC, DG Research (2003), <i>Hydrogen Energy and Fuel Cells – A vision of our future</i></p> <p>World Economic Forum (2011), <i>Repowering Transport</i></p> <p>Kritzinger, S; Beullens, P.; Limbers, J.; Bonilla, D.; Navajas-Cawood, E. et al. (2011), <i>LogMan project - deliverable 2 - Report on external factors</i></p> <p>European Trade Union Confederation (2008), <i>Reforming the Budget, Changing Europe.</i></p> <p>EC (2010a), <i>Critical raw materials for the EU. Report of the Ad-hoc Working group on defining critical raw materials</i></p> <p>EC (2011), <i>WHITE PAPER-Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system</i></p> <p>European travel commission (2006), <i>Tourism trends for Europe</i></p> <p>World Economic Forum (2011), <i>Global Risks 2011 - Sixth Edition: An initiative of the Risk Response Network</i></p> |        |                             |             |

## Shortage fossil fuels and other natural resources

| Challenge  |        |                             |             |
|--|--------|-----------------------------|-------------|
| <b>ENVIRONMENT - Fossil fuels (and other raw materials) shortage</b>   |        |                             |             |
| Description  |        |                             |             |
| Fossil fuels (coal, natural gas and oil) are currently the primary source of the cheap energy that powers the modern industrial civilisation. In particular, mass motorisation has been heavily founded on cheap oil. The latest measurements confirm that the world's supplies are running out fast and in the next decades will fall below the level required to meet international demand. In many fields research is ongoing to find alternatives (e.g. fuel cells cars) but often such alternatives need different raw materials which are expected to become scarce in the next future.  |        |                             |             |
| Field  | Scale  | Time horizon                | Probability |
| Environment  | Global | Medium / long (2030 / 2050) | High        |
| Relevance for the transport system   |        |                             |             |
| <ul style="list-style-type: none"> <li>- The transport sector is currently almost entirely dependent upon oil-based fuels</li> <li>- Strong adaptations are needed that may involve also mobility behaviours</li> <li>- Revolution in the industrial production in case transport of goods become more (too) expensive (currently its inexpensiveness is a key factor of the production chain)</li> <li>- In case of oil shortage or if fuel resource costs rise sharply a radical change might be needed: policy measures can be used to smooth the pressure on transport oil demand</li> <li>- Strong policies are expected to cause uneven impacts on different social groups (e.g. strong road pricing might be very penalising for who has no or poor alternatives to use car).</li> <li>- Research on alternative fuels and vehicle efficiency is an option to face this challenge, requiring supporting policies. However, alternative technologies might be dependent on some other raw materials which are also finite.</li> </ul>  |        |                             |             |
| Main references  |        |                             |             |
| <p>EC (2008), <i>REGIONS 2020. An Assessment of Future Challenges for EU Regions</i>.</p> <p>EC (2010), Critical raw materials for the EU. Report of the Ad-hoc Working Group on defining critical raw materials.</p> <p>Schade W., Fiorello D., Beckmann R., Fermi F., Köhler J., Martino A., Schade B., Walz R., Wiesenthal T. (2008): <i>High Oil Prices: Quantification of direct and indirect impacts for the EU. Deliverable 3 of HOP! (Macro-economic impact of high oil price in Europe)</i>. Funded by EC</p> <p>EC (2009), <i>A sustainable future for transport: Towards an integrated, technology-led and user friendly system</i></p> <p>EC (2010a), <i>Critical raw materials for the EU. Report of the Ad-hoc Working group on defining critical raw materials</i></p> <p>Petersen R., Hook W., Zimmer W. (2008), <i>Discussion Paper - Symposium "Future Challenges of Transport and Environment"</i></p> <p>S. FENICHELL, J.C. MAXWELL - Beetle Capital (2010), <i>The 2020 race to post oil</i></p> <p>EC, DG Research (2003), <i>Hydrogen Energy and Fuel Cells – A vision of our future</i></p> <p>TRT (2005) <i>ECOTRA: Energy use and COst in freight TRANsport chains</i>.</p> <p>World Economic Forum (2011), <i>Repowering Transport</i></p> <p>Navajas, E.; Mongelli, I.; Kritzinger, S.; Helmreich, S.; Morgenstern, C.; Dennisen, T. (2011), <i>LogMan project - deliverable 3 - Carbon footprint (preliminary analysis)</i></p> |        |                             |             |

Source: TRT

## Fighting increasing air pollution and noise

| Challenge  |        |              |             |
|--|--------|--------------|-------------|
| <b>ENVIRONMENT - Fighting increasing air pollution and noise</b>   |        |              |             |
| Description  |        |              |             |
| <p>Emissions of air pollutants, resulting from a wide range of human activities and natural sources, have an impact on human health and the natural environment. Therefore, air quality standards and targets exist in the EU for a range of pollutants, with an emphasis on reducing pollutants such as SO<sub>x</sub>, NO<sub>x</sub> and PM<sub>10</sub>.</p> <p>At the same time noise pollution, related to excessive human, animal or machine-created environmental activity, impacts on both health and behaviour of human and animal life. Thus European Member States have to develop noise maps and noise action plans for agglomerations with more than 250,000 inhabitants. The policy related to the control of noise emissions are supported to limit the exposure of citizens.</p>  |        |              |             |
| Field  | Scale  | Time horizon | Probability |
| Environment  | Global | Short (2020) | High        |
| Relevance for the transport system   |        |              |             |
| <ul style="list-style-type: none"> <li>- The transport sector contributes to both air and noise pollution.</li> <li>- Innovative or stronger policies should be developed to effectively contribute to the reduction of air pollutant emissions being produced on road and the other transport modes</li> <li>- If tight traffic restrictions should be needed to respect emission limits, the impact on economy and social activity could be quite significant</li> <li>- Transport policy can contribute to mitigate or remove noise (e.g. standards on vehicle construction, rules for infrastructure design and land-use planning etc.)</li> <li>- The balance between economic and social costs and benefits should be considered / kept in mind</li> </ul>   |        |              |             |
| Main references  |        |              |             |
| <p>EC (2009), <i>A sustainable future for transport: Towards an integrated, technology-led and user friendly system</i>. Communication from the Commission</p> <p>EC, DG Research (2003), <i>Hydrogen Energy and Fuel Cells – A vision of our future</i></p> <p>World Economic Forum (2011), <i>Repowering Transport</i></p> <p>Meyer-Rühle O., Beige S., Greinus A., Erhardt T., Bozuwa J., Harmsen J., Kok R., Kille C., Hua-Kellermann N., Roth M., Burg R., Röhling W. (2008), <i>SEALS project - final report</i></p> <p>EC (2011), <i>WHITE PAPER-Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system</i></p> <p>Petersen R., Hook W., Zimmer W. (2008), <i>Discussion Paper - Symposium “Future Challenges of Transport and Environment”</i></p> <p>SILENCE project (2008), <i>Practitioner Handbook for Local Noise Action Plans</i></p> |        |              |             |

Source: TRT

## Urbanisation and sprawling

|  |              |                     |                    |
|--|--------------|---------------------|--------------------|
| <b>Challenge</b>   |              |                     |                    |
| <b>ENVIRONMENT - Urbanisation and sprawling</b>  |              |                     |                    |
| <b>Description</b>   |              |                     |                    |
| <p>Urbanisation describes the increase in the proportion of people living in towns and cities, due to a rising share of individuals moving from rural areas to suburbs. This often generates an un-planned incremental urban development, characterised by a low density mix of land uses on the urban fringe, i.e. urban sprawl. Development is patchy and scattered, with a tendency for discontinuity.</p> <p>Another driver of urban sprawl might be identified in new transport investment, in particular motorway construction, which can be a powerful stimulant for new development and sprawl, including shopping centres and residential areas.</p> <p>Global urban population will continuously increase in the forthcoming decades.</p>  |              |                     |                    |
| <b>Field</b>   | <b>Scale</b> | <b>Time horizon</b> | <b>Probability</b> |
| Environment / Society  | Global       | Short (2020)        | High               |
| <b>Relevance for the transport system</b>  |              |                     |                    |
| <ul style="list-style-type: none"> <li>- It should be considered if improving transport supply ends always up with benefits or can become undesirable beyond a certain point for the sake of other objectives.</li> <li>- Changes in lifestyle associated with urban sprawl contribute to increase the use of resources, e.g. the growing consumption of energy (and therefore the emission of CO<sub>2</sub>)</li> <li>- Sprawl increases the length of trips and emphasise the problems of automobile dependency, increasing expenditure for commuters.</li> <li>- From a social perspective, urban sprawl generates greater segregation of residential development according to income.</li> <li>- The cost to business of the congestion in sprawled urban areas with inefficient transportation systems will have to be added</li> <li>- Combined land-use and transport policies should be taken into account to avoid unregulated expansion of the cities.</li> </ul> |              |                     |                    |
| <b>Main references</b>   |              |                     |                    |
| <p><i>EC (2009), A sustainable future for transport: Towards an integrated, technology-led and user friendly system. Communication from the Commission</i></p> <p><i>EEA Report N° 10 (2006), Urban sprawl in Europe - The ignored challenge</i></p> <p>Litman T. (2011), <i>The Future Isn't What It Used To Be Changing Trends And Their Implications For Transport Planning</i></p>   |              |                     |                    |

Source: TRT

## Ageing of the European society

| Challenge  |          |                             |             |
|--|----------|-----------------------------|-------------|
| <b>SOCIETY - Ageing of European society</b>  |          |                             |             |
| Description  |          |                             |             |
| <p>Unlike other world areas, population in Europe is stable or even declining. Net of migration from other continents, birth rates are low and hardly compensate death rates. One effect of this situation is ageing of European society. In the future, a further increase in the number and proportion of older people is expected, caused by the longer life expectancy (decreased death rate), and the decreased birth rate in many European countries.</p> <p>In most European countries, older adults comprise the fastest growing segment of the population, and in many, one in every four persons will be aged 65 or more/older in 2030. By 2050, the population with 80 years or more is expected to triple in most countries.</p>   |          |                             |             |
| Field  | Scale    | Time horizon                | Probability |
| Society / Economy  | European | Medium / long (2030 / 2050) | High        |
| Relevance for the transport system   |          |                             |             |
| <ul style="list-style-type: none"> <li>- Elderly people expect to have access to (alternative) transport modes that meet their individual needs.</li> <li>- Specific circumstances will have to be taken into account: e.g. possible change of travel patterns and the reduced driving capacity (on average) of even healthy elderly individuals.</li> <li>- Increasing mobility of elderly people might result in more short trips with slow or public transport modes, even though it is not straightforward to appraise the impact on total transport demand.</li> <li>- Older people account for nearly half of all pedestrian fatalities in many countries: safety issues might need to be addressed.</li> </ul>  |          |                             |             |
| Main references  |          |                             |             |
| <p>ABN AMRO (2012) <i>Logistieke Arbeidsmarkt, Uw Uitdaging (Logistics Labour Market, Your Challenge!)</i>.</p> <p>Constant &amp; Tien (2010), <i>Germany's Immigration Policy and Labor Shortages</i></p> <p>EC (2008), <i>REGIONS 2020. An Assessment of Future Challenges for EU Regions</i>. Commission Staff Working Document</p> <p>OECD (2001), <i>Ageing and Transport. Mobility Needs and Safety Issues</i></p> <p>European Trade Union Confederation (2008), <i>Reforming the Budget, Changing Europe. Public Consultation</i></p> <p>EC (2009), <i>A sustainable future for transport: Towards an integrated, technology-led and user friendly system</i></p> <p>Liisa Hakamies-Blomqvist (2003), <i>Ageing Europe: the challenges and opportunities for transport safety</i></p> <p>European travel commission (2006), <i>Tourism trends for Europe</i></p> <p>World Economic Forum (2011), <i>Global Risks 2011 - Sixth Edition: An initiative of the Risk Response Network</i></p> <p>Litman T. (2011), <i>The Future Isn't What It Used To Be Changing Trends And Their Implications For Transport Planning</i></p> |          |                             |             |

Source: TRT

## Migratory pressure

| Challenge  |        |                           |             |
|--|--------|---------------------------|-------------|
| <b>SOCIETY - Migratory pressure</b>  |        |                           |             |
| Description  |        |                           |             |
| <p>Migration can be defined as a movement of people from one country to another for settlement that is often permanent. In recent years, migratory pressure has increased and is expected to intensify further in the coming decades, given the rising gap in wages between countries (from same or different continents) and their differing demographic futures. The potential number of climate refugees might increase migratory pressure as well.</p>   |        |                           |             |
| Field  | Scale  | Time horizon              | Probability |
| Society / Economy  | Global | Short /Medium (2020/2030) | Medium      |
| Relevance for the transport system   |        |                           |             |
| <ul style="list-style-type: none"> <li>- The integration of migrants into the social context gives rise to needs of additional services, also in the transport sector.</li> <li>- Many migrant users will need time to be fluent in a new language: specific attention should be paid regarding service rules, communication to customers, help desks etc.</li> <li>- Migrants at the beginning of their experience generally travel less and mostly by public transport due to economic reasons; nevertheless, as long as they extend their stay the mobility patterns can change significantly becoming similar to resident habits.</li> <li>- Additional measures might be required to face the needs of this segment of population, which can require more resources</li> <li>- As a consequence of increasing migrant flows, an increase of demand for international transport services might be observed.</li> </ul>                                   |        |                           |             |
| Main references  |        |                           |             |
| <p>ABN AMRO (2012) <i>Logistieke Arbeidsmarkt, Uw Uitdaging (Logistics Labour Market, Your Challenge!)</i>.</p> <p>Assum (2011), <i>Immigrants in Europe, their travel behaviour and possibilities for energy efficient travel</i></p> <p>Constant &amp; Tien (2010), <i>Germany's Immigration Policy and Labor Shortages</i></p> <p>EC (2008), <i>REGIONS 2020. An Assessment of Future Challenges for EU Regions</i>. Commission Staff Working Document</p> <p>European Trade Union Confederation (2008), <i>Reforming the Budget, Changing Europe. Public Consultation</i></p> <p>EC (2009), <i>A sustainable future for transport: Towards an integrated, technology-led and user friendly system</i></p> <p>EC (2010b), <i>Thematic Programme "Cooperation with Third Countries in the areas of Migration and Asylum"</i>.</p> <p>World Economic Forum (2011), <i>Global Risks 2011 - Sixth Edition: An initiative of the Risk Response Network</i></p> |        |                           |             |

Source: TRT

## Unemployment

| Challenge  |        |              |             |
|--|--------|--------------|-------------|
| <b>SOCIETY - Unemployment</b>  |        |              |             |
| Description  |        |              |             |
| <p>In the last 20 years the average unemployment rate in the EU27 countries has never fallen below the 7%, more often being larger than 9% and with some countries experiencing unemployment rates well larger than 10%. At the same time, the share of precarious employment has grown also in those countries where official unemployment rate has remained low or also in those economies and sectors where some shortage of specific skilled labour was noted. The recent crisis has further exacerbated the problem. As a result, income inequality has grown and aggregate demand has been stagnating.</p>   |        |              |             |
| Field  | Scale  | Time horizon | Probability |
| Society / Economy  | Global | Short (2020) | Medium      |
| Relevance for the transport system   |        |              |             |
| <ul style="list-style-type: none"> <li>- Households might have less resources for transport. Especially if energy prices will increase owning a car might be not affordable and probably travel for leisure purposes would fall significantly.</li> <li>- Public transport services might face an increase of demand, due to the modified behaviour of individuals.</li> <li>- At the same time, unemployed persons could not afford to pay public transport fares needed to cover a large share of production costs, putting balances of transport providers under pressure.</li> <li>- Despite the mass unemployment challenge, the transport sector can be affected by shortage of skilled workers</li> </ul> |        |              |             |
| Main references  |        |              |             |
| <p>EC (2009), <i>A sustainable future for transport: Towards an integrated, technology-led and user friendly system. Communication from the Commission.</i></p> <p>EUROSTAT database: Unemployment rate, annual average, by sex and age groups (une_rt_a)</p> <p>Forstater M. (2002): <i>Unemployment</i>. Elgar Companion to Post Keynesian Economics, John King (ed.), Edward Elgar Publishing.</p> <p>Friedrich-Ebert-Stiftung (2012): <i>Social Growth Model of a Progressive Economic Policy</i>. International Policy Analysis . January 2012</p>  |        |              |             |

Source: TRT

## Income inequality and distortions

|   |              |                     |                    |
|---|--------------|---------------------|--------------------|
| <b>Challenge</b>  |              |                     |                    |
| <b>SOCIETY - Income inequality / distortions</b>  |              |                     |                    |
| <b>Description</b>  |              |                     |                    |
| Over the last three decades in a large majority of OECD countries, household incomes of the top 10% grew faster than those of the poorest 10%, leading to widening income inequality. At the same time, the income of poorest households has been stagnating. Real wages have grown much less than productivity and only a growing debt of households has allowed to sustain consumption leading to a distorted and fragile growth.   |              |                     |                    |
| <b>Field</b>  | <b>Scale</b> | <b>Time horizon</b> | <b>Probability</b> |
| Society / Economy   | Global       | Short (2020)        | Medium             |
| <b>Relevance for the transport system</b>   |              |                     |                    |
| <ul style="list-style-type: none"> <li>- Due to increasing income inequality and stagnation of wages a larger share of households might have less resources for transport. Especially if energy prices will increase owning a car might be not affordable and probably travel for leisure purposes would fall significantly</li> <li>- Public transport services might face an increase of demand, due to the modified behaviour of a larger share of individuals.</li> <li>- At the same time, unemployed persons could not afford to pay public transport fares needed to cover a large share of production costs, putting balances of transport providers under pressure. Additional resources (subsidies) might be need to provide affordable public transport services.</li> </ul> |              |                     |                    |
| <b>Main references</b>  |              |                     |                    |
| <p>The Economist (2012b), <i>Seeing the back of the car. In the rich world, people seem to be driving less than they used to</i></p> <p>Friedrich-Ebert-Stiftung (2012): <i>Social Growth Model of a Progressive Economic Policy</i>. International Policy Analysis . January 2012</p> <p>Haries T. (2007): <i>Globalization and Income Inequality: A European Perspective</i>. International Monetary Fund Working Paper 07/169.</p> <p>OECD (2011): <i>Growing Income Inequality in OECD Countries: What Drives it and how Can Policy Tackle it?</i>. OECD forum on tackling inequality. Paris 2 may 2011</p>   |              |                     |                    |

Source: TRT

## Terrorism and feeling of insecurity

| Challenge  |        |              |             |
|--|--------|--------------|-------------|
| <b>SOCIETY - Terrorism / feeling of insecurity</b>   |        |              |             |
| Description  |        |              |             |
| Since 9/11, terrorism has become a major concern for population and governments, increasing the feeling of insecurity in everyday life and especially in sensitive environments like airports and mass tourist resorts.  |        |              |             |
| Field  | Scale  | Time horizon | Probability |
| Society  | Global | Short (2020) | low         |
| Relevance for the transport system   |        |              |             |
| <ul style="list-style-type: none"> <li>- People tend to travel less or to avoid some destinations (e.g. passenger decrease observed after 9/11)</li> <li>- If new events like 9/11 should occur resurging mass fear, the transport sector - and especially aviation – could see a reduced demand trend</li> <li>- The costs of potential damage from terrorism are substantial but improving security is not cheap. Especially when resources are scarce, cost-effective air passenger screening policy should be developed</li> <li>- Also maritime transport is affected by terrorism (both as target of attacks which has increased recently and because it can be vehicle for moving weapons and terrorists).</li> <li>- Establishing a systematic and coordinated approach to the regulation of security is a challenging goal for the transport policy.</li> </ul> |        |              |             |
| Main references  |        |              |             |
| <p>ECMT (2003), <i>Vandalism, Terrorism and Security in Urban Transport</i>.</p> <p>EC (2010c), <i>Recommendations. Commission Recommendation on 11 March 2010 on measures for self-protection and the prevention of piracy and armed robbery against ships (2010/159/EU)</i>.</p> <p>OECD, International Transport Forum (2009), <i>Security, Risk Perception and Cost-Benefit Analysis</i>. Summary and conclusions. Discussion Paper n. 2009-6</p> <p>European Travel Commission (2006), <i>Tourism Trends for Europe</i>.</p>  |        |              |             |

Source: TRT

## Individualism

|   |              |                     |                    |
|---|--------------|---------------------|--------------------|
| <b>Challenge</b>  |              |                     |                    |
| <b>SOCIETY - Individualism</b>  |              |                     |                    |
| <b>Description</b>  |              |                     |                    |
| Individualism makes the individual its focus, stressing "the moral worth of the individual". Individualists promote the exercise of one's goals and desires and so value independence and self-reliance while opposing most external interference upon one's own interests, whether by society, family or any other group or institution. One consequence is that individuals tend to address issues from a more egoistic point of view, withdrawing their trust and support to social institutions and collective actions.   |              |                     |                    |
| <b>Field</b>  | <b>Scale</b> | <b>Time horizon</b> | <b>Probability</b> |
| Society   | Global       | Short (2020)        | Medium             |
| <b>Relevance for the transport system</b>   |              |                     |                    |
| <ul style="list-style-type: none"> <li>- Public transport is not perceived as an attractive alternative</li> <li>- Car is perceived to represent the freedom of the individual. As a results, also low car average occupancy might be observed</li> <li>- Low acceptance of taxation reduces public resources for transport</li> <li>- Searching for private space increase sprawling and travel distances</li> <li>- Limitations to personal mobility would be more and more perceived as limitation of personal choices.</li> <li>- Fragmentation of families, smaller households, might produce different transport choices</li> <li>- Shopping patterns change due to individualism: e-commerce, more small parcels, large footprint</li> </ul> |              |                     |                    |
| <b>Main references</b>  |              |                     |                    |
| <p>Barber B. R. (2007), <i>Consumed: How Markets Corrupt Children, Infantilize Adults, and Swallow Citizens Whole</i><br/> <a href="http://www.nowandnext.org">www.nowandnext.org</a></p> <p>Grimaldo F., Lozano M., Barber F., Guerra-Hernández A. (2011), <i>A J-MADeM agent-based social simulation to model urban mobility</i>, PAAMS International Conference on Practical Applications of Agents and Multi-Agent Systems</p> <p>Petersen (2009), <i>Report on Transport Scenarios with a 20 and 40 year horizon</i></p>   |              |                     |                    |

Source: TRT

## Diffusion of ICT and technological innovation

| Challenge  |        |              |             |
|--|--------|--------------|-------------|
| <b>TECHNOLOGY - Diffusion of ICT and technological innovation</b>  |        |              |             |
| Description  |        |              |             |
| <p>The growth and development of information and communication technologies (ICT) leading to their wide diffusion and application in terms of unified communications and integrated telecommunications, will enable users to create, access, store, transmit, and manipulate information.</p> <p>ICTs have a critical role in three key areas:</p> <ul style="list-style-type: none"> <li>- productivity and innovation, by facilitating creativity and management;</li> <li>- modernisation of public services, such as health, education and transport;</li> <li>- advances in science and technology, by supporting cooperation and access to information</li> </ul> <p>In parallel, technological innovation (in particular with reference to vehicle design and production) is on-going and will continue to take place in various fields, playing a crucial role in the transport sector.</p>  |        |              |             |
| Field  | Scale  | Time horizon | Probability |
| Technology / Society   | Global | Short (2020) | High        |
| Relevance for the transport system   |        |              |             |
| <ul style="list-style-type: none"> <li>- One potential of ICT is the chance to avoid or drastically limit physical mobility of people and goods. ICT can shape a world where personal mobility is more and more a matter of will than a matter of need.</li> <li>- If compulsory trips are replaced by leisure trips, the pressure on transport supply could be even higher, since travel patterns could become more and more erratic in time and space.</li> <li>- ICT provide new possibilities in traffic management, route planning, with impacts on congestion.</li> <li>- A transportation system enabled by ITC could significantly reduce accidents, save lives, reduce traffic, optimise good delivery etc. Suitable regulation would be needed.</li> <li>- ICT can help to enforce transport rules (e.g. vehicles speed) and/or to implement sophisticated (and therefore efficient) pricing policies.</li> <li>- Technological innovation in vehicle design and engine might affect consistently efficiency and fuel consumption.</li> <li>- Technological innovation developing new transport modes (e.g. Segway, etc.) might provide new alternatives and affect mobility behaviour.</li> </ul> |        |              |             |
| Main references  |        |              |             |
| <p>Kritzinger, S; Beullens, P.; Limbers, J.; Bonilla, D.; Navajas-Cawood, E. et al. (2011), <i>LogMan project - deliverable 2 - Report on external factors</i></p> <p>Litman (2011) <i>The Future Isn't What It Used To Be Changing Trends And Their Implications For Transport Planning</i></p> <p>Meyer-Rühle O., Beige S., Greinus A., Erhardt T., Bozuwa J., Harmsen J., Kok R., Kille C., Hua-Kellermann N., Roth M., Burg R., Röhling W. (2008), <i>SEALS project - final report</i></p> <p>European travel commission (2006), <i>Tourism trends for Europe</i></p> <p>World Transport Forum (2011) <i>Global Risks 2011 - Sixth Edition: An initiative of the Risk Response Network</i></p>   |        |              |             |

Source: TRT

## Third manufacturing revolution

|  |              |                     |                    |
|--|--------------|---------------------|--------------------|
| <b>Challenge</b>   |              |                     |                    |
| <b>TECHNOLOGY - Third Manufacturing Revolution</b>   |              |                     |                    |
| <b>Description</b>   |              |                     |                    |
| It is intended as the 3D printing out of physical objects using digital design file. In fact, a number of remarkable technologies are converging: clever software, novel materials, more dexterous robots, new processes (notably three-dimensional printing) and a whole range of web-based services. A product can be designed on a computer and "printed" on a 3D printer, which creates a solid object by building up successive layers of material. The 3D printer can run unattended, and can make many things which are too complex for a traditional factory to handle, making a variety of products anywhere. |              |                     |                    |
| <b>Field</b>   | <b>Scale</b> | <b>Time horizon</b> | <b>Probability</b> |
| Technology   | Global       | Medium (2030)       | Medium             |
| <b>Relevance for the transport system</b>  |              |                     |                    |
| <ul style="list-style-type: none"> <li>- Change in trade flows might occur, affecting transport route and congestion on one hand and transport supplier on the other hand (facing a reduction of demand)</li> <li>- Average distance travelled for goods distribution will decrease in the sectors affected by the new production system, since companies want to be closer to their customers to respond more quickly to changes in demand</li> <li>-</li> </ul>  |              |                     |                    |
| <b>Main references</b>   |              |                     |                    |
| <a href="http://www.economist.com/node/21553017">http://www.economist.com/node/21553017</a><br><a href="http://www.opendemocracy.net/openeconomy/aaron-peters/third-industrial-revolution-response-to-economist">http://www.opendemocracy.net/openeconomy/aaron-peters/third-industrial-revolution-response-to-economist</a>   |              |                     |                    |

Source: TRT

## Globalisation and outsourcing

| Challenge  |        |              |             |
|--|--------|--------------|-------------|
| <b>ECONOMY – Globalisation / Outsourcing</b>   |        |              |             |
| Description  |        |              |             |
| <p>In economic terms, globalisation refers to the increasing unification of the world's economic order through reduction of barriers concerning international trade such as tariffs, export fees, and import quotas. Nevertheless, it also describes the process by which regional economies, societies, and cultures have become integrated through communication, transportation and trade. Furthermore, modern globalisation is characterised by the technical and legal possibility to move capitals worldwide (and instantaneously, as far as financial capitals are concerned) and to conveniently split the production chain in different countries.</p> <p>“Outsourcing” describes the transfer of “functions” previously completely managed by a subject to external subjects: in this way, benefits of the functions are still enjoyed by the former subject at a lower cost (e.g. externalisation of segments of the production chain to third parties).</p>  |        |              |             |
| Field  | Scale  | Time horizon | Probability |
| Economy / Society  | Global | Short (2020) | High        |
| Relevance for the transport system   |        |              |             |
| <ul style="list-style-type: none"> <li>- Increasing globalisation leads to an increase in international transport activity involving all transport modes (shipping, aviation, road and rail)</li> <li>- Transport services need to face an increasing demand with requirements for high-quality, fast and reliable international transport</li> <li>- Appropriate actions have to be implemented to mitigate the undesired effects on environment (CO2 emissions).</li> <li>- As a result of modern globalisation public resources for financing investment and services are more and more scarce.</li> <li>- The pressure on labour income can make private transport expenditure (e.g. car purchase and maintenance) too expensive, representing a challenge for a growing amount of people.</li> <li>- Policies influencing significantly transport costs – especially for long distance transport of goods – can have severe economic impacts on outsourcing, which might become not convenient anymore (despite the share of transport on production costs is limited on average)</li> <li>- Outsourcing is often used by transnational companies to hide profits. This way their contribution to public revenues has decreased over time, This circumstance can be seen as a serious obstacle with reference to the need of public resources from the transport sector.</li> </ul> |        |              |             |

**Main references**

- EC (2008), *REGIONS 2020. An Assessment of Future Challenges for EU Regions*.
- EC (2009), *A sustainable future for transport: Towards an integrated, technology-led and user friendly system*
- European travel commission (2006), *Tourism trends for Europe*
- Kritzinger, S; Beullens, P.; Limbers, J.; Bonilla, D.; Navajas-Cawood, E. et al. (2011), *LogMan project - deliverable 2 - Report on external factors*
- Meyer-Rühle O., Beige S., Greinus A., Erhardt T., Bozuwa J., Harmsen J., Kok R., Kille C., Hua-Kellermann N., Roth M., Burg R., Röhling W. (2008), *SEALS project - final report*
- Stiglitz J..E. (2006), *Making globalization work*. W.W. Norton & C.
- Martin H.-P., Schumann H. (1996), *Die Globalisierungsfalle. Der Angriff auf Demokratie und Wohlstand*. Rowohlt Verlag. Reinbek bei Hamburg
- Franzini M. (1999), *Globalizzazione, profitti e salari*. Globalizzazione, istituzioni e coesione sociale ed. by Felice Roberto Pizzuti, Donzelli, Roma
- Havik K., Mc Morrow K. (2006), *Global Trade Integration and Outsourcing : How Well is the EU Coping with the New Challenges ?*. European Commission - Directorate-General for Economic and Financial Affairs, Economic Paper n. 259
- Navajas, E.; Mongelli, I.; Kritzinger, S.; Helmreich, S.; Morgenstern, C.; Dennisen, T. (2011), *LogMan project - deliverable 3 - Carbon footprint (preliminary analysis)*
- OECD (2008a), *The Impacts of Globalisation on International Road and Rail Freight Transport activity*.
- Palma (2009), *The Revenge of the Market on the Rentiers. Why neo-liberal reports of the end of history turned out to be premature*.
- Stiglitz (2006) *Making globalization work*
- TRT Trasporti e Territorio (2005). *ECOTRA: Energy use and COst in freight TRANsport chains*. Internal report, study conducted on behalf of DG Joint Research Centre/IPTS.
- Rifkin J. (2000), *The Age of Access*. Tarcher, Los Angeles

Source: TRT

## Public and private debt

| Challenge  |        |                              |             |
|--|--------|------------------------------|-------------|
| <b>ECONOMY - Debt</b>  |        |                              |             |
| Description  |        |                              |             |
| <p>Despite the modern economy is based on credit, debt becomes a challenge when debt size or trend is exceeding the underlying real economic values (asset value or income growth rate) and debtors are believed to be unable to honour their commitment. In the recent years debt has increased in many countries and, despite the root of the crisis is on private debt, especially public debt has blown up after the financial crisis in 2008 and the consequent bailouts decided by national governments.</p>   |        |                              |             |
| Field  | Scale  | Time horizon                 | Probability |
| Economy  | Global | Short / Medium (2020 / 2030) | High        |
| Relevance for the transport system   |        |                              |             |
| <ul style="list-style-type: none"> <li>- As the public transport sector typically needs subsidies it may suffer from lack of resources for operation costs and investments as well. The risk is that the scope of public transport services will be reduced and concentrate on financially viable networks, mainly in dense areas.</li> <li>- The negative implication on the aggregate demand can easily induce a recession. Freight flows are reduced such as haulers and logistics operators face a shrinking turnover.</li> <li>- Privatisation of public transport companies is another possible measure applied attempting to reduce the debt.</li> <li>- Therefore households have less resources for transport (less car ownership) and will probably travel less for leisure purposes.</li> </ul> |        |                              |             |
| Main references  |        |                              |             |
| <p>De Grauwe (2011), <i>Balanced budget fundamentalism</i></p> <p>Frenkel R., Rapetti M. (2009), <i>A developing country view of the current global crisis: what should not be forgotten and what should be done</i>. Cambridge Journal of Economics 33 (4), pp 685-702.</p> <p>World Economic Forum (2011), <i>Global risks 2011. Sixth Edition</i>. Geneva, Switzerland</p> <p>Manifesto of the Appalled Economists (2010). <i>Crisis and Debt in Europe: 10 Pseudo "Obvious Facts", 22 Measures to Drive the Debate Out of the Dead End</i>, <i>real-world economics review</i>, issue no. 54, 27 September 2010, pp 19-31.</p> <p>Minsky H. (2008), <i>John Maynard Keynes</i>. McGraw-Hill, New York</p>  |        |                              |             |

Source: TRT

## Fragility of the EMU

| Challenge  |          |                              |             |
|--|----------|------------------------------|-------------|
| <b>ECONOMY - Fragility of European Monetary Union</b>  |          |                              |             |
| Description  |          |                              |             |
| <p>The idea behind the European Monetary Union (EMU) is to improve the European growth thanks to the introduction of a single currency. Further than strengthening the internal market – by avoiding costs imposed by currencies exchange – the Euro could challenge Dollar as reference currency for global trades. Since economic and financial conditions of EU countries were very different, the adoption of a single currency was not straightforward. Some key decisions were taken aiming at addressing this problem. First, strict rules to reduce unbalances in the national budgets. Second, a monetary policy independently managed by a Central bank, only aimed at fighting inflation but without the power of financing public deficits. Third, fiscal policies largely under the national control. Fourth, to leave the market working to tackle unbalances in the trade among member states. After a decade from the introduction of the Euro according to these principles, the situation of European economy is alarming. Many national economies are running into serious problems and the perspective that some countries might leave EMU is considered as more and more realistic.</p> |          |                              |             |
| Field  | Scale    | Time horizon                 | Probability |
| Economy  | European | Short / Medium (2020 / 2030) | High        |
| Relevance for the transport system   |          |                              |             |
| <ul style="list-style-type: none"> <li>- In the transport sector, the physical integration of the territory by means of the Trans European Network (TEN) would become much more challenging. Both financial and political problems might crowd out many investments.</li> <li>- Trade barriers will probably increase and therefore international transport will reduce drastically.</li> <li>- The recession, likely resulting in most of the countries, would reduce transport activity.</li> <li>- Public resources for financing transport service will probably be cut.</li> <li>- Increased unemployment will also negatively affect personal mobility: lower car ownership, less leisure trips.</li> <li>- International business flight demand within Europe might be substantially reduced.</li> </ul>  |          |                              |             |
| Main references  |          |                              |             |
| <p>Cesaretto (2012), <i>Controversial and novel features of the Eurozone crisis as a balance of payment crisis</i>,</p> <p>Frenkel R., Rapetti M. (2009), <i>A developing country view of the current global crisis: what should not be forgotten and what should be done</i>. Cambridge Journal of Economics 33 (4), pp 685-702.</p> <p>World Economic Forum (2011), <i>Global risks 2011. Sixth Edition</i>. Geneva, Switzerland</p> <p>Manifesto of the Appalled Economists (2010). <i>Crisis and Debt in Europe: 10 Pseudo "Obvious Facts", 22 Measures to Drive the Debate Out of the Dead End</i>, real-world economics review, issue no. 54, 27 September 2010, pp 19-31.</p>   |          |                              |             |

Source: TRT

## Annex 2: Impacts from transport policy measures

### Economic impacts

| ECONOMIC IMPACTS  |   |
|---|---|
| Transport costs   | Transport costs are caused by using or operating a transport system, e.g. tolls, fares, fuel prices and overall costs of operation.   |
| Private income / commercial turnover                      | Income / revenue changes that arise for persons / businesses due to economic changes caused by a TPM. For businesses, this also includes a change in transport costs because they are part of the supply chain. |
| Revenues for transport operators / service providers      | Revenue changes for transport operators / service providers are affected by the costs of operating the transport service. These are affected by transport costs, costs of employment, insurance costs etc.      |
| Sectoral competitiveness                                  | Change in competitiveness between transport companies (and industries closely connected to them) due to a change in productivity.   |
| Spatial competitiveness                                   | Change in local, regional, national or international competitiveness of transport companies due to different framework conditions, i.e. transportation costs, regulations / legislation etc...                  |
| Housing expenditures                                      | Change of costs for rent/floor space for residents/businesses due to the changed economic situation in the areas affected by the TPM.   |
| Insurance costs   | Change of insurance costs caused by the transport policy measure.   |
| Health service costs                                      | Costs for services regarding the diagnosis and treatment of disease and for the maintenance of good health.   |
| Public authorities & administrative burdens on businesses | Indicates the administrative effort for public authorities and businesses caused by the TPM.  |
| Public income (e.g.: taxes, charges)                      | Change of state revenues or other types of administrative units obtained by taxes and other charges.  |
| Third countries and international relations               | Change in the relations between the EU and third countries concerning trade, investment flows and services which have an effect on foreign and domestic businesses and consumers.                               |

Source: ProgTrans

## Social impacts

| SOCIAL IMPACTS   |  |
|--|--|
| Health (incl. well-being)                              | Impact on the physical and psychological well-being of an individual. This is influenced by pollution, noise and other factors affecting the individual and his/her environment. |
| Safety   | The safety of a transport system is measured in the number of accidents (fatalities) as well as the general feeling of safety.   |
| Crime, terrorism and security                          | The security of a transport system is affected by e.g. crime and terrorism. This impact field includes the current security measures and the feeling of security they imbue.     |
| Accessibility of transport systems                     | Improvements to the transport system regarding availability (time), reachability (distance), simplicity of access (physical, technical barriers) and usage.                      |
| Social inclusion, equality treatment and opportunities | Indicates discriminatory effects, i.e. how the measure influences the gap between certain social groups.   |
| Standards and rights (related to job quality)          | Depicts the situation of workers in the transport system, considering e.g. working hours regulation, training etc.   |
| Employment and labour markets                          | General situation of the labour market and change in the employment rate due to new job creation or loss of jobs, possibly for particular professions or groups of workers.      |
| Cultural heritage / culture                            | Impact on buildings of architectural or historical significance or archaeological sites, which influences the quality of living of the affected society.                         |

Source: ProgTrans

## Environmental impacts

| ENVIRONMENTAL IMPACTS                |  |
|--------------------------------------|--|
| Air pollutants                       | Change in air pollutants emitted by transport modes and affecting the environment (acidifying, eutrophying, photo-chemical, harmful pollutants).   |
| Noise emissions                      | Change in the levels of noise emitted by transport modes and affecting the social and natural environment.   |
| Visual quality of the landscape      | Influences on the quality of the urban and non-urban environment from an aesthetic point of view.  |
| Land-use                             | Land usage, e.g. reduction or limitation of urban sprawl (positive), greenfield developments (negative).   |
| Climate                              | Impact on the average meteorological conditions including temperature, precipitation and wind that characteristically prevail in a particular region, measured over a period of 30 years by changes in the emissions of greenhouse gases and ozone-depleting substances. |
| Renewable or non-renewable resources | Usage of non-renewable as well as renewable resources; direct or indirect impacts, e.g. due to a change in the modal split or vehicle mileage.   |

Source: ProgTrans



## Annex 3: Implications of challenges for selected TPMs

### Eurovignette

|  |
|--|
|  |
| <b>TPM category</b>  |
| Pricing  |
| <b>TPM</b>   |
| Eurovignette   |
| <b>Description</b>   |
| The Eurovignette Directive sets out the common rules by which Member States can charge heavy goods vehicles for the use of the road network by distance, time and location. The directives 1999/62/EC and 2006/38/EC recommend the introduction of tolls in all EU countries, requiring hauliers to pay when using interurban high capacity roads and main roads. The revision of the "Eurovignette" directive in 2011 introduces the internalisation of external effects.   |
| <b>Relevant potential future challenges for TPM category</b>   |
| Fighting Climate Change; Shortage Fuel and Natural Resources; Increasing Pollution and Noise; Diffusion of ICT; Fragility of EMU; Public and Private Debt  |
| <b>Relevant future challenges for TPM</b>  |
| <p><i>'Fighting Climate Change'</i>: The Eurovignette supports a modal shift to the less fuel-intensive modes rail and inland waterways and therefore contributes to a reduction of CO2 emissions as a main factor for climate change</p> <p><i>'Fossil fuel shortage'</i> will reinforce the implementation of the Eurovignette, by supporting modal shift to increase fuel efficiency.</p> <p><i>'Globalisation'</i>: On the one hand the Eurovignette makes the European road transport more expensive. On the other hand increased international trade raises the demand for (road) transport. The European road haulage sector needs to balance the higher transport prices and demand in order to remain competitive with other modes and other (non-European) markets. Thus globalisation puts more pressure on the European road transport performance</p> <p><i>'Diffusion of ICT'</i>: The improvement of information and communication technologies supports the implementation of the Eurovignette</p> <p><i>'Increasing air pollution and noise'</i>: The Eurovignette directive helps to decrease the air and noise pollution from road transport by facilitating modal shift.</p> |
| <b>Implication for transport system</b>  |
| The challenges 'climate change', 'fossil fuel shortage', 'increased awareness of air pollution and noise' and 'globalisation' restrain the growth of interurban road transport, whereas the 'diffusion of ICT' contribute to a slight increase of road transport demand. Overall the traffic impacts are reinforced by the future challenges, leading to the intended modal shift from road to rail and inland waterway transport.   |

**Social impacts**

Climate change, air pollution and noise have a huge social implication for public health, life expectancy and the quality of life. By increasing the costs of interurban road freight transport, the transport demand for road transport decreases, which has a positive effect on public health. Globalisation implication for the labour market affects the road haulage sector. The Eurovignette increases the pressure on this segment in the labour market: road freight transport becomes more expensive, the profit margins smaller, which also reduces the salaries for example of truck drivers. Furthermore, globalisation leads to more competition between countries and regions. The Eurovignette alleviates this effect to some extent by allowing authorities to exempt isolated areas or economically weak regions from applying tolls or user charges.

**Economic impacts**

The major economic implications of the future challenges are mainly the external costs imposed on the environment. The costs of climate change are likely to outweigh the economic benefits from international trade/globalisation. In this sense the Eurovignette directive is a promising measure to implement the "user pays" and a "polluter pays" principle, to finance alternative modes of transport (cross-financing), to operate a 'modal shift' of freight away from roads (to rail, inland waterways) and to reduce pollution from road freight transport. This is supported by the fact that the new version of the Eurovignette (2011) can be extended to all motorways (before: trans-European road network) and exempt less polluting vehicles, than EURO VI, namely hybrid and electrical heavy goods vehicles.

**Environmental impacts**

The Eurovignette leads to higher costs for the road transport sector. This should lead to less road transport and more transport by rail and inland waterways. This in return has a positive effect upon the environment. Also, it reduces emissions thus contributing to a healthier environment and a positive effect on the climate change.

**Policy response**

Greater modal shift effects and thus greater environmental benefits can be achieved if the earmarking obligation is extended to all revenue generated by the Eurovignette policy. Currently there exists only an earmarking obligation for mountainous regions, while Member states are recommended to earmark revenue generated by the Eurovignette charge for projects in the transport sector, in particular in support of the trans-European transport network.

## Inclusion of air transport into the EU-ETS in 2012

|   |
|---|
| <b>TPM category</b>   |
| Pricing   |
| <b>TPM</b>  |
| Inclusion of air transport into the EU-ETS 2012   |
| <b>Description</b>  |
| From the start of 2012, emissions from all domestic and international flights that arrive at or depart from an EU airport are covered by the EU Emissions Trading System (EU ETS). The overall aim of the inclusion of aviation in the EU ETS is to tackle the climate impact of aviation: In 2020 CO <sub>2</sub> emissions shall be 21% lower than in 2005.   |
| <b>Relevant potential future challenges for TPM category</b>  |
| Fighting Climate Change; Shortage Fuel and Natural Resources; Increasing Pollution and Noise; Diffusion of ICT; Fragility of EMU; Public and Private Debt   |
| <b>Relevant future challenges for TPM</b>   |
| Climate change': The inclusion of aviation in the EU ETS is aimed at tackling climate change by reducing CO <sub>2</sub> emissions.<br>'Fossil fuel shortage' will lower the profits of airlines in addition to the costs of having to buy or hold allowances for the EU-ETS. Hence, the affordability of flights for lower income groups will decrease, because of higher costs for aviation<br>'Globalisation' increases the pressure for the competitiveness of the European air industry. However, adding air transport to the EU ETS is not expected to harm the competitiveness of the sector as most costs are expected to be passed on the passengers/ shippers.<br>'Increasing air pollution and noise': The inclusion of air transport to the EU ETS helps to counteract this trend by reducing the total amount of air transport demand. This is achieved via higher travel costs, which negatively influences the inclusion of lower income groups. |
| <b>Implication for transport system</b>   |
| The challenges 'climate change' and 'fossil fuel scarcity' are likely to decrease air travel, whereas 'globalisation' will reinforce air transport demand. It is expected that overall the European air transport sector will continue to grow despite climate change and rising air travel costs due to the inclusion of air transport in the EU-ETS   |
| <b>Social impacts</b>   |
| Due to climate change the pressure on the air industry will increase. The call for alternative and more sustainable modes of transport, e.g. High speed trains will become louder especially in relation to short intra-European flights. Less demand may have a negative impact on employment in the airline industry.   |

**Economic impacts**

The major economic implications of the future challenges are the cost increases for air travel. Airline companies will have to face revenue losses. This leads to a decrease of the competitiveness of the businesses on a spatial and sectoral level. For the individual traveller the inclusion of air transport in the EU-ETS implies an increase of individual costs of mobility, while on a macro-economic level it supports the mitigation of external costs.

**Environmental impacts**

At the EU level, including aviation in the emissions trading scheme may result in a change of yearly CO<sub>2</sub> emissions by -0.09% (allowance price of €5), -0.23% (allowance price of €20) and - 0.23% (allowance price of €40) in 2020 compared with no action scenarios.

**Policy response**

Tackling climate change was the exact reason for the inclusion of aviation in the EU ETS: In 2020 CO<sub>2</sub> emissions shall be 21% lower than in 2005.

## Energy Taxation Directive (2003/96/EC)

|  |
|--|
| <b>TPM category</b>  |
| Taxation   |
| <b>TPM</b>   |
| Energy Taxation Directive (2003/96/EC)   |
| <b>Description</b>   |
| <p>The Energy Tax Directive (2003/96/EC) represents the restructured Community framework for the taxation of energy products and electricity. The Directive introduced a minimum rate system for all energy products, including coal, natural gas and electricity. It aims to:</p> <ul style="list-style-type: none"> <li>- reduce distortions of competition that exists between Member States as a result of divergent rates of tax on energy products</li> <li>- reduce distortions of competition between mineral oils and the other energy products that have not been subject to Community tax legislation before 2003</li> <li>- increase incentives to use energy more efficiently (to reduce dependency on imported energy and to cut carbon dioxide emissions); and</li> <li>- allow Member States to offer companies tax incentives in return for specific undertakings to reduce emissions.</li> </ul> <p>International aviation and shipping is excluded from this Directive.</p>   |
| <b>Relevant potential future challenges for TPM category</b>   |
| Fuel Shortage, Ageing, ICT, Globalisation, urbanisation and outsourcing.   |
| <b>Relevant future challenges for TPM</b>  |
| <p><i>Fossil fuel shortage:</i> The Directive might be reviewed in the light of fossil fuel shortage, on mid-long term especially for oil products. The need for incentives to use energy more efficiently will become more urgent as long as no alternatives are provided. Especially it needs to be taken into consideration whether international aviation and shipping need to be subject of this Directive as well. However, this can only be done efficiently by international agreements.</p> <p><i>Ageing:</i> Concerning this specific challenge, it is assumed that it will not affect the Directive.</p> <p><i>Diffusion of ICT:</i> Further diffusion of ICT is assumed not to have a direct implication for the Directive. On the other hand the developments may make it easier to enforce the Directive.</p> <p><i>Globalisation:</i> Globalisation may have some implications for the Directive. In combination with Fossil Fuel shortage, the Directive might be reviewed. Globalisation will enforce transport by air and maritime shipping. These two modes are not included in the Directive, but action might be undertaken at international level to reduce distortions. Taxation for air and maritime shipping will lead to extra costs. This may lead to further fuel efficiencies in both modes.</p> <p><i>Urbanisation and sprawling:</i> On one hand, increased urbanisation leads to a concentration of economic and transport activity. On the other hand, sprawling considerably increases the trip lengths of commuters and therefore increases transport and energy use. Additionally, residents of more rural areas are more affected due to lack of alternatives (less public transport).</p> <p><i>Outsourcing:</i> while streamlining processes within companies, outsourcing also increases the distances travelled and fossil energy use. Energy taxation makes road transport more expensive and therefore contributes to the overall decision whether to undertake outsourcing or not.</p> |

### Implication on transport system

The Directive is in force since 2003. Except for air and shipping, the Directive does not have traffic impacts anymore. If the Directive is reviewed in the light of Fossil Fuel Shortage and Globalisation, this may have some small effects especially upon traffic by air and shipping.

The challenges climate change, fossil fuel shortage are likely to decrease the energy use: first one by introducing restrictions for the more environmentally friendly usage of conventional energy sources and second why by the physical necessity to limit energy usage because of its shortage. At the same time, both will contribute to the promotion of the development and usage of the alternative energy sources or more efficient usage of the existing ones. Globalisation, urbanisation and outsourcing are expected to increase the distances travelled and therefore increase the energy use. Decrease in vehicle mileage for road and rail transport and increase of public transport might take place.

In summary, it is expected that some reduction in traffic will take place, due to an increase in costs. On the other hand one could argue that this reduction is hardly measurable. Therefore it can be assumed that the traffic impacts are very small.

### Social impacts

No specific social impacts are expected

### Economic impacts

The economic implications of the future challenges 'Fossil Fuel Shortage', 'Ageing', 'Globalisation' and 'Diffusion of ICT' can be neglected. Only if air and shipping are included in the Directive, an increase of transport costs can be expected. The impacts depend upon the amount of increase of transport costs. A small increase will lead to absorption of the costs. A large increase may lead to relocation of activities (if possible), thus reducing the need for transport. Also, an increase may lead to more fuel efficient technologies. This will then have an environmental effect as well.

### Environmental impacts

Concerning the environmental impacts, it is assumed that these are small. Although the Directive is affected by some future challenges, it is expected that the impact is small. Only if the Directive is reviewed and modes like air and shipping are included, some impacts may occur. Due to an increase in transport costs, it is expected that some relocation of activities will take place, as well as the introduction of fuel efficient technologies.

The impact of the Directive was greater in the new Member States as the level of energy taxation was lower there than in most EU15 countries, even with the implementation of the minimum tax. The reduction in CO<sub>2</sub> emissions in the New Member States varies between 4 and 12%, compared to an average of 2% in EU15.

### Policy response

In the light of Fossil Fuel Shortage and Globalisation, this Directive needs to be reviewed. International agreements might be needed to include air and shipping in the Directive. Also, there is a necessity to further remove imbalances between the Member States and to further take into account both CO<sub>2</sub> emission and energy content of the energy product in the tax. These issues as well as the necessity of the revision of the minimal tax levels for 2013 are the reasons why the new rules for the energy products taxation as well as minimum levels of taxes are currently under discussion. The background principles of the Energy Taxation Directive revision are presented in the Communication from the Commission "Smarter energy taxation for the EU: proposal for a revision of the Energy Taxation Directive" (COM (2011) 168/3). It aims to promote further energy efficiency and consumption of more environmentally friendly products.

## Reduction of TEN-T network cross border missing links

|   |
|---|
| <b>TPM category</b>   |
| Infrastructure  |
| <b>TPM</b>  |
| Reduction of TEN-T network cross border missing links   |
| <b>Description</b>  |
| <p>The TEN-T policy has helped to complete a large number of projects of common interest, interconnecting national networks and overcoming technological barriers across national borders. The wide consultation process, the external expertise, the ex-post assessments conducted, and the internal analysis used over the last two years have shown that the European Union does not dispose yet of a complete trans-European infrastructure network, and especially not for rail and inland waterways, where essential parts are still missing and constitute important bottlenecks. The infrastructure network in the EU today is indeed fragmented, both from a geographical and a multi-modal perspective. It is also not sufficiently integrated in the international trade flows that feed the European internal market. Despite important efforts towards improvement, European rail and inland waterway networks are still lacking capacity and efficiency</p>   |
| <b>Relevant potential future challenges for TPM category</b>  |
| Fighting Climate Change; Shortage of Fuel and Natural Resources; Increasing Pollution and Noise; Urbanisation and Sprawling; Diffusion of ICT; Fragility of EMU; Globalisation; Public and Private Debt; Outsourcing  |
| <b>Relevant future challenges for TPM</b>   |
| <p><i>Fighting Climate Change:</i> Climate change is relevant to the TPM, as the transport sector is one of the major greenhouse gas and other pollutant emitter. The completion of missing crossborder links will enhance the traffic flow and better infrastructure will help shifting toward more environmental friendly transportation modes</p> <p><i>Shortage of Fuel and Natural Resources:</i> The modern industrial civilisation, and particularly the transportation sector is heavily dependent on fossil fuels, as these energy sources are currently much cheaper than alternative sources. The shortage has a limited implication for the TPM.</p> <p><i>Globalisation:</i> The most relevant points: As globalisation evolves, it leads to an increase in international transport activity. Transport services need to face an increasing demand with requirements for high-quality, fast and reliable international transport.</p> <p><i>Fragility of the EMU:</i> The most relevant points: In the transport sector, the physical integration of the territory by means of the Trans European Network (TEN) would become much more challenging. Both financial and political problems might crowd out many investments, in particular, some of the cross-border developments may become unnecessary. Trade barriers will probably arise and therefore international transport demand will reduce drastically. The recession, likely resulting in most of the countries, would reduce demand and thus the transport activity.</p> <p><i>Public and Private Debt:</i> The financial contribution presumes also financial contribution from the member state the project takes place. Providing this financial contribution, especially when there are several projects in one country, may prove to be a too high burden on government finances, this may prove to be a barrier slowing or delaying the selected policy option. In addi-</p> |

tion, if national financial sources are not sufficient, additional funding may be necessary, which puts an additional burden on the national, or project budget

*Diffusion of ICT:* The growth and development of information and communication technologies (ICT) leading to their wide diffusion and application in terms of unified communications and integrated telecommunications, will enable users to create, access, store, transmit, and manipulate information.

### **Impact on transport system**

'Climate change', 'Globalisation' and 'Debt' are challenges which will not cause any serious difference regarding the effects of the TPM in the short term. Globalisation will increase vehicle mileage, therefore the effect on risk of congestion, and growing greenhouse gas emission should also be investigated. Climate change may prove indifferent, if as a result of the TPM, modal shift towards more environmental friendly transportation modes will balance, or reduce the effects of traffic growth.

The remaining three challenges need a bit of thinking in the nearby future. 'Fragility of the monetary union', 'Running out of fossil fuels' and 'Diffusion of ICT' will definitely affect the transport sector, and the TPM of developing the missing TEN-T cross-border sections will not be able to give sufficient answer. The conclusion of the effects of these challenges is that the transport volumes will decrease. In addition the fragility of the union may cause trading, financial, political and physical accessibility barriers which will result in increased transport and travel times, and worsening service and comfort, the diffusion of ICT will result in a reduced demand for movement of goods and people (which is overall its aim and a positive trend)

### **Social impacts**

The originally identified improvement of accessibility and employment will be valid in the future, the 'Debt', 'Globalisation', 'Climate change' will have limited effect, 'Diffusion of ICT' may have an effect on transport demand. The rest of the challenges can cause negative effects, such as the worsening economic situation can lead to strong decrease in transport demand thus making the measures in the TPM economically unsustainable.

### **Economic impacts**

Transport costs and competitiveness will not be affected by 'Globalisation' and national 'Debt'. Some measures of the TPM will have an effect on mode choice, which will point toward a more sustainable transport system.

In opposite to these, 'Fragility of the Union' and 'Fighting climate change' will increase transport costs and affect competitiveness and businesses badly, thus the advantages of the measures in the TPM may disappear. The TPM alone is not enough to solve the problem. The 'shortage of fossil fuel will cause the transport costs to increase on the short term, as new technologies tend to be more expensive than conventional ones, on the other hand, a possible cheaper alternative energy source may even lower costs related to transportation.

### **Environmental impacts**

Neither of the challenges 'Fighting climate change', 'Fossil fuel shortage', 'Fragility of the Union', 'Diffusion of ICT' modifies the positive effects of the TPM badly. 'Globalisation' will increase transport demand, but the measures in the TPM can give a proper solution to these.

### **Policy response**

Answering the challenges of 'Fighting climate change' and 'Globalisation' are the main goals of the TPM. The environmental, and social impacts are not affected seriously by the challenges, the economic impacts are also positive, the challenges facing the TPM cannot be handled by itself, only by a complex strategy which is the TPM part of.

## Eliminating TEN-T network bottlenecks

|  |
|--|
| <b>TPM category</b>  |
| Infrastructure   |
| <b>TPM</b>   |
| Eliminating TEN-T network bottlenecks  |
| <b>Description</b>   |
| <p>The Trans-European Networks are large infrastructure networks of transport, energy and telecommunications underpinning the developmental and integration goals of the European Union. The trans-European transport, energy and telecommunications networks cover the whole of the Union of 27 Member States, however the transport network still suffers from a number of bottlenecks (as well as several missing links). If Europe is to fulfil its economic and social potential, it is essential to build the missing links and remove the bottlenecks in our transport infrastructure, as well as to ensure the future sustainability of our transport networks by taking into account the energy efficiency needs and the climate change challenges.</p>   |
| <b>Relevant potential future challenges for TPM category</b>   |
| Fighting Climate Change; Shortage of Fuel and Natural Resources; Increasing Pollution and Noise; Urbanisation and Sprawling; Diffusion of ICT; Fragility of EMU; Globalisation; Public and Private Debt; Outsourcing   |
| <b>Relevant future challenges for TPM</b>  |
| <p><i>Fighting Climate Change:</i> Climate change is relevant for the TPM anyway as transport sector is one of the major responsible for the greenhouse emissions. The eliminating of the TEN-T network bottlenecks will help transport flows to become barrier free, therefore contributes to the reduction of CO2 emissions.</p> <p><i>Shortage of Fuel and Natural Resources:</i> The most relevant points: The transport sector is currently almost entirely dependent upon oil-based fuels. Revolution in the industrial production in case transport of goods becomes too expensive (short distance transport such as between manufacturers and customers will be highly appreciated). In case of oil shortage or if fuel resource costs rise sharply a change might be needed (in terms of policy measures as well)</p> <p><i>Globalisation:</i> The most relevant points: Increasing globalisation leads to an increase in international transport activity. Transport services need to face an increasing demand with requirements for high-quality, fast and reliable international transport.</p> <p><i>Fragility of the EMU.</i> The most relevant points: In the transport sector, the physical integration of the territory by means of the Trans European Network (TEN) would become much more challenging. Both financial and political problems might crowd out many investments. Trade barriers will probably increase and therefore international transport will reduce. The recession, likely resulting in most of the countries, would reduce transport activity.</p> <p><i>Diffusion of ICT:</i> The most relevant points: One potential of ICT is the chance to avoid or limit physical mobility of people and goods. ICT can shape a world where personal mobility is more and more a matter of will than a matter of need</p> |

### Impact on transport system

'Climate change' and 'Globalisation' are challenges which will not cause any serious difference regarding the effects of the TPM in the present, however globalisation may introduce a new effect, namely the increase of vehicle mileage, therefore the effect on risk of congestion should also be investigated.

The remaining three challenges need a bit of thinking in the nearby future. 'Fragility of the monetary union', 'Diffusion of ICT' and 'Running out of fossil fuels' will definitely affect the transport sector badly, and the TPM of eliminating TEN-T bottlenecks will not be able to give sufficient answer. The conclusion of the effects of these challenges is that the transport volumes will decrease. In addition the fragility of the union may cause trading, financial, political and physical accessibility barriers, the diffusion of ICT will result in a reduced need for movement of goods and people (which is overall its aim and a positive trend). These factors result in increased transport and travel times, and worsening service and comfort

### Social impacts

In the field of social impacts the picture is much more consolidated. The originally identified improvement of accessibility and employment will be valid in the future in the case of the challenges 'Globalisation', 'Climate change', and 'diffusion of ICT'. The rest two challenges can cause negative effects on the present social impacts – but not as much as transport and economic impacts

### Economic impacts

Transport costs and competitiveness will not suffer from 'Globalisation', but it is unpredictable how will the system react on the 'Fossil fuel shortage'. A cheaper alternative solution may save billions of Euros. In opposite to these, 'Fragility of the Union' and 'Fighting climate change' will increase transport costs and affect competitiveness and businesses badly. The TPM alone is not enough to solve the problem.

### Environmental impacts

Environmental impacts (noise and air pollution reduction) are the winner of all the impacts. Neither of the challenges 'Fighting climate change', 'Fossil fuel shortage', 'Fragility of the Union', 'Diffusion of ICT' modifies the present positive effects of the TPM badly. 'Globalisation' however is against decrease of pollutants, but the TPM can give a proper solution to these.

### Policy response

In overall, the policy, 'Eliminating TEN-T network bottlenecks' provides sufficient solution for the possible future challenges. The environmental and social impacts of the measure still remain on the right track. In fact, running out of fossil fuels and the fragility of the monetary union are serious possible challenges which need special targeted policies not only in the field of transport. The likely effects of these challenges will give the lesson for the EU so can hardly be handled within the policy category of 'Infrastructure' or in any category alone.

## Green transport corridors

|  |
|--|
| <b>TPM category</b>  |
| Infrastructure   |
| <b>TPM</b>   |
| 'Green' transport corridors  |
| <b>Description</b>   |
| <p>The concept of transport corridors is marked by a concentration of freight traffic between major hubs and by relatively long distances of transport. Along these corridors industry will be encouraged to rely on co-modality and on advanced technology in order to accommodate rising traffic volumes while promoting environmental sustainability and energy efficiency. Green transport corridors reflect an integrated transport concept where short sea shipping, rail, inland waterways and road complement each other to enable the choice of environmentally friendly transport. Green corridors could be used to experiment with environmentally-friendly, innovative transport units, and with advanced ITS applications.</p>  |
| <b>Relevant potential future challenges for TPM category</b>   |
| Fighting Climate Change; Shortage of Fuel and Natural Resources; Increasing Pollution and Noise; Urbanisation and Sprawling; Diffusion of ICT; Fragility of EMU; Globalisation; Public and Private Debt; Outsourcing   |
| <b>Relevant future challenges for TPM</b>  |
| <p><i>Fighting Climate Change:</i> Climate change is relevant for the TPM anyway as transport sector is one of the major responsible for the greenhouse emissions. The elimination of the TEN-T network bottlenecks helps transport flows to become barrier free, therefore contributes to the reduction of CO2 emissions.</p> <p><i>Shortage of fossil fuel and natural resources.</i> The most relevant points: The transport sector is currently almost entirely dependent upon oil-based fuels. Revolution in the industrial production in case transport of goods become too expensive (short distance transport, such as between manufacturers and customers, will be highly appreciated). In case of oil shortage or if fuel resource costs rise a change might be needed (in terms of policy measures as well).</p> <p><i>Globalisation:</i> The most relevant points: Increasing globalisation leads to an increase in international transport activity. Transport services need to face an increasing demand with requirements for high-quality, fast and reliable international transport</p> <p><i>Fragility of the EMU.</i> The most relevant points: In the transport sector, the physical integration of the territory by means of the Trans European Network (TEN) would become much more challenging. Both financial and political problems might crowd out many investments. Trade barriers will probably increase and therefore international transport will reduce. The recession, likely resulting in most of the countries, would reduce transport activity.</p> <p><i>Fighting air pollution and noise.</i> The most relevant points: The transport sector contributes to both air and noise pollution. Transport policy can contribute to mitigate or remove noise, and to reduce air pollution. The balance between economic and social costs and benefits should be considered.</p> <p><i>Outsourcing:</i> The most relevant points: Whatever policy influencing significantly transport costs – especially for long distance transport of goods – can have severe economic impacts. Despite the share of transport on production costs is on average limited, there is a point beyond which the outsourcing is not convenient anymore</p> |

**Impact on transport system**

'Fighting against climate change', 'Globalisation', 'Outsourcing', and 'Fighting against air pollution and noise' are challenges against (or for) the investigated TPM is an ideal policy. The measure supports fighting against climate change, air pollution and noise, and helps the realisation of outsourcing. The other two challenges 'Fragility of the monetary union', and 'Running out of fossil fuels' makes the context for the TPM more difficult (and differentiated). The problem of the fossil fuels can take the policy of green corridors forward, however the fragility of the union sets back the measure as it is.

**Social impacts**

The results of the fact sheet shows that the social impacts of the TPM is definitely positive (health, social inclusion), and the most of the challenges (similarly to the traffic impacts) will not harm them at all. The rest two (Fragility of the monetary union and the fossil fuel issue) gives the lesson for social impacts in the future. Green corridors are not a measure that can provide any protection against these challenges

**Economic impacts**

The present impacts of the TPM: Increase of transport costs, competitiveness and revenues will not be affected from 'Globalisation', 'Fighting against climate change, noise and air pollution' and 'Outsourcing'. Against 'Fossil fuel shortage' the measure of green corridors is one possible strategy which can reach the target. It depends very much on the applied alternative solutions. The only difficulty might be caused by the challenge, 'Fragility of the Union'. The TPM alone is not enough to solve the problem

**Environmental impacts**

Environmental impacts (climate change, noise and air pollution reduction) will also be valid for any of the challenges, except again the 'Fragility of the union', however in this case the intensity of impact change is not as much as for the other (traffic or economic) impacts.

**Policy response**

In overall, the transport policy measure, 'Green corridors' provides enough protection against the most of the possible future challenges. The environmental, economic and social impacts of the measure still remain on the right track. In fact, the fragility of the monetary union is a real challenge for the future, which is capable of causing serious difficulties.

## Bus priority measures

|   |
|---|
| <b>TPM category</b>   |
| Infrastructure  |
| <b>TPM</b>  |
| Bus priority measures   |
| <b>Description</b>  |
| The basic idea of the TPM is to give any kind of priority for public transport buses in cities (e.g. bus priority lanes) and outside (e.g. high occupancy vehicle lanes). The aim is to make public transport more reliable, reduce travel time, help mode change and provide a higher level of service. There is a wide range of solutions like mixed used lanes which are dedicated for buses only in peak hours or totally segregated 'bus corridors' (e.g. BRT, Metrobus in Istanbul).  |
| <b>Relevant potential future challenges for TPM category</b>  |
| Fighting Climate Change; Shortage of Fuel and Natural Resources; Increasing Pollution and Noise; Urbanisation and Sprawling; Diffusion of ICT; Fragility of EMU; Globalisation; Public and Private Debt; Outsourcing  |
| <b>Relevant future challenges for TPM</b>   |
| <p><i>Fighting Air Pollution and Noise:</i> Emissions of air pollutants, resulting from a wide range of human activities and natural sources, have an implication for human health and the natural environment. Therefore, air quality standards and targets exist in the EU for a range of pollutants, with an emphasis on reducing pollutants such as SO<sub>x</sub>, NO<sub>x</sub> and PM<sub>10</sub>.</p> <p>At the same time noise pollution, related to excessive human, animal or machine-created environmental activity, implications for both health and behaviour of human and animal life. Thus European Member States have to develop noise maps and noise action plans for agglomerations with more than 250,000 inhabitants. The policy related to the control of noise emissions are supported to limit the exposure of citizens.</p> <p><i>Shortage of fossil fuels and natural resources.</i> Fossil fuels (coal, natural gas and oil) are currently the primary source of the cheap energy that powers the modern industrial civilisation. In particular, mass motorisation has been heavily founded on cheap oil. The latest measurements confirm that the world's supplies are running out fast and in the next decades will fall below the level required to meet international demand. In many fields research is ongoing to find alternatives (e.g. fuel cells cars) but often such alternatives need different raw materials which are also expected to become scarce in the next future</p> <p><i>Urbanisation and sprawling.</i> Urbanisation describes the increase in the proportion of people living in towns and cities, due to a rising share of individuals moving from rural areas to suburbs. This often generates an unplanned incremental urban development, characterised by a low density mix of land uses on the urban fringe, i.e. urban sprawl. Development is patchy and scattered, with a tendency for discontinuity. Another driver of urban sprawl might be identified in new transport investment, in particular motorway construction, which can be a powerful stimulant for new development and sprawl, including shopping centres and residential areas. Global urban population will continuously increase in the forthcoming decades</p> |

**Impact on transport system**

The TPM is well known as a fine tool to help mode change from car towards public transport, therefore will constantly be proper to fight against increasing air pollution and noise, so 'Fighting against increasing air pollution and noise' does not mean any change in comparison to the original impacts. The challenge will mean increased load on urban roads, which can be decreased by making better public transport. So 'Urbanisation and sprawling' will not affect the reason of existence of the measure badly. Running out of fossil fuels will affect the whole transport sector unbelievably badly. Urban public transport, however, uses electric power up to a quite high percentage, buses still depends on fossil fuels. Introducing hybrid, or fuel cell engine vehicles can significantly help bus transport to become independent from conventional fuel.

**Social impacts**

The previously identified social impacts will not be affected by any of the challenges. The reduction of car traffic will be a continuous impact therefore safety and health conditions will improve in any case.

**Economic impacts**

Neither of the future challenges will end up in any implication for the TPM identified originally. The revenues and sectoral competitiveness of public transport will increase independently of the challenges, while costs of car transport will increase. One risk is the rising costs of transport in general, due to high fuel prices and the introduction of new technologies.

**Environmental impacts**

As the challenge 'Fighting against increasing air pollution and noise' is also a main challenge nowadays, the environmental impacts of the TPM, namely reduction of noise and air pollutants, will not be affected badly or suffer from any changes. It is a permanent aim, and the measure is an adequate answer. 'Urbanisation' will affect badly the expected environmental benefits. Despite the fact that the TPM is a good answer to the challenge and the impacts of the TPM remain the same, in global meanings urbanisation will decrease the volume of the positive changes. 'Fossil fuel shortage' will strengthen the originally identified impacts (reduction of air pollutants and noise) as it brings forward to more environmental friendly solutions

**Policy response**

In overall, the policy, 'Bus priority measure' provides a proper solution for the possible future challenges. The environmental and traffic impacts of the measure still remains on the right track, and there are no or very limited changes regarding economic and social impacts

## Implementation of SESAR

|  |
|--|
| <b>TPM category</b>  |
| Internal market  |
| <b>TPM</b>   |
| Implementation of SESAR  |
| <b>Description</b>   |
| The implementation of the Single European Sky ATM (Air Traffic Management) is part of the Single European Sky initiative (SES), which aims at harmonising the European air traffic management network and meeting the projected traffic by the year 2020. By accelerating and simplifying the exchange of information, SESAR brings ground and air control closer together, introducing a paradigm change in ATM. The improvement of technologies exchanging the information will not only be restricted between air traffic controllers and pilots, but also improve the information flow from airline operation centres, meteorological services and airports.   |
| <b>Relevant potential future challenges for TPM category</b>   |
| Fighting Climate Change; Shortage Fuel and Natural Resources; Terrorism and insecurity; Diffusion of ICT; Fragility of EMU; Globalisation; Public and Private Debt; Outsourcing.   |
| <b>Relevant future challenges for TPM</b>  |
| <p><b>'Climate change'</b>: The implementation of SESAR will help to avoid climate change by reducing air pollutants.</p> <p><b>'Fossil fuel shortage'</b> will lower the profits of airlines gained by the implementation of SESAR technologies and system. Hence, the affordability of flights for lower income groups will decrease, because of higher costs for aviation.</p> <p><b>'Globalisation'</b>: The increasing economic linkage will accelerate international transport. The need for higher transportation capacities will be partly gained by SESAR technologies and the European aviation industry will benefit from higher global demand of such systems. A negative effect is based on increasing CO<sub>2</sub> emissions due to capacity enhancements and the corresponding demand enlargement. In addition, there will be pressure on labour costs in the relevant aviation industries.</p> <p><b>'Fragility of European Monetary Union'</b>: Increasing trade barriers negatively affects trade and international European business. Hence, business flight demand will decrease, as well as the capacity gains, which lowers the impacts of implementing SESAR.</p> <p><b>'Diffusion of ICT'</b>: The improvement of information and communication technologies leads to a reduced business trip demand, which straightens out the capacity shortages within the aviation system. Nevertheless the efficiency gains by implementing SESAR will decrease.</p> <p><b>'Increasing air and noise pollution'</b>: The challenge to decrease the air and noise pollution by transport policies focussing on aviation aims to restrict the emissions of planes. This leads to higher travel costs, which negatively influences the inclusion of lower income groups. Nevertheless such policies additionally support the SESAR impacts concerning residents and the society by improving the health levels and reducing the air and noise emissions.</p> <p><b>'Outsourcing'</b>: The outsourcing of production and services is relevant for the implementation of SESAR leading to additional business flight demand (passenger, freight), reaching the current aviation capacity faster. Nevertheless it will not influence the TPM impacts itself.</p> <p><b>'Terrorism / feeling of insecurity'</b>: The challenge of terrorism is directly addressed by SESAR, which will improve the aviations security level (crime, terrorism) regarding aviation operations and society</p> |

**Impact on transport system**

The positive impacts of implementing SESAR technologies concerning traffic to increase the flight efficiency and the aviation system capacity will be not be affected by any future challenges.

**Social impacts**

Lower income groups will be negatively affected by higher costs respectively fares for aviation due to fossil fuels scarcity and increasing air pollution and noise. Hence, social inclusion, equality & opportunities will be impaired. Globalisation will lead to higher pressure on labour costs and thus on employment and labour markets.

**Economic impacts**

Businesses are negatively affected by the future challenge 'Fragility of the European monetary Union'. In addition, transport costs and private income respectively the commercial turnover will increase / decrease due to fossil fuel shortage, increasing air pollution and noise. These challenges also lower the revenues in the transport sector and its spatial competitiveness.

**Environmental impacts**

The increasing demand caused by globalisation and the systems capacity enhancement leads to increasing CO<sub>2</sub> emissions. In contrast, the challenge to decrease air pollution and noise will lead to a restriction of flight emissions, which will affect the societies health level positively.

**Policy response**

Due to the systems efficiency and capacity enhancements, leading to decreasing aviation fares, policy should be able to react appropriately to the corresponding emission enlargements

## European Road Safety Action Programme

|  |
|--|
| <b>TPM category</b>  |
| Efficiency standards and flanking measures   |
| <b>TPM</b>   |
| European Road Safety Action Programme  |
| <b>Description</b>   |
| <p>Of all modes of transport, transport by road is the most dangerous and the most costly in terms of human lives. For this reason, the Road Safety Action Programme (2003-2010) proposes a series of measures, such as stepping up checks on road traffic, deploying new road safety technologies, improving road infrastructure and measures to improve users' behaviour. The RSAP includes 60 measures which are quite diverse, but together cover all aspects of road safety. The measures are aimed at the three well-known areas of road safety:</p> <p>Road users: RSAP aims to encourage road users to improve their behaviour, in particular through better compliance with existing legislation, through basic and continuous training and by combating dangerous practices.</p> <p>Vehicle technology: RSAP aims for technical harmonisation and support for technological progress should help to make vehicles safer. With respect to vehicle technology a distinction can be made between actions aimed at improving active safety of vehicles and those at passive safety of vehicle.</p> <p>Road infrastructure: by defining and disseminating best practices and elimination of black spots, the road infrastructure can be made safer.</p> |
| <b>Relevant potential future challenges for TPM category</b>   |
| Fighting Climate Change; Shortage Fuel and Natural Resources; Ageing; Diffusion of ICT   |
| <b>Relevant future challenges for TPM</b>  |
| <p><i>Fossil fuel shortage:</i> It is assumed that this challenge will not have a major implication for the Road Safety Action Programme.</p> <p><i>Ageing:</i> Ageing may have some implications for the RSAP. Due to more aged persons, the RSAP might be reviewed in the light of elderly people. Does the RSAP provide a good base for elderly people? Can they improve their behaviour? These are questions that are imposed upon RSAP by the trend of Ageing.</p> <p><i>Diffusion of ICT:</i> Further diffusion of ICT is assumed not to have a direct implication for the RSAP.</p> <p><i>Globalisation:</i> Globalisation is assumed to have no major implication for the RSAP</p>   |
| <b>Impact on transport system</b>  |
| Although the RSAP has the objective to improve road user behaviour as well as road infrastructure, it is expected that the programme does not have major traffic impacts. Concerning mode choice, the challenge of Ageing may lead to the use of more safe vehicles or more use of public transport (Bosetti et al, 2010).   |

**Social impacts**

Especially the challenge of 'Ageing' has some social impacts when related to this TPM. Due to the TPM, it is likely that less elderly people will be killed in traffic. Also, it is expected that less elderly people will get severe injuries from accidents (Bosetti et al, 2010).

**Economic impacts**

Especially Ageing has some social impacts when related to this TPM. Due to the TPM, it is likely that less elderly people will be killed in traffic. Also, it is expected that less elderly people will get severe injuries from accidents.

**Environmental impacts**

Concerning the environmental impacts, it is assumed that these can be neglected for this TPM.

**Policy response**

The Road Safety Action Programme needs to be reviewed, especially in the light of the Ageing trend. It is expected that elderly people will profit from more safe infrastructure, safer vehicles and safe behaviour when taking part in traffic.

## Park & Ride systems

|   |
|---|
| <b>TPM category</b>   |
| Transport Planning  |
| <b>TPM</b>  |
| Park & Ride systems   |
| <b>Description</b>  |
| 'Park & Ride' systems (P&R) are parking facilities at the periphery of cities linked to public transportation. Hence, trips will not be conducted entirely by car and partly by bus or other modes of public transport. Park & Ride aims mostly at commuters but is also made for people who make irregular trips to the inner city as well as tourists. The concept targets people which are not well connected to public transportation and need a car  |
| <b>Relevant potential future challenges for TPM category</b>  |
| Shortage of Fuel and Natural Resources; Increasing Air Pollution and Noise; Ageing; Urbanisation and Sprawling; Diffusion of ICT;   |
| <b>Relevant future challenges for TPM</b>   |
| <p>One future challenge being relevant for the TPM Park &amp; Ride is the <b>shortage on fossil fuels</b>, because of the fact that the price development of fossil fuels will enhance and foster the usage of park &amp; ride systems in (sub-)urban areas. Nevertheless it also depends on the structure of suburban passenger flows; that means it has to be considered if there is a shift from previously public transport usage (whole trip) to a mix of transport modes (car – public transport).</p> <p><b>(Sub-)urbanisation and urban sprawl.</b> This challenge will significantly influence the measure of building respectively installing park &amp; ride facilities in urban areas. However, such systems concerning the passenger mode shift do foster the urban sprawl on the one hand. On the other hand, the population living in suburban areas will be encouraged to use park &amp; ride facilities to counter the congestion on urban roads.</p> <p>Park &amp; ride facilities will definitely positively influenced by the societal <b>ageing</b>. The mobility of elderly people living in suburban or peripheral areas will be positively affected by the possibility to use public transport as an alternative and safe transport mode.</p> <p>If the <b>public debts</b> of territorial entities on European national, regional and local level will suffer in future, the implementation of park &amp; ride facilities in suburban/urban areas will be questionable. Hence, this future challenge is significantly questioning the realisation / implementation at times of low budget resources due a publicly quite unapparent measure.</p> <p>At times of growing individual motorised urban / suburban road traffic and the according future challenge of increasing <b>air and noise pollution</b>, the enhancement of public transportation, especially between and within urban and suburban areas has significant importance.</p> <p>In contrast, the challenge of growing <b>individualism</b> is a threat to this TPM. The extensive use of individual transport modes (mostly motorised), which is a result of a reluctant attitude towards all kinds of public respectively mass transportation</p> |

**Impact on transport system**

Of course, the shortage of fossil fuels will force several passengers (commuters and tourists) to use public transportation systems, which will decrease the risk of intra-urban congestions and the travel/transport time. Nevertheless, the new structure of transportation (performance per mode) has to be compared to the structure before implementing the park & ride facility. Until now there the results park & ride systems connecting urban and suburban areas (vehicle mileage) is quite ambiguous. However, the measure will positively influence the public transport usage (mileage) and pay positive dues to challenges like ageing, urban sprawl and the increasing air and noise emissions (climate change).

**Social impacts**

In respect of the challenges mentioned above, the level of health and safety is likely to increase for residents, society as a whole and the slow mode users. In contrast, higher travel speed on suburban road increases the risks of accidents and lowers the safety level at some specific areas.

**Economic impacts**

As stated above the impacts of the measure is difficult to assess, even for the economic effects. Assumed that public debts are increasing, but also a decrease of fossil fuels, an ageing society and a growing perception of individual motorised road transport as one main agents concerning air and noise pollution, public transportation operators may expect increasing revenues by a growing number of (park & ride) system users. Nevertheless, public authorities will further be burdened and the public income will decrease.

**Environmental impacts**

If intra-urban traffic will decrease due to the challenges concerning shortage of fossil fuels, ageing, urban sprawl and rising air and noise pollution, park & ride facilities will be able to mitigate some poor environmental implications from challenges for residents as well as for society. As a result the level of air and noise pollutants, land usage (by new transport infrastructures) and the speed of climate change will decrease. In parallel the visual quality of landscape will improve.

**Policy response**

When implementing the TPM the policy should be encouraged to strictly analyse and assess the impacts of park & ride facilities in urban areas, keeping the future challenges and their positive as well as negative effects in mind

## Introduction of city logistics and urban freight distribution

|   |
|---|
| <b>TPM category</b>   |
| Efficiency standards and flanking measures  |
| <b>TPM</b>  |
| Introduction of City Logistics and Urban Freight Distribution   |
| <b>Description</b>  |
| Fighting Climate Change; Shortage Fuel and Natural Resources; Ageing; Diffusion of ICT  |
| <b>Relevant potential future challenges for TPM category</b>  |
| The TPM concerns the introduction of 'city logistics / urban freight distribution' measures in an urban area (compared to a do-nothing case). "City logistics incorporates many activities (i.e. production, commerce and supply) between different actors, which appear in form of inner urban goods transport or distribution of interurban freight, fulfilling a substantial contribution to economy, city life and operations." <sup>9</sup> Common concepts also include the local distribution of goods by smaller, cleaner and efficient vehicles. Overall, the urban freight distribution concepts aim to decrease traffic passing through cities and metropolitan areas by means of the implementation of technical and planning measures like e.g. urban consolidation centres. |
| <b>Relevant future challenges for TPM</b>   |
| <b>Climate change:</b> The implementation of city logistics respectively urban freight distribution concepts aims to decline the climate change by reducing air pollutants of road freight transport.   |
| <b>Fossil fuel shortage</b> enhances the deployment of energy efficient vehicles/systems.   |
| <b>Sub-urbanisation and urban sprawl</b> leads to a sprawl of city logistics with lower efficiency because of higher vehicle mileage but a lower risk of congestion in the inner city. Nevertheless it might overall increase the traffic loads in the whole urban area.  |
| <b>Public debt:</b> Especially public debt has blown up after the financial crisis and as a result public authorities will not be able to take over costs for implementation of urban logistical systems. Comparably, public investments financing transport services are cut if the 'European Monetary Union' will further be disturbed.   |
| <b>Diffusion of ICT:</b> Optimisation of city logistics by ICT leads to an overall enhancement of the system and enforce its implications, e.g. increase the safety level and the quality of life, reduction of traffic, lower transportation costs etc.  |
| The challenge to 'decrease the <b>air and noise pollution</b> ' by transport policies helps to promote the implementation of city logistics, possibly by taking (energy efficient) electric and less noisy vehicles into operation. Not at least because of targeting some of its main environmental impacts it will directly influence the environmental impacts positively and increase the level of health for society and residents   |

<sup>9</sup> BESTUFS II - Best Urban Freight Solutions (2006): Deliverable 5.2 - Quantification of urban freight transport effects II, p. 5.

**Impact on transport system**

As future economic challenges debts and the fragility of the European Monetary Union lead to a lower overall demand which reduces the urban traffic load (positive), which is also influenced by the diffusion of ICT systems. Nevertheless the lower demand might reduce the efficiency of the urban logistic systems.

**Social impacts**

Future challenges as climate change, fossil fuel shortage, the diffusion of ICT and the increased awareness of air and noise pollution will lead to a reinforcement of urban freight distribution systems which impact urban areas positively by lower traffic loads and an increasing level of health of residents (directly) and society (indirectly) based on a decrease of air and noise pollutions. Overall, also the security level and the quality of life are other social impacts, which are positively affected by these challenges. In contrast, urbanisation and the increasing sprawl lead to a lesser inclusion of lower income groups due to a decelerated valorisation of urban areas being negatively influenced by traffic loads.

**Economic impacts**

Transport costs will be reduced by the challenge of an increasing diffusion of ICT systems, which will as a consequence improve city logistical systems.

**Environmental impacts**

Not at least because of targeting the main environmental impacts, the future challenge to decrease noise and air pollution will lead to an enhancement of initiating further urban logistic systems, which influence the environmental impacts positively and increase the level of health for society and residents.

**Policy response**

Overall, the transport policy strategy to adapt respectively promote urban logistic system will be influenced negatively by the given challenges just to a less extend. Thus there is no necessity to adjust the policy measure in general and in the context of the main future challenges

## Electro-mobility of road transport vehicles

|   |
|---|
| <b>TPM category</b>   |
| Research and Innovation   |
| <b>TPM</b>  |
| Electro-mobility of road transport vehicles   |
| <b>Description</b>  |
| The TPM 'Electro-mobility of road transport vehicles' is about the fostering of research and development leading to an increase of efficiency, safety and reliability of vehicles with electronic propulsion. The implementation of this measure is expected to increase the number of electric road vehicles transporting passengers (cars, buses and coaches) as well as freight (light-duty vehicles for city logistics, excluding long-haul trucks). It focuses on the plug-in hybrid electric vehicles and battery electric vehicles. The assessment does not describe policies concerning the instalment of a charging infrastructure   |
| <b>Relevant potential future challenges for TPM category</b>  |
| Fighting Climate Change; Shortage of Fuel and Natural Resources; Ageing; Urbanisation and Sprawling; Diffusion of ICT; Fragility of EMU; Globalisation; Public and Private Debt;  |
| <b>Relevant future challenges for TPM</b>   |
| <p><b>Climate change:</b> The efforts being made concerning research and development of electric vehicles for road transportation aims to reduce GHG-emissions and therefore will positively influence climate change.</p> <p>The challenge concerning the future <b>shortage of fossil fuels</b> (increasing prices) will positively affect the demand of road related electro-mobility, due the assumption that the usage of common road vehicles (combustion engines) will comparably get more expensive.</p> <p>In addition the future challenge of 'increasing <b>air and noise pollution</b>' will be positively influenced by the higher demand, usage and efficiency of electro powered road transport vehicles due to fewer emissions of air pollutants and noise.</p> <p>It is quite vague how the future trend of <b>suburbanisation / urban sprawl</b> will be influenced by efforts concerning the research and development of electro-mobility propulsion. Until now, the distance range of vehicles is smaller compared to combustion engines due to the limited charging capacity of batteries.</p> <p>The challenge respectively trend regarding the <b>individualism</b> of mobility, which is expected to become increasingly important in the future will benefit by promoting electro-mobility research and development. The increasing vehicle efficiency, safety and reliability will attract people which have a reluctant attitude to public transportation and thus support an extensive use of private modes</p> |
| <b>Impact on transport system</b>   |
| The challenge of suburbanisation will restrain the demand for (hybrid) electric road vehicles due to the limited range of the distance. However there is a chance for higher electro-mobility demand if there are significant efficiency gains being induced by capacity improvements.  |

**Social impacts**

Assuming the future challenge of an aging society and an increasing usage of electric road vehicles, a negative impact has to be expected. This impact is based on the decreasing level of safety on roads due to the lower noise emissions of vehicles, which especially affects the safety level of older people (Fender, 2011).

**Economic impacts**

As stated above, the upcoming shortage of fossil fuels will influence the transport costs of combustion engines negatively. In contrast, the movement of electric powered vehicles will comparably become cheaper, assuming that the electricity supply costs will not increase at an equal rate. The higher demand will affect the vehicle costs negatively at a first stage. However, this leads to an increasing production of vehicles with lower unit costs leading to lower purchasing prices. As a result the sectorial level of competitiveness will increase as well as the inclusion of lower income groups to environmental friendly road transportation.

**Environmental impacts**

As indicated before, lower emission of noise and air pollutants will negatively affect the some social groups assuming the future challenge of aging. Nevertheless the increasing awareness of air and noise pollution and the climate change will additionally foster the usage of electric powered road vehicles, which will affect the societal level of health positively. Concerning the production of electricity, it still needs to be kept in mind that for the production energy is needed, which is not abundant available, even if it is 'green' energy (Matthew-Wilson, 2010).

**Policy response**

In general, the transport policy strategy to promote the research and development in the fields of electro-mobility (efficiency, safety, reliability) will have positive effects regardless of the expected future challenges. Hence, there is no necessity to adjust the policy measure in general and in the context of the main future challenges. Nevertheless the production of energy being used for the vehicles propulsion has to be considered in detail.

## Development of E-Freight

### TPM category

Research and Innovation

### TPM

Development of E-Freight

### Description

The 'development of E-freight' technology aims at the simplification of the information exchange regarding freight and transportation.

Currently there are different documents being used for freight transportation according to the different modes of transport. This procedure is expensive and entails administrative costs for multimodal transport. As the enforcement of multimodal transport is one of the main objectives of the European transport policy, these unfavourable transport conditions, compared to a single mode operation, needs to be eliminated.

The improvement of transport organisation/management will be possible by the creation of a single transport document being valid for the transportation of freight by all modes on the one hand. On the other hand, the improvement of freight transport management, established by a digital single transport document (electronic waybill) will simplify the identification and location of freight regardless to the transportation mode. One of the main technologies being essential for the successful implementation of E-Freight is the deployment of the RFID (Radio Frequency Identification) technology and the GALILEO satellite positioning systems

### Relevant potential future challenges for TPM category

Fighting Climate Change; Shortage of Fuel and Natural Resources; Ageing; Urbanisation and Sprawling; Diffusion of ICT; Fragility of EMU; Globalisation; Public and Private Debt;

### Relevant future challenges for TPM

As **climate change** is driven by GHG-emissions of road freight transport, the deployment of e-freight technologies will help to shift freight transport to comparably less emitting modes such as railway and inland waterway.

The **shortage of fossil fuels** is of high relevance for this transport policy measure, since the facilitation to shift freight transport to the comparably cheaper railway and inland waterways will further support multimodal transport and the application of e-freight technologies.

**Globalisation**, as the further increase of international transport activity involving all transport modes, will be highly relevant for the implementation of e-freight, since this measure mainly depends on this trend. Especially the crossing of borders and the customs clearance will be temporally fastened by e-freight, thus globalisation and such measure will reinforce each other.

Similar to the trend of further globalisation, the challenge of the increasing **outsourcing** of production into lower wage countries entailing the respective global division of labour will further increase the demand of a digital single transport document regarding the fastening of supply chains and its surveillance / management

**Impact on transport system**

Under consideration regarding which challenges will be relevant for the TPM it becomes obvious, that on the one side challenges as globalisation, and outsourcing will enhance the usage of e.g. a single transport document. In respect of the challenges, the (digital) transport document will further help to fasten the freight transport, to lower the risk of congestion and increase the level of services. In addition the challenges will possibly increase the operators willingness to shift freight from road to rail and inland waterways, the more environmental friendly modes. The trend to enhance the modal shift will be encouraged by the challenge on the shortage of fossil fuels.

**Social impacts**

All challenges considered beforehand (climate change, shortage of fossil fuels, globalisation, outsourcing) will further support the social impacts being assessed for the TPM in WP2. Hence, positive social impacts such as the increasing level of societal health and safety as well as the increasing level of security (decreasing level of crime / terrorism) for transport operators and the economies will be supported by e-freight technologies.

**Economic impacts**

By the decrease of transport costs due to the fastening of supply chains / freight transport (customs clearance, monitoring / management, efficiency gains of operations etc.) which is supported by challenges like globalisation and outsourcing, revenues in the freight operators sector will increase as well as their sectoral and spatial competitiveness. In addition, the economy will gain income benefits respectively the commercial turnover will increase.

**Environmental impacts**

The main environmental impacts are positive, due to the fact that e-freight will help to fasten respectively optimise freight operations which will decrease air and noise emissions incriminating the society. The impacts connected to mentioned challenges will further decreasing the climate change and lead to lesser usage of renewable and non-renewable resources.

**Policy response**

By means of the discussion, there is no definite reason to change the existing transport policy in respect of the given challenges /trends. On the contrary, the TPM "e-freight" is able to lower some negative effects of existing challenges

## Teleworking

|  |
|--|
|  |
| <b>TPM category</b>  |
| Other  |
| <b>TPM</b>   |
| Teleworking  |
| <b>Description</b>   |
| Telework consists of different incentives to work at home or another remote location.  |
| <b>Relevant potential future challenges for TPM category</b>   |
| Fighting Climate Change; Shortage Fuel and Resources; Increasing Air Pollution and Noise; Ageing; Migratory Pressure; Urbanisation and Sprawling; Terrorism and Insecurity; Diffusion of ICT; Fragility of EMU; Globalisation; Public and Private Debt; Outsourcing.   |
| <b>Relevant future challenges for TPM</b>  |
| Out of the list of challenges identified in task 3.1, those most relevant for teleworking are (in a broad rank of relevance): Diffusion of Information Communication Technologies (ICT); Outsourcing; Urbanisation and sprawling; Individualism; Fossil fuel shortage; Fighting air pollution and noise; Fighting climate change, Ageing   |
| <b>Impact on transport system</b>  |
| When implemented correctly, teleworking may have a large impact on the transport system. Reduction in travel distance, travel time, travel costs and number of trips is expected. Although promising, one needs to keep in mind that not all work can be replaced by telework.   |
| <b>Social impacts</b>  |
| <p>One positive social impacts of teleworking could be the increased quality of life for workers who could have more flexibility in their daily schedule and more time (as commuting would be unnecessary). When individualism is rising, flexibility and control on own life are more and more appreciated and the regret for missing social life in workplaces becomes less relevant. Therefore individualism could amplify a positive social impact of teleworking. At the same time, however, teleworking widens the potential labour supply for companies (as distance become less relevant). This is positive for companies, but increases competition among workers. When outsourcing is added to this picture, competition becomes stronger and this could generate unemployment and/or stress for competing workers.</p> <p>Another social aspect to be taken into account with reference to teleworking is the ageing of European society: in this sense, the challenge might encourage the diffusion of teleworking, being an attractive option for elder employees.</p> <p>From a social perspective, teleworking might be considered as a possible solution to face the challenge of an ageing society, in order to handle the problem of reduced mobility of individuals</p> |

**Economic impacts**

On the economic side, one expected impact of teleworking is to improve an effective and efficient staff utilisation in the companies also reducing absenteeism and tardiness. Both the diffusion of ICT and outsourcing could amplify such economic impact. First, companies could have a wider choice of technical instruments to manage work from remote locations. Second, when the use of resources located outside become a widespread solution, companies could developed and refine their internal procedures to ensure a smooth integration of different contributions. Also the involvement of teleworkers could benefit of this wider experience in using external staff.

**Environmental impacts**

In environmental terms teleworking is expected to reduce commuting traffic, but at the same time it could be a contributing factor for urban sprawling, which is one of the challenges. It could be said that urban sprawling does not affect the environmental impact of teleworking but rather it can be one environmental impact of teleworking.

**Policy response**

Policy measures about teleworking are more likely defined and applied outside the transport domain. No specific reactions in terms of transport policy seems needed.